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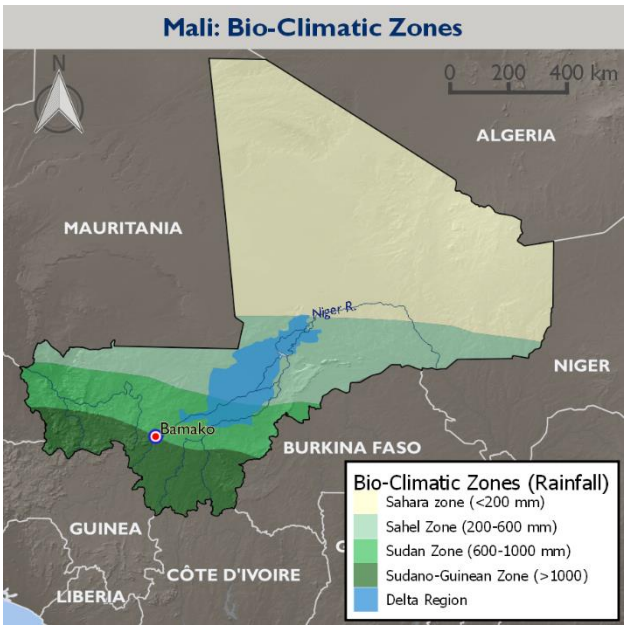
FACT SHEET

CLIMATE RISK PROFILE
MALI

COUNTRY OVERVIEW



Landlocked Mali is estimated to be among the most vulnerable countries to climate stress due to its socioeconomic status, location, and climate-sensitive economy. Nearly half the population lives below the poverty line. Two-thirds of the country is in the arid Sahara and semiarid Sahel. Pastoralist and agrarian systems provide livelihoods for 74 percent of Malians and are highly sensitive to the droughts and rainfall variability typical of the Sahel region. Recurring extreme events—severe drought in the 1970s and 1980s, five major droughts from 1987 to 2007, and catastrophic floods—prevent households from recovering and moving out of poverty. Political instability and uneven infrastructure distribution add to Mali's vulnerability to climate stress. The Malian Government and northern armed groups signed an internationally mediated peace accord in June 2015, yet the encroachment of Islamist armed groups into central Mali contributes to a fragile, dynamic security situation that has displaced hundreds of thousands of Malians to southern Mali or adjacent countries. Conflict also has limited pastoralist mobility and harmed agricultural production and markets through disruption of supply routes, labor shortages, and lack of agricultural extension. (17, 23, 32, 10, 26, 18)

CLIMATE PROJECTIONS

1.2°–3.6°C increase in temperatures by 2060

Increase in frequency and intensity of droughts and other extreme weather events

Increased rainfall variability

KEY CLIMATE IMPACTS

Agriculture
Reduced rainfed crop yield
Increased extent of transhumance corridors
Increased livestock mortality

Water
Decrease in inflows and flood extent of the Inner Niger Delta
Increased variability and quality of water supplies

Ecosystems
Changing inundation patterns of Inner Niger Delta; shifting vegetation zones

Human Health
Increased risk of diarrheal disease
Increased food insecurity and malnutrition

December 2018
This document was prepared under the 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

Mali has flat to rolling landscapes, occasionally interrupted by high rising plateaus. The Sahara Desert covers nearly half of Mali's northern territory, where the dry season can last more than nine months. Moving southward, the climate transitions to the semiarid Sahel region (interrupted by the seasonally flooded alluvial plain of the Inner Niger Delta), then to the Sudanian savanna, which has a tropical wet and dry climate, in the south and west. Southern Mali receives up to 1,100 mm of rainfall annually, mostly between June and October. Rainfall averages decrease moving north through the Sahel (100–1,100 mm annual average) to the Sahara (less than 50 mm annually). Mali experiences three seasons: a rainy season from June to September/October; a cool, dry season from October to January coinciding with Harmattan winds; and a hot, dry season from February to May, during which temperatures reach 33°C. The annual West African Monsoon is influenced by the Intertropical Conversion Zone (ITCZ), which brings large interannual variability in wet-season rainfall and contributes to recurring droughts and floods. Annual temperatures range from 27°C to 30°C, with greater temperature variation in the north. (31, 29, 30, 5, 16, 22, 9)

HISTORICAL CLIMATE

Climate trends have included:

- An increase in average annual temperatures of 0.7°C since 1960.
- Rapid decline in rainfall observed beginning in the 1950s through the 1980s, with partial recovery from the 1990s onward.
- Below-average rainfall for 2000–2009 (-12 percent compared with the 1920–1969 average).
- Increase in frequency of hot nights and decrease in frequency of cold nights in all seasons except December–February.
- Increase in the frequency of Harmattan dust storms in central and northern Mali.

FUTURE CLIMATE

Projected changes include:

- An increase in temperature of 1.2°C to 3.6°C by 2060, with larger increases in the southwest (Kayes) and central regions (Mopti, Gao).
- Increase in the duration of heat waves; reduction in length of cold spells.
- Precipitation changes are uncertain, but models show tendency toward an increase in heavy rainfall events in the south and a decrease in rainfall in the north.
- Accelerated desertification in the north and more frequent extreme weather events (floods and droughts) in the south.

SECTOR IMPACTS AND VULNERABILITIES

AGRICULTURE

Almost three-quarters of the Malian labor force is employed in agriculture. The dominant livelihood is pastoralism in the arid north and mixed crop/livestock production in central and southern Mali. Ninety-five percent of agriculture is rainfed, and rainfall (both timing and amount) is a major constraint for crop production. Smallholder production includes cereals such as millet, market gardening, and export crops such as rainfed cotton. National reforms and investment in the sector increased annual cereal production from 2.6 million tons to 6.4 million tons between 2001 and 2011, and abundant rains contributed to record harvests in 2014. Despite these production gains, food insecurity in a quarter of the population has persisted due to increasing demographic pressures and informal trade and unregulated export to neighboring countries. High variability in annual rainfall coupled with significant increases in warming may lead to permanent declines in rainfed crop yields in Mali's southern breadbasket. Over the last six decades, the northern limit for rainfed millet and sorghum, key household subsistence crops, has shifted southward by approximately 50 km. This trend is likely to continue as temperature increases reduce soil moisture.

Livestock, an indicator of wealth and food security in many households, is likely to suffer heat stress and reduced production from rising temperatures. Desertification and drought, along with expansion of armed groups in the north, have altered pastoralists' range and pasture access, contributing to increased herder–farmer conflict. Higher temperatures and lower rainfall may lead to decreased vegetation, affecting grazing potential and fodder production. Climate change will also impact the range and incidence of pests and diseases afflicting livestock. A hotter, wetter climate may expand the range of

Rift Valley fever in some areas (with particularly adverse effects on sheep) and increase transmission risk for African swine fever. A hotter and drier climate, however, may lead to increased poultry losses as a result of more frequent outbreaks of Newcastle disease and increased risk of avian flu, as well as higher exposure to anthrax as reduced water availability drives larger numbers of livestock to graze in dry flood zones or contaminated watering ponds. (7, 4, 13, 33, 11, 14, 8, 19, 24, 27)

Climate Stressors and Climate Risks AGRICULTURE

Stressors	Risks
Rising temperatures	Increased evapotranspiration and reduced water for agriculture
	Shifting agricultural zones
Variable rainfall	Reduced pasture access and decreased grazing potential
Extreme events (droughts, intense rainfall events)	Heat stress and reduced livestock production
	Changes in distribution and presence of disease vectors (e.g., mosquitoes, ticks) and pathogens

WATER RESOURCES

Much of Mali's potable water comes from exploiting groundwater from nine aquifer systems. While few hydrology studies have been done of areas outside of the Niger River Basin, populations relying on wet season surplus, especially in *bas-fonds* (shallow inland valleys with high water tables), seasonal ponds and streams, and shallow groundwater, remain vulnerable to long-term and short-term fluctuations in water availability. Expansion for drinking water and sanitation needs has the potential to lower groundwater supply, particularly when rainfall and aquifer recharge is below normal. About 47 percent of Mali lies within the Niger River Basin and 11 percent within the Senegal River Basin, which together provide most of the country's surface water. Bamako and surrounding cities source potable water from the Niger River, which is threatened by pollution (artisanal mining, industries, plastic bags, etc.). The Inner Niger Delta (IND) is hydrologically vulnerable to climate changes. Projected impacts vary, but most models project declines in average annual river inflow by the 2050s and decreased flood extent within peak months of July–September. Flows and flood extent would be further affected by planned hydropower and irrigation projects such as the Fomi Dam in Guinea. Expanded irrigation raises demand for dry season water, but the longer-term implications of water allocation decisions and climate change on water availability need further study. Significantly reduced runoff is expected in this century in the basin of the Bani River, a tributary of the Niger, due to declining rainfall and increased evaporation. Water stress has led to internal migration and conflict between farmers and pastoralists. (12, 7, 21, 25)

Climate Stressors and Climate Risks WATER RESOURCES

Stressors	Risks
Rising temperatures	Decrease in inflows and flood extent of the Inner Niger Delta
Increased evaporation	Decrease in river runoff for the Niger, Senegal rivers and their tributaries
Increase in rainfall variability	Regional and domestic conflict over usage rights and availability

ECOSYSTEMS

Mali has 4.2 million hectares of wetlands of international importance, including the IND, one of the largest Ramsar sites in the world. Over 1 million people use floodplain resources for rice cultivation, fishing, and livestock grazing. More than 140 bird species live in the delta. These wetlands already face soil erosion, desertification, recurrent droughts, salinization, and desiccation, all of which may be exacerbated by climate change. As noted above, climate projections vary, indicating both possible increases and decreases in flood extent for the period 2050–2080. This may lead to a range of potential ecological implications, such as increases in dry season river flows and flooding that facilitate expansion of invasive species, or beneficial expansion of the floodplain fish nurseries. Climate changes and population growth affecting the spatio-temporal inundation patterns of the IND in turn have an impact on food production and food security. For economically important inland fish species like characin and perch, rising temperatures alter water quality and dissolved oxygen content in lakes, harming fish reproduction, survivability, and virility. Rainfall variability and drought can lower water

levels of tributaries and prevent seasonal fish migrations to rich flood plains for feeding and breeding. Beyond potential impacts to the IND, higher temperatures and lower rainfall may lead to decreased density of tree and shrub species. This vegetation is not only important for soil and water conservation, but also a significant source of construction material and fuelwood. This impact is further exacerbated by the southward shift of vegetation zones. (2, 21, 12)

Climate Stressors and Climate Risks ECOSYSTEMS	
Stressors	**Risks**
Rising temperatures	Reduced river inflows during rainy season and/or increase in dry season flooding
Changes in seasonal flood extent	Loss of potential agricultural areas within the Inner Niger Delta
Increased rainfall variability	Increased competition and conflict between water users
	Shifting vegetation zones

HUMAN HEALTH

Malaria, the leading cause of death in Mali, could decline in many zones with current transmission suitability 7–9 months of the year (e.g., southern Mali). Temperatures rising above the thermal threshold for survival of the vector (*Anopheles* mosquitoes), will shorten the transmission season. Rising temperatures and more frequent heat waves also increase exposure to heat stress, which can have both direct impacts on human health (e.g., heat rash, heat stroke) and indirect impacts (e.g., heightened food insecurity and malnutrition resulting from crop failure and decreased livestock productivity). Mali has high rates of diarrheal disease because only 25 percent of the population uses improved sanitation facilities and only 77 percent uses piped water or other improved drinking water sources. Although the incidence of diarrheal disease declined 32 percent from 2005 to 2016, higher temperatures and increased flood risk may increase transmission of pathogens. Southern Mali lies in the "meningitis belt," characterized by seasonal epidemics during the dry season. Although the exact linkages to climate have not been isolated, risk factors include dust and low humidity— both of which may increase in a drier, hotter climate. Twenty-five percent of Malian families are considered moderately to severely food insecure, and one in three children under the age of five is affected by stunting. Malnutrition also increases susceptibility to other diseases. Decreased agricultural production as a result of climate stressors may lead to increased household food insecurity. (27, 3, 15, 20, 6, 1, 28)

Climate Stressors and Climate Risks HUMAN HEALTH	
Stressors	**Risks**
Rising temperatures	Decrease in seasonal malaria
Increase in rainfall variability	Increased transmission of waterborne pathogens
	Increased risk factors for bacterial meningitis
Increased incidence of flooding	Prevalence of stunting and malnutrition in children as a result of increased food insecurity

POLICY CONTEXT

Mali has established national level strategies and plans for climate adaptation and focused on institutional framework and policy instruments. In the 1990s Mali began a process of decentralization to institutionalize local control over decision-making and resource allocation. Climate adaptation is not a required element of the commune-level participatory development planning process, but with support from donor agencies, communes have begun to incorporate climate adaptation strategies into their planning.

INSTITUTIONAL FRAMEWORK

In 2011 the Ministry of Environment and Sanitation launched the planning process for operationalizing national climate change policy through its Agency for Environment and Sustainable Development (AEDD). Established in 2010, AEDD coordinates state, civil society, private sector, and international development actors in climate change response and environmental protection. AEDD works closely with the weather and climate services agency Mali-Météo. "Agence du Bassin du Fleuve Niger (ABFN)" was created to safeguard and protect the Niger.

NATIONAL STRATEGIES AND PLANS

- Intended National Determined Contribution (2015)
- National Climate Change Strategy (2011)
- Second National Communication to the UNFCCC (2011)
- National Adaptation Plan of Action (2007)

KEY RESOURCES

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31. World Bank. 2011. Climate Risk Adaptation Country Profile: Mali.
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Map resource: Hijmans, R.J. et al. 2005. Very high resolution interpolated climate surfaces for global land areas.

SELECTED ONGOING EXPERIENCES

Below are selected projects focused on climate change adaptation, or some aspect of it, in Mali.

Selected Program	Amount	Donor	Year	Implementer
Mali Climate Change Adaptation Activity	$12.75 million	USAID	2015–2020	Chemonics International
RIC4REC: Strengthening community initiatives for resilience to climate extremes	Not available	DFID	2013–2018	Blumont (formerly International Relief & Development)
Mali Hydrological and Meteorological Services Modernization Project	$33.5 million	World Bank, Green Climate Fund	2017–2021	World Meteorological Organization, Direction Générale de la Protection Civile
Senegal River Basin Climate Change Resilience Development Project	$212.50 million	World Bank	2013–2021	Senegal River Basin Development Authority
Natural Resources Management in a Changing Climate in Mali	$13 million	World Bank	2014–2019	AEDD, Ministry of Environment, Sanitation and Sustainable Development
Capacity Building Project for Adaptation and Resilience to Climate Change in the Agricultural Sector.	Not available	UNDP, CIDA, GEF	2009–2018	Not available
Support Program for Environmental Management and the Promotion of Sustainable Development in Mali	$2.5 million	UNDP, government of Mali	2011–2018	AEDD, Ministry of Environment, Sanitation and Sustainable Development
Support Program for Sustainable Agriculture and Climate Change Resilience in Yanifolila	$587,559	Multi-Partner Trust Fund Office of United Nations Development Programme – Mali Climate Fund	2014–2018	AGIR, GUAMINA, Association pour la Protection et la Valorisation de l'Environnement, Ministry of Environment, Sanitation and Sustainable Development
Innovative Development Planning for Adaptation to Climate Change in Mali	Not available	GIZ	2011–2018	Ministry of Environment, Sanitation and Sustainable Development
Supporting the National Strategy for Adaptation to Climate Change	Not available	GIZ	2014–2019	Ministry of Environment, Sanitation and Sustainable Development
Integrated Development for Rural Increased Climate Resilience in the Niger Basin	$73.4 million	GEF Trust Fund	2017	African Development Bank, Niger Basin Authority