



Climate Change Adaptation in MALI

Mali is highly vulnerable to climate change and variability. Droughts, storms, strong winds, and increased temperature variability are the climate risks of greatest concern. The Malian government and international and national institutions and organizations began addressing climate-related challenges in the 1960s and have since conducted several vulnerability assessments, enhanced climate observations and modeling, and developed and implemented adaptation plans and capacity building efforts. However, adaptation needs remain, including the necessity of additional and more accessible research on climate change impacts and vulnerabilities at local community levels with particular focus on food security, water resources, and coastal resources. Additional funding for implementation of adaptation plans and strategies is also needed.

CLIMATE IMPACTS AND VULNERABILITY

Historic Weather and Climate

- Increase in average temperatures of about 0.7°C since 1960, an average of 0.15° per decade.
- Annual average precipitation ranges from 100-1700 mm, with very little rainfall throughout the year in the north.
- In the early 1960s, late 1990s, and early 2000s, annual rainfall was particularly high, while the early 1980s were very dry.
- Increases in the number of long drought periods.

Projected Weather and Climate

Although projections vary across climate models depending on assumptions, most models predict for Mali:

- An average increase of 1.2-3.6°C in annual temperatures by the 2060s, and of 1.8-5.9°C by the 2090s.
- Increased evapotranspiration, a process that dries land surfaces and soil.
- A decrease in average annual rainfall by 8.7 percent below 1961 levels by 2015, but a rise in rainfall variability.
- Greater frequency and longer duration of droughts, and more intense floods and storms.

KEY SECTOR VULNERABILITIES

Food Security, Agriculture, and Livestock

Agriculture in Mali is crucial to ensure economic stability and food security. The agriculture sector employs about 75 percent of the country's population and accounts for approximately 50 percent of Mali's gross domestic product. Due to the predominance of rain-fed agriculture in the country, it is highly vulnerable to anticipated droughts, reduced precipitation, and increases in temperature. Current projections estimate a decline in the crop yields for cotton, rice, sorghum, and millet in the Inner Niger Delta area. Losses in millet and sorghum production range from 150 tons in 2005 to an estimated 2,500 tons in 2025. In addition, changes in temperature and precipitation may facilitate pest infestations, which threaten crops and affect livestock grazing.

Non-climate stressors, such as poor land management practices, intense agricultural expansion, and increased demands on land for agriculture and pastoral activities, also threaten food security in Mali. Intensified land use, especially in the Niger River floodplain, has led to increased erosion of land surfaces and sedimentation of water resources available for farming. Subsistence farmers are particularly vulnerable because they have limited access to financial and agricultural resources and are impeded by policies that focus on cotton and rice production with little emphasis on increasing production of critical food crops such as sorghum and millet.

Water Resources

Surface water, which include lakes, rivers, streams, and ponds, and groundwater are vital to Mali's economy and support activities in all economic sectors, including agriculture, fisheries, tourism, mining, and livestock herding. Prolonged droughts and lack of rainfall have



Map of Mali. Source: Encyclopedia Britannica

imposed limitations on water availability to communities throughout Mali. Estimates from a case study by N'Djim and Doumbia predict a 52 percent decline in per capita freshwater supplies by 2020 primarily due to projected decreases in precipitation and future population growth. Even as overall rainfall decreases, climate variability and the likelihood of extreme events are anticipated to increase with climate change. This may result in greater frequency and intensity of heavy rainfall events and storms such as those seen in the country in the 1960s, 1990s, and 2000s, which caused floods, contaminated surface and groundwater; and caused siltation of surface water sources. In areas like the Niger River flood plain, heavy rainfall events during the rainy season can lead to overflows of the Niger River and intense flooding, causing a loss of lives and livestock, destruction of settlements and infrastructure, and land erosion. Non-climate stressors such as pollution, inadequate management of irrigation systems, sedimentation, and siltation also threaten water resources in Mali.

Health

Currently, health conditions, infrastructure, and services are well below international standards, making the health sector in Mali especially vulnerable to changes in climate. The table below summarizes key health vulnerabilities in Mali.

Impact Mode	Impacts	Consequences
Direct	<ul style="list-style-type: none"> Exposure to thermal extremes, especially heat waves. Altered frequency and/or intensity of other extreme weather conditions (droughts, floods, storms, etc.). 	<ul style="list-style-type: none"> Altered rates of heat- and cold-related illness, especially cardiovascular and respiratory diseases. Deaths, injuries, and damage to public health infrastructure.
Indirect (due to disturbances of ecological systems)	<ul style="list-style-type: none"> Effects on ranges and activity of vectors and parasites. Altered local ecology of water- and food-borne infective agents. Altered food (especially crop) productivity due to changes in climate, weather, and associated pests and diseases. Shifts in the quality, quantity, and distribution of fresh water. Increased levels and biological impacts of air pollution including pollens and spores. Social, economic, and demographic dislocations due to adverse climate change impacts on the economy, infrastructure, and resource supply. 	<ul style="list-style-type: none"> Change in transmission zones of vector-borne diseases and numbers of people infected. Changed incidences of diarrhea and infectious diseases such as cholera. Regional malnutrition and hunger with consequent impairment of child growth and development, especially in vulnerable communities. Injuries, increased risk of various infectious diseases (due to migration, overcrowding, contamination of drinking water). Asthma and allergic disorders, other acute and chronic respiratory disorders and deaths. Wide range of consequences affecting public health (e.g. mental health, nutritional impairment, infectious diseases, civil strife).

Higher temperature can lead to a rise in the incidence of vector-borne diseases, and a lack of potable water and water contamination can increase the occurrence of water-borne diseases. Two diseases closely linked to weather conditions in Mali are meningitis and malaria. Malaria incidences tends to increase in warmer temperatures and after heavy rainfall or flooding events. Predicted temperature increases may also result in a greater prevalence of bacteria and viruses that cause infections such as meningitis.

In addition to climate change, non-climate stressors contributing to the vulnerability of the Malian population are poverty, sanitation, poor nutrition, and environmental degradation. These issues must all be considered in adaptation efforts in order to ensure long-term improvements in health challenges.

KEY ECOSYSTEM VULNERABILITIES

Forests

Malian forests, which are predominantly savanna, are an important source of food, fodder, and medicinal products, and provide over 90 percent of the country's energy consumption (in the form of firewood and charcoal). Forests also support a diversity of flora and fauna, many of which are endangered. Climate change has already contributed significantly to the desertification and degradation of forest resources. Impacts include:

- Reduced precipitation and longer and more severe droughts have altered forest lands and reduced biodiversity.
- Water scarcity has led to the degradation of trees, plants, and soil.
- Droughts and bush fires have turned forest areas into sandy, grassy dune, and dead wood areas. Brush fires also kill animals.

Non-climate stressors that intensify forest vulnerability and accelerate the loss of forests and biodiversity include intensive agricultural practices, land clearing, overgrazing, pruning, poaching, illegal fishing, mining, excessive herb and plant harvesting, and the introduction of exotic species. These stressors are largely a result of greater population pressures and demands on land and natural resources for urban development practices, energy needs, and economic development.

NATIONAL STRATEGIES, PLANS AND INSTITUTIONS RELEVANT TO CLIMATE CHANGE

National Strategies and Plans

- Initial National Communication (2000): Identifies priority adaptation sectors.
- National Adaptation Programme of Action (NAPA) (2007): Identifies sectors and communities most vulnerable to climate change and variability; introduces strategies that promote sustainable development and poverty reduction.
- Strategic Framework for Growth and Poverty Reduction (adopted in 2002): Highlights the importance of sustainable natural resources management and environmental protection in order to achieve rapid broad-based growth.
- National Program to Combat Deforestation (established in 1988): Includes rural development projects in agriculture and forestry, public awareness and information dissemination, and the promotion of improved cook stoves that reduce demands for fuel wood as a source of energy.

Institutional Framework

- The Ministries of Agriculture, Environment and Sanitation, Livestock and Fisheries, Planning and Spatial Planning, and Energy and Water are involved in conducting research and assessments and in developing and implementing climate change adaptation plans.
- The National Directorate for Meteorology (DNM) is the focal point for coordination on climate change initiatives, including the United Nations Framework Convention on Climate Change, and is charged with monitoring the implementation of adaptation projects.
- The Permanent Technical Secretariat for the Institutional Framework of Environmental Issues Management is charged with managing national environment and climate information.

Adaptation Priorities

Mali's NAPA identifies priority sectors and provides detailed information on the Government's 19 priority adaptation projects (see box at right). The NAPA also highlights the importance of understanding and finding relevant solutions for climate change based on past and current adaptation practices. Improving synergy, information sharing, and best practices between government agencies, research institutions, and non-governmental organizations (NGOs) are also priorities. A climate change screening performed by the Danish International Development Agency (DANIDA) identified several adaptation strategies in reports and studies on climate change in Mali, including:

Improvement of infrastructure (roads, dams, and irrigation schemes)
Use of integrated water resource management schemes
Creation of new income-generating activities as a basis for adaptation

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Key Players and Initiatives

Many of Mali's climate change initiatives are led and financed by international agencies, institutions, and NGOs working with local partners.

- DANIDA has focused on and funded climate change initiatives relative to water resources and sanitation, agriculture and private sector enterprise, energy and good governance, capacity building, awareness raising, and training.
- The German Agency for International Cooperation (GIZ) is financing efforts to mainstream climate strategies into environmental assessments. The French Institute for Development, Netherlands Development Organization, United Nations Environment Programme, United Nations Development Programme, and Food and Agriculture Organization of the United Nations have focused on assessments, research, capacity building of local stakeholders, strategy development, dissemination of information on climate change and adaptation in Mali, and other efforts related to the NAPA. Many of these programs and projects are addressing issues related to agriculture, food security, water resources management, and rural livelihoods.

Priority Adaptation Projects from NAPA

- Promotion of improved varieties of major food crops adapted to climatic conditions (millet, sorghum, maize, and rice)
- Promotion of animal and plant species adapted to climatic conditions
- Promotion of income-generating activities and mutual assistance associations
- Aquaculture development and equipping
- Grain banks promotion
- Use of weather information to improve agricultural production and contribute to food security
- Lowland development
- Installation of boreholes equipped with solar- or wind-powered pumps
- Promoting use of *Typha australis* (plant) for energy needs
- Removal of barriers preventing the promotion of solar energy applications
- Runoff water harvesting system and restoration of water points (backwater, lakes)
- Awareness raising and organizing people for the preservation of natural resources (development of local agreements for reforestation and agroforestry)
- Forest fire management
- Development of farming conservation and composting activities
- Development of fodder crops
- Development of a technology package to train people on simple adaptation to climate change activities
- Promotion of animal feeding banks
- Promotion of *Jatropha* oil as clean energy alternative (vegetable oil from seeds of a plant)
- Establishing an information system on climate change-related health risks

- The National Meteorological Organization (DNM) monitors and predicts temperature, precipitation, and climate change events.
- The African Monsoon Multidisciplinary Analysis focuses on improving information and understanding of the West African Monsoon's impact on natural resources and land surfaces.

PRIORITY CHALLENGES AND CONSTRAINTS FOR ADDRESSING VULNERABILITY AND INCREASING RESILIENCE

Data, research, and capacity needs include:

- Improving inter-ministerial and inter-institutional coordination to avoid overlap and duplication of efforts and to enable the successful implementation and mainstreaming of cross-cutting environmental and climate change programs, plans, and policies.
- Increasing personnel in key national institutions and improving their training on tools for developing climate scenarios and analyzing vulnerability.
- Increasing available location-specific and detailed data on climate change forecasts and impacts.
- Raising awareness, disseminating information, and increasing education on climate change and adaptation.

An additional constraint relates to funding. Most funding for climate change and adaptation initiatives in Mali is either pending, limited, or nonexistent, and has been provided predominantly by the Global Environment Fund, international agencies, and institutions. Significant additional funding is still needed to accelerate the implementation of climate change adaptation projects, as well as social and economic development, national poverty reduction, and growth objectives, which remain threatened by climate change, climate variability, and extreme weather events. Increased funding will not only support necessary climate change adaptation efforts and initiatives, but will also contribute to strengthening the capacities of decision makers and stakeholders to work towards achieving climate resilience and sustainable development goals in Mali.

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