COUNTRY OVERVIEW

Senegal is one of the most politically stable countries in Africa and has maintained steady economic growth over the last decade. Nonetheless, Senegal remains vulnerable to environmental shocks that threaten its stability, including recurring natural disasters (particularly floods and droughts) that will increase in magnitude and extent due to increased climate variability. Between 1970 and 2000, the country suffered prolonged droughts that contributed to a rural exodus. Today, roughly 67 percent of Senegal’s population resides in the urban coastal zone, also the location of 90 percent of Senegalese industrial production. This coastal area is characterized by low-lying, rapidly expanding, high-population suburbs, high water tables and poorly planned drainage systems. Even small amounts of rain can flood entire neighborhoods. In addition to extreme events, rising sea levels place much of the coastal population, infrastructure and ecosystems at risk from flooding and erosion. Climate change will also impact climate-sensitive sectors such as agriculture (70 percent of production is rainfed), livestock and fisheries, which account for 20 percent of GDP and employ a majority of the workforce. Food security is already stressed due to low yields and high population growth. Estimates suggest that over 15 percent of rural households and over 8 percent of urban households are food insecure, and the country imports approximately 60 percent of its cereal requirements, mostly rice (a main staple crop). (2, 4, 13, 14, 15, 17)

CLIMATE PROJECTIONS

1–3°C increase in temperatures by 2060
1m rise in sea levels by 2100
Increased unpredictability of seasonal rains and increased intensity of rainfall events

KEY CLIMATE IMPACTS

Agriculture
Reduced crop quality and yields
Decreased livestock productivity
Increased incidence of locust invasions

Water
Reduced availability and degraded quality of freshwater resources
Reduced hydropower production

Coastal Zones
Flooding of urbanized areas
Damage to coastal infrastructure
Salinization of aquifers and arable land

Fisheries
Shift in distribution of species
Habitat destruction and degradation
Loss of income and livelihoods

Health
Increased risk of water- and vector-borne diseases
More heat-related health issues
CLIMATE SUMMARY

Senegal’s climate is generally characterized as tropical, with one rainy season from May–November and a dry season dominated by dry, hot harmattan winds between December and April. Temperatures and rainfall vary across regions, with rainfall generally increasing from north to south and temperatures increasing from coast to interior. Along the coast, temperatures are cool, ranging from 17–27°C. In the northern Sahelian zone, the climate is characterized by cool nights (minimum of 14°C) and hot days (maximum of 40°C). The north has a longer dry season from November–May, and receives about 360 mm of rainfall the rest of the year. Moving south, rainfall increases and reaches up to 1,500 mm per year in the extreme south. Hot and humid, the southern region averages temperatures of 30°C throughout the year. (1, 4, 6, 11, 15)

HISTORICAL CLIMATE

Climate trends since the 1960s include:

- Increase in average temperatures by 0.9°C, with higher rates of warming in the north and more pronounced between October and December.
- Twenty-seven more ‘hot’ nights per year since 1960.
- Decline in rainfall; although rains have partially recovered since the mid-1990s, they have not recovered their pre-1970 levels and remain 15 percent below the long-term average.
- Rainfall decline is most significant in the southern region during the wet season (June–September).

FUTURE CLIMATE

Projected changes by the 2060s include:

- Rising average annual temperatures by 1.1–3.1°C; projected rates of warming are faster in the north and interior, and during the dry season.
- Substantial increases in the frequency of ‘hot’ days and nights, with more rapid increases in the south and east.
- Uncertainties exist about whether rainfall will increase or decrease, but overall increases in heavy rainfall events are expected.
- Rising sea level of up to 1 meter (by 2100).

SECTOR IMPACTS AND VULNERABILITIES

WATER RESOURCES

Senegal has a relatively large supply of both surface and groundwater, and access to improved water sources across the country is relatively high – more than 93 percent of urban and 67 percent of rural populations have adequate access. But rising demand, regional disparities in terms of access and quality, pollution and inadequate infrastructure make the water sector highly vulnerable to increasing climate variability and future climate change. Surface water and shallow groundwater are highly dependent on rainfall conditions; for example, river flows in Senegal declined by an estimated 35.7 percent from 1981 to 1989 due to droughts and rainfall deficits. Groundwater levels also decreased significantly during this period, 5 meters to 10 meters in the north and 15 meters to 20 meters in the south. In addition to reduced surface flows, future rainfall deficits and increased variability are likely to reduce aquifer recharge rates. Along the coast and in major cities like Dakar, saltwater intrusion into coastal aquifers and arable land is already a problem, and sea level rise and decreased rainfall will exacerbate salinity issues.

Climate Stressors and Climate Risks

| WATER RESOURCES |
|-----------------|-----------------|
| Stressors       | Risks           |
| Rising temperatures | Reduced supply of freshwater resources; increased evaporation of surface water and reduced recharge of groundwater, impacting water quality |
| Reduced or variable rainfall and increased heavy rainfall events | Increased salinity of groundwater |
| Sea level rise | Increased demand for irrigation |
|                 | Reduced or interrupted hydropower production; reduced potential for future investment in hydropower |

Future demand for irrigation will be a concern as rains become more erratic; agriculture consumes more than 90 percent of water resources, but only 4 percent of land is currently irrigated. Hydropower production, which contributes more than 10 percent to the country’s electric supply, is susceptible to variable rainfall and increased evaporation rates of retention ponds and dams. (6, 7, 8, 10, 15)
AGRICULTURE
Agriculture employs more than 70 percent of the Senegalese workforce and is the backbone of the rural economy. Cereals like millet and sorghum are key subsistence crops, while groundnuts, a main cash crop, are grown on 40 percent of cultivated land and employ up to 1 million people. Smallholder agriculture, which is predominantly rainfed, is already stressed by overexploitation of land, degraded soil and limited extension services. Climate change is expected to magnify most of these challenges. Groundnuts are sensitive to both rainfall variability and higher temperatures, and crop models project a 5–25 percent decrease in yields. Rainfall has been inadequate and decreasing in some areas, affecting important growing regions near Thies and Dioubel. While clear evidence does not yet exist, climate factors may also increase the frequency of Desert Locust infestations, which cause significant crop losses throughout West Africa.

COASTAL RESOURCES
Senegal’s rapidly urbanizing coastal zone is home to the majority of the country’s population, infrastructure and industry, as well as diverse ecosystems providing vital services upon which local economies are highly dependent. Coastal infrastructure, including 74 percent of housing, is at risk from sea level rise-induced coastal erosion and inundation. Rapid and pervasive erosion (due to both climate and human activity) affects almost every major coastal city, leading to losses of physical and financial assets. The 2009 floods caused over $100 million in damages ($67 million in Dakar alone), affecting housing, transportation and health systems. Most of the country’s tourism infrastructure lies along the Petite Côte, which already faces the impact of erosion, losing 1–2 meters of sandy beachfront a year. Rising sea levels threaten shallow coastal groundwater sources through increased salinization. Climate change will also impact mangroves, a vital coastal resource as they protect the coastline by moderating storm and wave impacts. Mangroves also stabilize sand and soils, cycle nutrients, absorb and break down waste products, provide wildlife habitat and maintain biodiversity. Mangroves are extremely dependent on sea level variations, rainfall and salinity and could therefore migrate or decrease significantly. (3, 6, 15)

FISHERIES
In Senegal fisheries employ 17 percent of the workforce, contribute 2.5 percent to GDP and are one of the main sources of animal protein in the Senegalese diet. Already stressed from overfishing, fisheries are expected to be negatively impacted by climate change as rising surface water temperatures and ocean acidification alter species reproduction and migration. This is turn affects biodiversity and the livelihoods, incomes and nutrition that depend on fisheries. (9, 11, 15)

---

**Climate Stressors and Climate Risks**

**AGRICULTURE**

<table>
<thead>
<tr>
<th>Stressors</th>
<th>Risks</th>
</tr>
</thead>
<tbody>
<tr>
<td>Rising temperatures</td>
<td>Reduced crop quality and yields, particularly for rainfed maize, sorghum, millet and groundnuts</td>
</tr>
<tr>
<td>Reduced or variable rainfall</td>
<td>Reduction in available land suitable for growing groundnuts</td>
</tr>
<tr>
<td></td>
<td>Increased occurrence of locust infestations</td>
</tr>
<tr>
<td></td>
<td>Heat stress and reduced water and feed supplies for livestock</td>
</tr>
<tr>
<td></td>
<td>Food shortages and increased food insecurity</td>
</tr>
</tbody>
</table>

Around 30 percent of households rely on livestock (mainly cattle and small ruminants) to support their livelihoods. Climate change impacts livestock directly (via heat stress and reduced productivity) as well as indirectly through reduced water and forage resources. (6, 14, 15)

**COASTAL RESOURCES**

<table>
<thead>
<tr>
<th>Stressors</th>
<th>Risks</th>
</tr>
</thead>
<tbody>
<tr>
<td>Rising temperatures</td>
<td>Erosion and flooding of coastal infrastructure</td>
</tr>
<tr>
<td>Sea level rise</td>
<td>Economic losses to tourism industry; loss of sandy beaches and damage to hotels</td>
</tr>
<tr>
<td></td>
<td>Damage to coastal ecosystems, particularly mangroves</td>
</tr>
<tr>
<td></td>
<td>Sea water intrusion/salinization of coastal aquifers and arable land</td>
</tr>
</tbody>
</table>

also impact mangroves, a vital coastal resource as they protect the coastline by moderating storm and wave impacts. Mangroves also stabilize sand and soils, cycle nutrients, absorb and break down waste products, provide wildlife habitat and maintain biodiversity. Mangroves are extremely dependent on sea level variations, rainfall and salinity and could therefore migrate or decrease significantly. (3, 6, 15)

**FISHERIES**

<table>
<thead>
<tr>
<th>Stressors</th>
<th>Risks</th>
</tr>
</thead>
<tbody>
<tr>
<td>Rise in sea levels and temperatures</td>
<td>Reduced fish yields/productivity</td>
</tr>
<tr>
<td></td>
<td>Temperature-induced migration</td>
</tr>
<tr>
<td></td>
<td>Damage to habitats (mangroves)</td>
</tr>
<tr>
<td>Ocean acidification</td>
<td>Loss of income and livelihoods (50 percent decline in related employment by 2050)</td>
</tr>
<tr>
<td>Extreme events</td>
<td>Loss of life and equipment</td>
</tr>
</tbody>
</table>
HEALTH
Climate change is likely to exacerbate the risks and impacts associated with water- and vector-borne diseases, which are already prevalent in Senegal. Across the country, higher temperatures will alter water availability and quality, increasing the incidence of waterborne diseases such as cholera and diarrheal disease, especially during the dry season as lower water levels from evaporation concentrate bacteria. Urban areas such as Dakar, already prone to flooding, will likely see more cholera outbreaks due to an increase in intense rainfall events that damage water and sanitation facilities. In the south, malaria (the number one cause of death in children under 5) will remain a significant risk as temperatures rise and may spread to the north. (6, 12, 18)

POLICY CONTEXT
INSTITUTIONAL FRAMEWORK
The Directorate of Environment and Classified Establishments is responsible for strengthening the awareness and knowledge of various government agencies on climate change and adaptation issues. The National Committee on Climate Change (COMNACC) think tank is the national platform for climate change coordination and acts as the focal point for the United Nations Framework Convention on Climate Change (UNFCCC). Senegal set up the National Climate Fund as an instrument to mainstream climate finance into its 20-year blueprint to achieve reforms and economic emergence, and to help tap into global climate finance. Senegal is reformulating its Country Investment Plan to factor resiliency into agricultural investments. (5, 15)

NATIONAL STRATEGIES AND PLANS
• Republic of Senegal's Third National Communication to the UNFCCC (2016)
• National Adaptation Programme of Action (NAPA) (2006)
• Environment Code Law 2001-01
• National Strategy for Sustainable Development (2005)
• National Adaptation Plan of Action (2006)
• Fisheries National Adaptation Plan (2016)

KEY RESOURCES
4. GFDRR. 2015. Senegal Country Profile
11. USAID. 2014. Senegal Climate Change Vulnerability Assessment and Options Analysis.

Map: adapted from Peel, M.C., et al. 2007. Updated world map of the Köppen-Geiger climate classification; data accessed from SDAT. Rainfall data from WorldClim.
## SELECTED ONGOING EXPERIENCES

<table>
<thead>
<tr>
<th>Selected Program</th>
<th>Amount</th>
<th>Donor</th>
<th>Year</th>
<th>Implementer</th>
</tr>
</thead>
<tbody>
<tr>
<td>Collaborative Management for a Sustainable Fisheries Future (COMFISH) and COMFISH Plus</td>
<td>$16 million</td>
<td>USAID</td>
<td>2011–2018</td>
<td>University of Rhode Island, Coastal Resources Center</td>
</tr>
<tr>
<td>Mainstreaming ecosystem-based approaches to climate resilient rural livelihoods in vulnerable rural areas through the Farmer Field School methodology</td>
<td>$30.9 million</td>
<td>GEF, FAO</td>
<td>2015–2019</td>
<td>Ministry of Agriculture and others</td>
</tr>
<tr>
<td>Promoting Innovative Finance and Community-based Adaptation in Communities Surrounding Community Natural Reserves</td>
<td>$22.5 million</td>
<td>UNDP, GEF</td>
<td>2016–2020</td>
<td>Ministry of Environment and Sustainable Development</td>
</tr>
<tr>
<td>Senegal National Adaptation Plan</td>
<td>$11.9 million</td>
<td>GEF, UNDP</td>
<td>2016–</td>
<td>Ministry of Environment and Sustainable Development</td>
</tr>
<tr>
<td>Senegal Disaster Risk Management and Climate Change Project</td>
<td>$5 million</td>
<td>World Bank</td>
<td>2010–2015</td>
<td>Civil Protection Directorate</td>
</tr>
<tr>
<td>Increasing Productivity and Livelihoods in the Nioro du Rip Basin in Senegal</td>
<td>Not available</td>
<td>USAID-CIAT</td>
<td>2014–unknown</td>
<td>CCAFS, AgMIP</td>
</tr>
<tr>
<td>Climate Information Services for Increased Resilience and Productivity in Senegal</td>
<td>$3.5 million</td>
<td>USAID</td>
<td>2016–2019</td>
<td>CCAFS, ICRISAT, and ANACIM</td>
</tr>
</tbody>
</table>