
Annex

- Country Profiles
- Endnotes





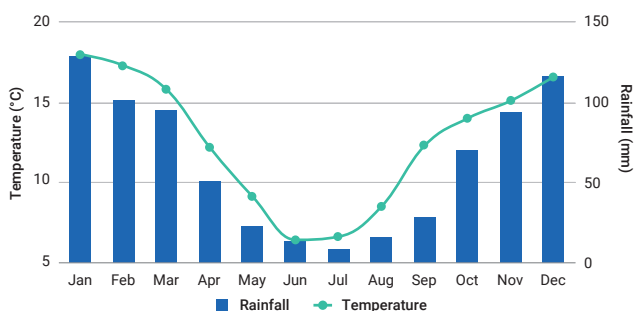
Photo: Joe Saade/UN Women/Flickr

Lesotho Climate Risk and Adaptation Overview

Adapted from the [World Bank's Climate Risk Country Profiles Series, 2021](#)

Climate Trends

Average Monthly Temperature (T) and Precipitation (Ppt), 1991–2020¹



Country Context

Population 2.1 m (2020)	Annual growth rate 0.8% (2020)
GDP US\$1.8 bn (2020)	Annual growth rate -11.1% (2020)
GDP per capita US\$861 (2020)	GNI per capita US\$1,100 (2020)

Literacy rate, adult female/male: 85% / 68% (2014).
Geography: Landlocked country surrounded by South Africa; land area: 30,355 km²; the country has four ecological zones: the lowlands (17%), foothills (15%), mountains (59%), and the Senqu River Valley (9%). Topography is mountainous with sharp terrains.
Broad climate: Temperate with alpine characteristics. Hot summers and relatively cold winters.

Climate Projections²

CMIP5 Ensemble Projection	2020–2039	2040–2059	2060–2079	2080–2099
Annual Temperature Anomaly (°C)	+0.6 to +1.7 (+1.6°C)	+1.5 to +3.0 (+2.1°C)	+2.4 to +4.5 (+3.3°C)	+3.4 to +6.2 (+4.4°C)
Annual Precipitation Anomaly (mm)	-21.6 to +20.1 (-0.5 mm)	-27.3 to +21.0 (-1.9 mm)	-26.5 to +26.7 (-1.6 mm)	-30.2 to +28.2 (-2.9 mm)

Note: The table shows CMIP5 ensemble projection under RCP8.5. Bold value is the range (10th–90th Percentile) and values in parentheses show the median (or 50th Percentile).

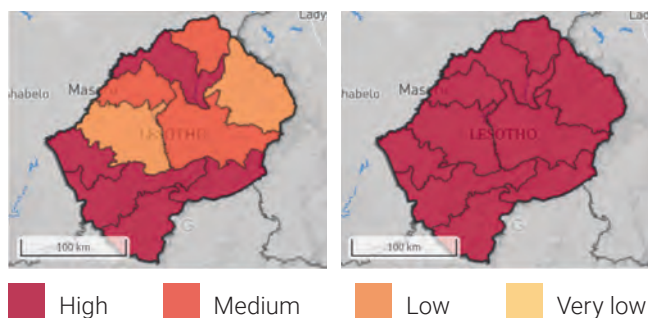
Climate Hazards

- More than 90% of disasters in Lesotho are related to climate variability and change, specifically drought, snowfall, hailstorms, strong winds, floods, early frost, and pest infestations.
- The country is particularly vulnerable as more than 70% of the population live in remote and ecologically fragile mountainous terrain.
- Lesotho has experienced increasingly frequent occurrences of drought in recent years. The country recently suffered from a severe drought from 2015 to 2017, due largely to El Niño events that affected Southern Africa. This significantly impacted food security and required international food assistance from international donors.
- Impacts of extreme rainfall events on public and private infrastructure have resulted in costly repairs, road closures, limited or no access to electricity, and complete failures of sewage and storm-water systems.
- Lesotho saw unprecedented rains, floods, and rock slides in December 2010 and January 2011, causing total losses and damages estimated at 3.2% of GDP.
- Increased temperatures and increased aridity will also heighten the country's risk of wildfires.
- Rural farmers are more sensitive to impacts of disasters due to having limited resources and low adaptive capacity.

Natural Hazards Occurrence, 1991–2022³

Hazard	Subtype	Events	Deaths	Affected
Drought		6	–	3,608,515
Flood	Riverine	2	26	5,000
Storm	Unstated	5	1	3,780
	Convective	2	–	4,500
Total		15	27	3,621,795

Risk of River Flood (left)⁴, Risk of Wildfires (right)⁵



ENABLING ENVIRONMENT

Leadership and Governance

- Ministry of Energy, Meteorology and Water Affairs (MEMWA): Responsible for the country's climate change strategies and serves as the national climate change focal point.
- The Lesotho Meteorological Service is responsible for the collection, processing, formatting, and management of data relating to weather and climate change for the Government, and supports reporting on climate change to the UNFCCC.
- Lesotho is also actively coordinating its climate change policies and strategies with stakeholders in the public and private sectors, including non-governmental organizations (NGOs), civil society, the donor community, and local communities.

Key Adaptation Policies

Key Policy Documents: Lesotho Vision 2020 (2018), Nationally Determined Contribution (2017), National Climate Change Strategy 2017–2027 (2017), National Resilience Strategic Framework and Theory of Change (2016).

Disaster Risk Management (DRM):

- Lesotho is in the process of developing and implementing a Disaster Risk Management Act and a corresponding Disaster Policy to strengthen institutional linkages between DRM and climate change adaptation.
- The Lesotho Meteorological Service plays a critical role in providing meteorological forecasts and extreme climate event information to the country's Disaster Management Agency (DMA) and other ministries in support of preparatory and response efforts to climate-related natural disasters.
- The DMA has undertaken systematic risk assessments specifically in regard to the country's water resources sector (including on flooding and drought potential) and water management systems.
- The DMA received technical support from the World Bank and the World Food Programme in order to build its early-warning systems in 2015. This was used to improve the country's preparedness and response capabilities.

ND-GAIN Index⁶

Country Index rank (score): 129 (41.4)

Vulnerability: 0.484

Ecosystem Services 18%, Food 21%, Human Habitat 22%, Health 26%, Water 12%

Readiness: 0.311

Economic 36%
Governance 46%
Social 17%



ND-GAIN Evolution

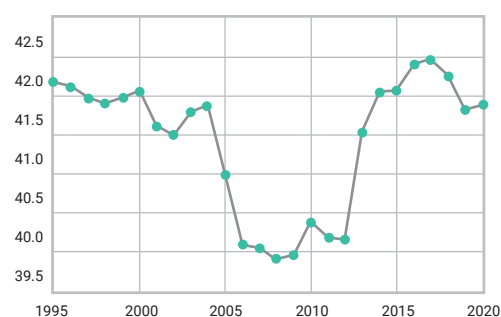


Photo: pg-images/iStock

SECTORAL ADAPTATION PLANNING



WATER

The sector contributed approximately 10% to Lesotho's GDP (in 2018).

Main Climate Change Impacts

- Longer dry spells interspersed with heavy rainfall events could intensify the potential for soil erosion.
- Increased temperatures are expected to decrease water availability and thus stream flows, increasing evapotranspiration and reducing runoff.
- An increase in the intensity of rainfall, coupled with a change in seasonality and duration, is likely to result in the increased occurrence of floods and droughts, which may also compromise irrigation potential.
- Future projected water supply constraints and temperature rise will impact food production and food security.

Milestones

- The Lesotho Highlands Water Project is a multistage infrastructure project that enables the transfer of water to Gauteng Province, South Africa.

Proposed Adaptation Strategies

- Develop policies to protect wetlands from persistent degradation and land-use mismanagement.
- Services and job creation can promote decentralization, which in turn could relieve pressure on water resources in urban centers.
- Implement integrated catchment conservation and management programs, expand rainwater-harvesting, water conservation techniques, water use, water reuse, and irrigation efficiency.
- Expand construction of dams to enhance water storage.
- Planning and adaptation strategies for water resources should also be included within development strategies for agriculture, infrastructure, and energy sectors.



AGRICULTURE

60–70% of the country's labor earnings are derived from agriculture, predominantly small scale, and characterized by rainfed cereal production with extensive animal grazing.

- **Important domestic crops:** maize, wheat, sorghum, potato, beans, peas, fruit trees, vegetables such as cabbage and tomato.
- **Major livestock:** sheep and goats (primarily for wool and mohair), cattle and pigs.

Main Climate Change Impacts

- Projected changes in precipitation and increases in temperature from September to May through mid-century are likely to positively impact yields for maize, sorghum, and wheat, and to negatively impact growth of beans and cucurbits (gourds).
- The projected decrease in precipitation from July to August through the end of the century will reduce soil moisture reserves and negatively impact the growth of winter crops.
- Decreased water availability is likely to reduce yields. The reduction in soil moisture may alter areas suitable for agriculture or the production of specific crops.
- Southern areas of the country are expected to be more adversely affected with regard to crop yields and productivity.
- Increased heat and water scarcity conditions are likely to increase evapotranspiration and contribute to crop failures and overall yield reductions.

Proposed Adaptation Strategies

- Develop linkages that connect smallholders to export and domestic markets.
- Switch to a more traditional farming system that combines the use of crop rotation, relay cropping, and intercropping practices with the application of manure and plant ash to conserve soil moisture and replenish soil fertility.
- Implement climate-smart agriculture practices.
- Improve water management and promote water-harvesting techniques.
- Improve monitoring and early-warning systems, and develop knowledge and decision-support systems.



NEEDS

Research

- Improve Lesotho Meteorological Service capabilities in projecting future climate trends and identifying the occurrence and magnitude of hazards.
- Widen participation of the public, scientific institutions, women, and local communities in planning and management, accounting for approaches and methods of gender equity.
- Strengthen environmental observation and monitoring capabilities for more effective environmental management.
- Expand capacity to use and apply analytical tools and models for enhancing effective and efficient decision-making.
- Increase the priority of research related to climate change and environmental sustainability efforts.
- Strengthen the technical capacity to integrate climate-smart agriculture, agricultural financing opportunities, and risk management for small-scale farmers.

Data and Information

- Increase sectoral data availability, particularly regarding land use and forestry and health sectors.
- Develop early-warning systems for dangerous hydrometeorological phenomena.
- Develop a geo-information-based approach in storage and management of data for accessibility and manipulation within the context of Lesotho's National Spatial Data Infrastructure.
- Establish a unit within the Bureau of Statistics that will facilitate data collection and archiving for environmental and climate change studies.
- Quantify the required international financial, technological, and capacity-building support for the implementation of vulnerability abatement measures up to and beyond 2030.
- Ensure that nationwide climate change and atmosphere monitoring systems are maintained and enhanced where necessary, including through monitoring networks at appropriate spatial density and frequency.

Institutional

- Intensify coordination across ministries, departments, and sectors on collection and exchange of specific data among stakeholders.
- Ensure that National Climate Change Strategy goals are developed within sectoral and regional plans and in line with financial opportunities with donors.
- Integrate climate change concerns into relevant policies and planning processes at state and national levels.

1 World Bank. 2022. "Lesotho – Current climate > Climatology" in Climate Change Knowledge Portal.

<https://climateknowledgeportal.worldbank.org/country/lesotho/climate-data-historical>

2 World Bank. 2022. "Lesotho – Climate projections" in Climate Change Knowledge Portal. <https://climateknowledgeportal.worldbank.org/country/lesotho/climate-data-projections>

3 Authors' summary based on data from: Centre for Research on the Epidemiology of Disasters (CRED) EM-DAT database. Université catholique de Louvain, Brussels, Belgium.

<http://www.emdat.be> (accessed June 2022).

4 ThinkHazard! 2020. "Lesotho: Water scarcity." <https://thinkhazard.org/en/report/142-lesotho/DG>

5 ThinkHazard! 2020. "Lesotho: Extreme heat." <https://thinkhazard.org/en/report/142-lesotho/EH>

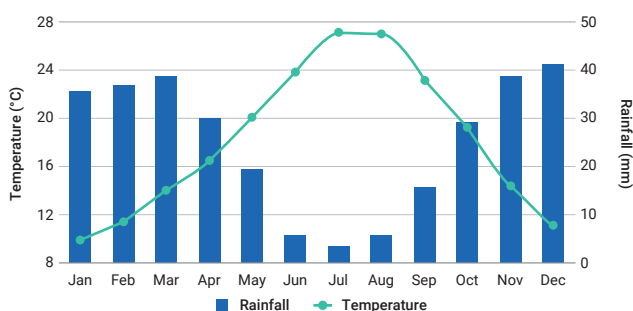
6 Notre Dame Global Adaptation Initiative (ND-GAIN) Country Index. <https://gain.nd.edu/our-work/country-index/>

Morocco Climate Risk and Adaptation Overview

Adapted from the [World Bank's Climate Risk Country Profiles Series, 2021](#)

Climate Trends

Average Monthly Temperature (T) and Precipitation (Ppt) 1991–2020¹



Country Context

Population 36.9 m (2020)	Annual growth rate 1.2% (2020)
GDP US\$112.8 bn (2020)	Annual growth rate -7.1% (2020)
GDP per capita US\$3,000 (2020)	GNI per capita US\$3,020 (2020)

Literacy rate adult female/male: 64.59% / 83.30% (2018).
Geography: Located in the northwest of Africa; bordered by the Atlantic Ocean and the Alboran Sea; topography includes the Rif Mountains in the north, the Atlas Mountains in the center, plateaus in the east, plains and coast in the west, and desert in the south.
Broad climate: Most of the country experiences a Mediterranean climate. Mild, wet winters and hot, dry summers.

Climate Projections²

CMIP5 Ensemble Projection	2020–2039	2040–2059	2060–2079	2080–2099
Annual Temperature Anomaly (°C)	+0.6 to +2.3 (+1.4°C)	+1.5 to +3.7 (+2.4°C)	+2.6 to +5.3 (+3.7°C)	+3.6 to +7.0 (+4.9°C)
Annual Precipitation Anomaly (mm)	-8.9 to +7.0 (-1.4 mm)	-10.5 to +7.0 (-1.8 mm)	-12.4 to +4.7 (-3.2 mm)	-13.9 to +5.3 (-4.0 mm)

Note: The table shows CMIP5 ensemble projection under RCP8.5. Bold value is the range (10th–90th Percentile) and values in parentheses show the median (or 50th Percentile).

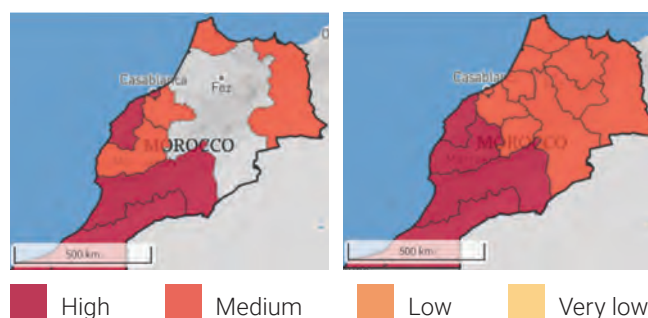
Climate Hazards

- Impacts from natural hazards are estimated to cost the country US\$800 million annually.
- Extreme rainfall has resulted in soil erosion, land degradation, loss of ecosystems and ecosystem services, alien species invasion, salinization of groundwater and flood trails containing pesticides and fertilizer.
- Increasing incidence, severity and duration of drought in Morocco is the most significant concern for the country. This will exacerbate food insecurity through crop damage, loss of pasture and water sources, loss of animals, hunger, disease outbreaks, asset depletions, malnutrition and migration.
- Extreme weather events, such as storms and flash floods, are also expected to become increasingly more common.
- Changing rainfall patterns are expected to play a significant role in agricultural production and harvest seasons, with later onsets expected to impact crop productivity as well as livestock health.
- Rising sea levels pose a high risk especially to coastal urban zones as 60% of the population and the majority of the country's economic activities are along its coast.

Natural Hazards Occurrence, 1991–2022³

Hazard	Subtype	Events	Deaths	Affected
Drought		3	–	275,000
Flood	Unstated	4	65	3,650
	Riverine	11	921	116,400
	Flash	9	212	114,375
Storm	Unstated	1	14	–
	Tropical	1	1	–
	Convective	2	49	117,000
Landslide		2	16	10,000
Total		33	1278	636,425

Risk of Coastal Flooding (left)⁴, Risk of Extreme Heat (right)⁵



ENABLING ENVIRONMENT

Leadership and Governance

- The National Committee for Climate Change and Biological Diversity (established in 2007) oversees all climate-related and biodiversity activities.
- This committee is chaired by the Ministry of Energy, Mines and Environment, which is also the national focal point for the UNFCCC.
- Morocco recognizes climate change as a multisectoral and cross-cutting issue. Critical sector attention is paid to water, agriculture, fisheries, shorelines, forestry, and health.
- Between 2020 and 2030, Morocco plans to invest at least US\$35 billion in adaptation-related efforts for the country's most vulnerable sectors.

Key Adaptation Policies

Key Policy Documents: Updated Nationally Determined Contribution (2021); Le Plan Maroc Vert, Bilan et Impacts, 2008–2018 (2020); The 2030 National Climate Plan (PCN) (French) (2019); Second Biennial Update Report (French) (2019); The 2030 National Sustainable Development Strategy (NSDD) (2017); Third National Communication (2016).

Disaster Risk Management (DRM):

- Morocco is committed to integrating systematic DRM processes to be implemented at national to local levels, including: risk management finance initiatives, insurance programs, and adaptation research assessments to support implementation and strengthen vulnerable sectors.
- Morocco is working to finalize its National Adaptation Plan. This process is guided by the National Climate Change Policy (2014) to respond to climate change and disaster risks and promote more proactive risk reduction and adaptation planning.

ND-GAIN Index⁶

Country Index rank (score): 66 (52.6)

Vulnerability: 0.380

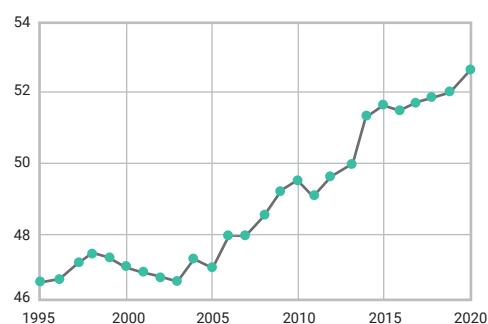
Ecosystem Services 16%, Food 19%, Human Habitat 17%, Health 22%, Infrastructure 15%, Water 10%

Readiness: 0.432

Economic 39%
Governance 35%
Social 25%



ND-GAIN Evolution



SECTORAL ADAPTATION PLANNING



WATER

Irrigation consumes an estimated 80–85% of available water.

Main Climate Change Impacts

- Rising temperatures and more erratic rainfall have reduced river flows and increased evaporation and siltation of storage dams, leading to a 20% reduction in overall water resources in the last 30 years.
- Rising temperatures are expected to reduce stream flows and overall water availability. Reservoirs of the Hassan Addakhil and Idriss I, both critical water sources, are projected to decrease by 7–40% by the 2080s.
- Changing precipitation patterns and reduced water availability are expected to significantly alter some fertile regions, which may shift from semi-arid to arid or from sub-humid to semi-arid.
- Rainfall and evaporation changes also impact degrees of surface water infiltration and recharge rates for groundwater.
- Temperature increases have the potential to result in increased soil moisture deficits even under conditions of increasing rainfall.

Proposed Adaptation Strategies

- Morocco is in the process of constructing 60 large dams to mobilize 1.7 billion m³ per year and support more efficient transfer from the northern basins to the south.
- The Government has committed to improve the country's water adaptation efforts through improving its wastewater treatment at a rate of 50% in 2016 to 60% by 2020, construct an average of three dams per year to reach 25 billion m³ in stocking capacity in 2030, and invest in the desalinization of seawater to reach a capacity of 500 million m³ per year.

Milestones

- A National Water Strategy has been implemented to improve water resource demand management and efficiency through irrigation programs.



AGRICULTURE

Accounts for about 15% of Morocco's GDP and 23% of its exports. Represented 69% of rural employment and 39% of jobs nationally (as of 2019). Some 87% of the country's total crop production is primarily rainfed, dominated by cereals. Morocco accounts for 53% of total Middle East and North Africa regional EU agribusiness exports.

- **Key agricultural exports:** citrus fruit, vegetables, almonds, table olives, olive oil, dairy products, blueberries, cherries and asparagus.

Main Climate Change Impacts

- Hotter, drier conditions are expected to increase crop water requirements by up to 12%, increasing demand for irrigation and further stressing limited water resources.
- Rising temperatures are expected to reduce yields of rainfed crops by 50–75% during dry years.
- Erratic precipitation and increased aridity and drought conditions will result in shortened growing seasons, reduced yields, and lowered productivity.
- Drought also promotes proliferation of the Hessian fly, increasing the risk of damage to wheat yields.

Proposed Adaptation Strategies

- Shift traditional rainfed systems in cereal production to conservation agriculture techniques (including no-tillage).
- Shift cereal production in fragile areas to more resilient crops such as olive trees or almonds.
- Promote climate change-resilient technologies.
- Establish monitoring and early-warning systems to improve drought decision-support systems and preparedness efforts.
- Expand emergency operational planning to develop networks and awareness across the most vulnerable areas.

Milestones

- Morocco has committed to switch from current to localized irrigation systems covering over 550,000 ha and to extend irrigation to over 260,000 ha of new agricultural areas.
- The sector will increase multi-risk insurance for cereals and legumes covering farming areas of 1 million ha.



NEEDS

Research

- Improve understanding of the impact and magnitude of climate change events and trends across the country.
- Widen participation of the public, scientific institutions, women, and local communities in planning and management, accounting for approaches and methods of gender equity.
- Strengthen environmental monitoring capabilities for more effective environmental management.
- Invest in weather stations and expand the country's national hydrometeorological monitoring system to advance networking for the measurement of climate parameters.
- Strengthen technical capacity to integrate climate-smart agriculture techniques, improved water resource efficiency, and climate change risk management across identified key sectors.
- Introduce academic curricula specializing in climate risk and climate change.

Data and Information

- Develop early-warning systems for hydrometeorological phenomena and climate risk management.
- Ensure maintenance and enhancement of nationwide climate change and atmosphere monitoring systems.

Institutional

- Integrate climate change concerns into relevant policies and planning processes at state and national levels.
- Implement cross-sectoral climate-smart solutions at national and subnational levels.
- Finalize land demarcation and the registry of forested areas to support adaptation planning.
- Build capacity for developing, financing, implementing, and monitoring climate change adaptation projects at institutional and local levels, inclusive of public-private partnerships.
- Strengthen adaptation of infrastructure against bad weather and future weather conditions.
- Develop and implement a monitoring and evaluation system to assess Morocco's vulnerability and adaptation progress.

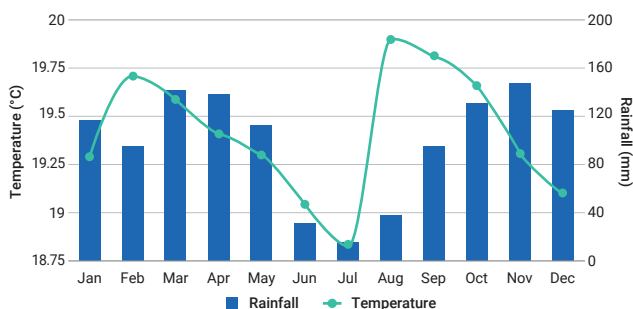
1 2021. Climate Risk Profile: Morocco. Washington, DC. https://climateknowledgeportal.worldbank.org/sites/default/files/2021-09/15725-WB_Morocco%20Country%20Profile-WEB.pdf
2 Ibid.
3 Authors' summary based on data from: Centre for Research on the Epidemiology of Disasters (CRED) EM-DAT database. Université catholique de Louvain, Brussels, Belgium. <http://www.emdat.be> (accessed June 2022).
4 ThinkHazard! 2020. "Morocco: Coastal flood." <https://thinkhazard.org/en/report/169-morocco/CF>
5 ThinkHazard! 2020. "Morocco: Extreme heat." <https://thinkhazard.org/en/report/169-morocco/EH>
6 Notre Dame Global Adaptation Initiative (ND-GAIN) Country Index. <https://gain.nd.edu/our-work/country-index/>

Rwanda Climate Risk and Adaptation Overview

Adapted from the World Bank's Climate Risk Country Profiles Series, 2021

Climate Trends

Average Monthly Temperature (T) and Precipitation (Ppt) 1991–2020¹



Country Context

Population 12.9 m (2020)	Annual growth rate 2.5% (2020)
GDP US\$10.3 bn (2020)	Annual growth rate -3.4% (2020)
GDP per capita US\$798 (2020)	GNI per capita US\$780

Literacy rate adult female/male: 69.39% / 77.56% (2018).

Geography: Landlocked country in central Africa. Total land area: 26,338 km².

Broad climate: The country has four primary climatic regions: the eastern plains, central plateau, highlands, and the region around Lake Kivu. Tropical climate.

Climate Projections²

CMIP5 Ensemble Projection	2020–2039	2040–2059	2060–2079	2080–2099
Annual Temperature Anomaly (°C)	+0.7 to +1.5 (+1.1°C)	+1.4 to +2.6 (+1.9°C)	+2.3 to +4.0 (+2.9°C)	+3.1 to +5.3 (+3.9°C)
Annual Precipitation Anomaly (mm)	-18.4 to +29.3 (3.3 mm)	-23.3 to +39.3 (5.1 mm)	-26.4 to +63.6 (9.5 mm)	-24.5 to +91.5 (18.2 mm)

Note: The table shows CMIP5 ensemble projection under RCP8.5. Bold value is the range (10th–90th Percentile) and values in parentheses show the median (or 50th Percentile).

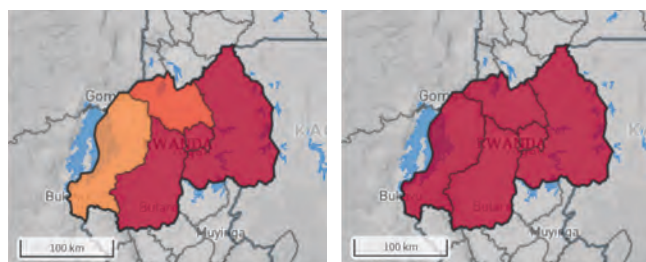
Climate Hazards

- Since the early 2000s, the frequency and severity of disasters, particularly floods, landslides, and droughts, have increased significantly.
- Droughts have already resulted in famine, population displacement, conflicts, and biodiversity loss. Seasonal droughts are expected to become longer, which will cause problems especially in the east and southeast of the country (Bugesera, Mayaga, and Umutara).
- Heavy rainfall events and at times flash flooding have become increasingly common, especially in the northern and western provinces, and can trigger landslides and mudslides. The risk and intensity of flooding through increased frequency and the intensity of heavy rainfall events are expected to increase due to climate change.
- Land degradation and soil erosion, exacerbated by recurrent floods, adversely impact agricultural production, disproportionately affecting the livelihoods of the rural poor.
- Recent population growth and land scarcity have pushed people to settle in flood-prone areas, worsening the effects of flood hazards.
- Approximately 40 percent of the population are exposed to landslides because they reside in highly vulnerable areas in the highlands of the western, southern and northern provinces.

Natural Hazards Occurrence, 1991–2022³

Hazard	Subtype	Events	Deaths	Affected
Drought		3		1,976,545
Flood	Unstated	11	183	18,690
	Riverine	9	122	56,968
	Flash	3	106	42,210
Storm	Convective	2	3	6,525
Landslide		5	113	32,000
Total		33	527	2,132,938

Risk of River Flood (left)⁴, Risk of Wildfires (right)⁵



■ High
 ■ Medium
 ■ Low
 ■ Very low

ENABLING ENVIRONMENT

Leadership and Governance

- The Ministry of Environment is responsible for designing and monitoring national climate policies.
- The Rwanda Environment Management Authority (REMA) is responsible for climate policy implementation through its Department of Climate Change and international obligations.
- The Fund for Environment and Climate Change (FONERWA) aims to mobilize domestic and international financing for environmental and climate change projects.

Key Adaptation Policies

Key Policy Documents: Updated Nationally Determined Contribution (2020); Third National Communication (2018); National Strategy for Transformation (NST 1) 2017–2024 (2017); Vision 2050 (2015); Green Growth and Climate Resilience Strategy (2011); Rwanda Biodiversity Policy (2011); National Adaptation Plan of Action (2006).

Disaster Risk Management (DRM):

- In 2010, the Ministry of Disaster Management and Refugee Affairs was established to manage natural disasters.
- The National Disaster Management Policy (2012) and the National Disaster Contingency Matrix (2016) serve as the country's legal and institutional framework for DRM.
- Efforts are focused on strengthening institutional capacity, coordinating DRM mechanisms across sectors, enhancing disaster preparedness, and ensuring alignment with local and national disaster management plans. Public-warning and disaster-related information systems are also being developed and promoted.
- Rwanda is committed to improving its disaster management and will conduct country-wide risk assessments and vulnerability mapping by 2030 to improve planning and related adaptation efforts.

ND-GAIN Index⁶

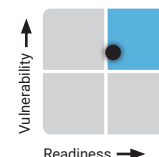
Country Index rank (score): 124 (42.0)

Vulnerability: 0.586

Ecosystem Services 19%, Food 20%, Human Habitat 20%, Health 25%, Water 15%

Readiness: 0.426

Economic 42%
Governance 42%
Social 15%



ND-GAIN Evolution

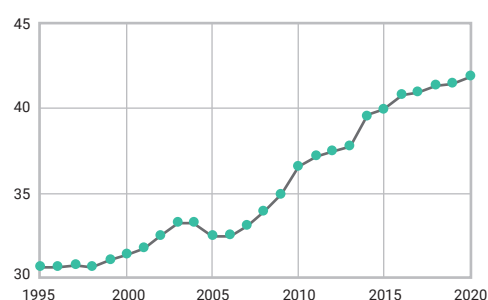
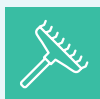


Photo: Vadim_Nefedov/iStock

SECTORAL ADAPTATION PLANNING



AGRICULTURE

Employs over 70% of the working population. About 51% of land area is agricultural, of which about 73% is used to grow crops and 27% is kept fallow or used for pastures and afforestation.

Main Climate Change Impacts

- Rising temperatures, increasing frequency and intensity of heavy rain events, and increased duration of dry spells threaten Rwandan agriculture.
- Rising temperatures threaten to compromise the quality and productivity of highly lucrative, temperature-sensitive crops such as tea and coffee (which account for more than 20% of export earnings).
- In contrast, temperature increases are likely to expand production through mid-century for maize, Irish potato, cassava, and sorghum.
- Warming temperatures are also likely to expand the range of crop pests, such as the coffee berry borer beetle, and livestock diseases, such as Rift Valley fever.
- 90% of crops are grown on hills and steep slopes. Heavy rainfall events may lead to landslides and further exacerbate soil erosion and degrade cultivated lands.
- Projections of longer dry spells are particularly concerning in the east and south.

Proposed Adaptation Strategies

- Mainstream agroecology techniques on farms to improve productivity, soil health, and water conservation.
- Promote recovery and reuse of both organic waste and wastewater to restore and maintain soil fertility, and promote the use of organic fertilizer and enriched compost.
- Expand soil conservation and land husbandry programs through installing land protection structures such as radical and/or progressive terraces.
- Increase investment in irrigation.
- Diversify local and export markets to meet growing demand and maximize agricultural trade.



FORESTRY

Nearly 30% of the country is covered by forests.

Main Climate Change Impacts

- Rwanda already experiences high rates of soil erosion that are depleting topsoil in forests and riparian corridors, with the Gishwati ecosystem being particularly vulnerable.
- Rising temperatures threaten plants and wildlife through increased physiological stress and disruption of pollination and predator–prey relationships.
- An estimated 107 mammal, 199 bird, 31 fish, 34 amphibian, and 79 plant species in the Albertine Rift region have high thermal sensitivity and/or are highly vulnerable to changes in habitat suitability induced by climate change. Most notably affected are the hippopotamus, African wild dog, western rift puddle frog, grey crowned crane, and mountain gorilla.
- More frequent droughts will likely increase deforestation, forest degradation, frequency and severity of forest fires, and reduce the capacity of water catchments.
- Increased precipitation may increase forest productivity. However, increased extreme weather events such as strong winds, violent storms, violent floods, and landslides will negatively affect forest resources. These threats to biodiversity are likely to decrease tourism.

Proposed Adaptation Strategies

- Improve spatial planning.
- Strengthen sustainable forest management.
- Establish seed banks for reforestation activities.
- Extend the network of protected areas on land and in the wetlands.

Milestones

- Rwanda's National Forest Policy (2001), which aims to make the forestry sector a key pillar of the country's economy, won the World Future Council's Future Policy Award as the world's most inspiring and innovative forest policy.
- Through the use of mixed-species approaches, Rwanda aims to achieve an overall 30% sustained forest cover of the total national land surface by 2030 from 28.8% in 2013. Additionally, by 2030, Rwanda will implement public–private partnerships to sustainably manage all forestry plantations.



NEEDS

Research

- Improve, support, and reinforce the teaching of meteorology, climate science, and hydrology in higher education and build staff capacity.
- Enhance capabilities for handling climate change data at national, regional, and local levels.
- Develop a system for monitoring, preventing, and effectively responding to the human diseases associated with climate change.
- Develop a Monitoring, Reporting and Verification (MRV) framework for tracking the progress of project implementation and Rwanda's pathway toward achieving its NDC, while meeting its international obligations under the Paris Agreement.
- Evaluate needs and develop a national strategy for technology transfer to support NDC adaptation measures.

Data and Information

- Improve technical capacity to analyze hydrometeorological data and project impacts across sectors.
- Complete an updated technology needs assessment.
- Establish institutional capacity for providing timely early-warning systems to farmers for improved decision-making.
- Increase the understanding of water resource threats and groundwater risks to improve long-term management and improve water-use efficiency in agriculture and urban management.
- Improve regulation and enforcement to protect forests, rainforests, and protected areas.
- Increase public awareness and participation in the climate change adaptation debate.

Institutional

- Establish a national environment and climate change research center.
- Expand Rwanda's technical and vocational educational and training to develop skills for effective climate change impact translation and improved adaptation planning across sectors.
- Establish land-use plans by type of use.
- Integrate climate change concerns into relevant policies and planning processes at state and national levels.
- Provide national-level adaptation reporting.
- Finalize regulations to fund and implement climate change impact studies.

1 World Bank. 2022. "Rwanda – Current climate > Climatology" in Climate Change Knowledge Portal.

<https://climateknowledgeportal.worldbank.org/country/rwanda/climate-data-historical>

2 World Bank. 2022. "Rwanda – Climate projections" in Climate Change Knowledge Portal. <https://climateknowledgeportal.worldbank.org/country/rwanda/climate-data-projections>

3 Authors' summary based on data from: Centre for Research on the Epidemiology of Disasters (CRED) EM-DAT database. Université catholique de Louvain, Brussels, Belgium.

<http://www.emdat.be> (accessed June 2022).

4 ThinkHazard! 2020. "Rwanda: River flood." <http://thinkhazard.org/en/report/205-rwanda/FL>

5 ThinkHazard! 2020. "Rwanda: Wildfire." <http://thinkhazard.org/en/report/205-rwanda/WF>

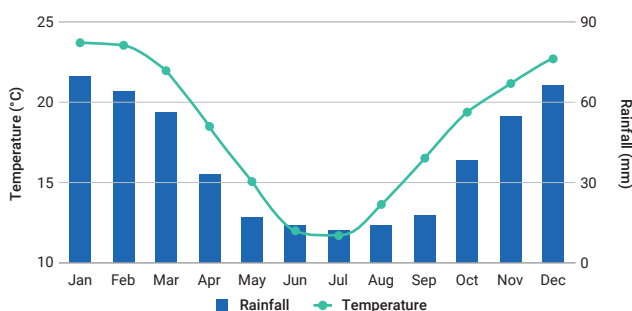
6 Notre Dame Global Adaptation Initiative (ND-GAIN) Country Index. <https://gain.nd.edu/our-work/country-index/>

South Africa Climate Risk and Adaptation Overview

Adapted from the [World Bank's Climate Risk Country Profiles Series, 2021](#)

Climate Trends

Average Monthly Temperature (T) and Precipitation (Ppt), 1991–2020¹



Country Context

Population 59.3 m (2020)	Annual growth rate 1.3% (2020)
GDP US\$302 bn (2020)	Annual growth rate -7.0% (2020)
GDP per capita US\$5,091 (2020)	GNI per capita US\$6,010 (2020)

Literacy rate adult female/male: 94.53% / 95.55% (2019).

Geography: Located at the southern tip of Africa, it has a coastline of 3,000 km, with the Indian Ocean on the eastern coast and the Atlantic Ocean on the western coast. Total land area: 1,219,602 km².

Broad climate: Cool and wet in the Drakensberg region; warm and subtropical in the northeast; Mediterranean in the southwest; warm dry desert environment in the central-west and northwest.

Climate Projections²

CMIP5 Ensemble Projection	2020–2039	2040–2059	2060–2079	2080–2099
Annual Temperature Anomaly (°C)	+0.5 to +1.7 (+1.2°C)	+1.4 to +2.9 (+2.0°C)	+2.4 to +4.4 (+3.2°C)	+3.3 to +6.0 (+4.2°C)
Annual Precipitation Anomaly (mm)	-16.2 to +14.0 (-1.6 mm)	-21.4 to +11.9 (-3.7 mm)	-22.2 to +13.2 (-4.3 mm)	-26.1 to +12.4 (-5.9 mm)

Note: The table shows CMIP5 ensemble projection under RCP8.5. Bold value is the range (10th–90th Percentile) and values in parentheses show the median (or 50th Percentile).

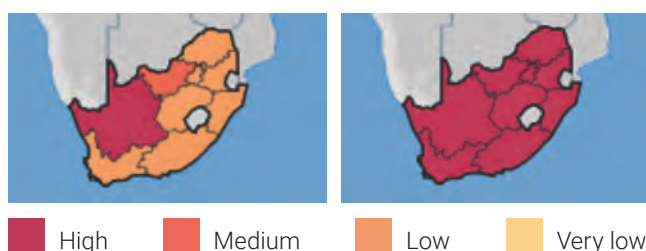
Climate Hazards

- The three most significant drivers of climate-related disasters in South Africa are drought, floods, and wildfires. Annually, these disasters incur approximately ZAR3 billion (US\$163.3 million) a year in damages.
- Increasingly droughts and floods, along with rising temperatures and sea levels, pose challenges to municipalities. For example, recently the Western Cape struggled with one of the worst droughts in 100 years, severely limiting water supplies in urban areas.
- Climate change is expected to increase the risk and severity of water scarcity and drought, and future flood risk is also likely to increase across the entire country.
- As flood risks rise, so too will the incidence of waterborne diseases common in South Africa, such as cholera, dysentery, typhoid, and other rotavirus infections.
- The country is likely to become hotter and drier in the future, with continuing rainfall variability. This will likely result in increased soil erosion, deforestation, recurrent droughts, desertification, land degradation, and the loss of biodiversity including the country's unique wildlife populations.
- Coastal cities such as Cape Town, Durban, and Port Elizabeth are at risk from rising sea levels that could impact infrastructure and important economic sectors, such as tourism and fisheries.

Natural Hazards Occurrence, 1991–2022³

Hazard	Subtype	Events	Deaths	Affected
Drought		6	–	424,388,932
Flood	Unstated	13	646	176,330
	Riverine	17	252	406,645
	Flash	7	235	8,900
Storm	Tropical	2	4	4,550
	Unstated	5	42	150
	Convective	21	164	141,414
Wildfires	Unstated	1	9	5,500
	Forest	2	31	1,600
	Land	7	97	1,000
Total		81	1480	425,135,021

Risk of Urban Flooding (left)⁴, Risk of Wildfires (right)⁵



ENABLING ENVIRONMENT

Leadership and Governance

- Climate change focal point: the Department of Environmental Affairs is responsible for developing and implementing the Climate Change Strategy, and ensuring the country is on track to meet its obligations outlined in its Nationally Determined Contribution (NDC) and development plans.
- Cross-sector efforts involve actions from national departments of: Energy; Mineral Resources; Basic and Higher Education; Health; Agriculture, Forestry and Fisheries; Cooperative Governance and Traditional Affairs, including the National Disaster and Risk Management Centre; Transport; Science and Technology; Statistics; National Treasury; Trade and Industry; Water Affairs; Human Settlements; International Relations and Cooperation; Public Enterprises; and the Presidency.

Key Adaptation Policies

Key Policy Documents: Updated Nationally Determined Contribution (2021); Third National Communication to the UNFCCC (2018); National Climate Change Adaptation Strategy (2018); National Climate Change Response White Paper (2017); Second Biennial Update Report (2017).

Disaster Risk Management (DRM):

- DRM is led by the National Disaster Management Advisory Forum, a technical committee tasked with coordinating and managing disaster recovery and preparedness actions. Work is guided by the Disaster Management Act (2002) and Disaster Management Framework (2005).
- Working to integrate its disaster management strategy into sectoral policies and programs, and to shift thinking from a largely reactive system toward more proactive risk reduction and adaptation planning.

ND-GAIN Index⁶

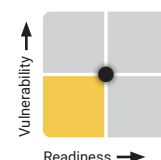
Country Index rank (score): 96 (47.4)

Vulnerability: 0.415

Ecosystem Services 19%, Food 18%, Human Habitat 21%, Health 18%, Infrastructure 10%, Water 13%

Readiness: 0.364

Economic 35%
Governance 45%
Social 19%



ND-GAIN Evolution

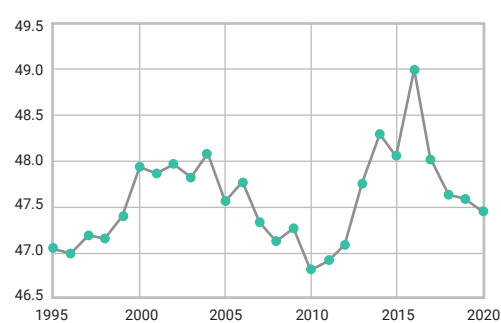
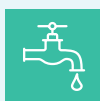


Photo: Rocky89/iStock

SECTORAL ADAPTATION PLANNING



WATER

South Africa is a highly water-stressed country: less than 9% of annual rainfall received filters into the region's rivers and only 5% goes on to recharge groundwater aquifers. There are 794 large dams in the country, with a combined storage capacity of about 31 billion m³.

Main Climate Change Impacts

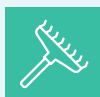
- Heightened dry conditions and increased pressure on water resources are expected by mid-century. Severe drought conditions and water scarcity are likely by the end of the century.
- Southwestern areas are projected to experience the most severe drought conditions.
- Rising temperatures are expected to decrease water availability and thus stream flows. For example, stream flows for the Limpopo and Okavango catchments are projected to decrease by 35% and 20%, respectively.
- Altered water infiltration and groundwater recharge rates are expected due to rainfall and evaporative changes.
- More variable rainfall is also likely to increase disasters associated with droughts, floods, and waterborne diseases.

Proposed Adaptation Strategies

- Additional water resource capacity is needed to meet a growing demand for domestic needs.
- Water resource management strategies need to incorporate sourcing from catchment and river systems, storage, abstraction, and securing return flows from irrigation projects.
- Planning and adaptation strategies for water resources should be included within development strategies for agriculture, infrastructure, and energy sectors.

Milestones

- South Africa has developed a National Water Master Plan to support its broader climate change adaptation agenda.



AGRICULTURE

The sector employs over 860,000 people. It is dominated by maize, wheat, sugarcane, and sunflower seed. Some 14% of the country considered arable, with one fifth of this land having high agricultural potential.

Main Climate Change Impacts

- Climate change is expected to have adverse impacts on cereal crop production, high-value export agricultural production, and intensive animal husbandry practices.
- Trends are, however, likely to positively impact the productivity of key tropical crops such as sugarcane, though these gains could be offset by increased pest diversity and distribution.
- Climate change impacts are crucially linked to future projected water supply constraints.
- Reduced water availability will likely reduce yields and increase soil moisture deficits.
- Rising temperatures, particularly the number of "very hot days" (maximum temperature > 35°C), are likely to increase the presence of pests and risks of wildfires.
- Increased intensity and frequency of extreme events are likely to negatively affect "regulating services" such as soil water maintenance, base flows, and filtration.

- Increased heat stress is likely to alter growing seasons and adversely affect livestock, reducing milk production and reproduction, particularly for cattle.
- Climate change impacts for the agricultural sector are compounded by issues of land rights and inequality.

Proposed Adaptation Strategies

- Implement climate-smart agricultural practices.
- Improve water management, and monitoring and early-warning systems.
- Develop knowledge and decision-support systems.
- Develop new crop varieties and technologies to support farming systems.
- Implement soil and water conservation strategies.



NEEDS

Research

- Improve understanding of expected future climate change trends and events, as well as key vulnerabilities, development impact, and possible adaptation responses.
- Widen participation of the public, scientific institutions, women, and local communities in planning and management, accounting for approaches and methods of gender equity.
- Strengthen environmental monitoring capabilities for more effective environmental management.
- Invest in weather stations and expand the country's national hydrometeorological monitoring system to advance networking for the measurement of climate parameters.
- Strengthen technical capacity to integrate climate-smart agriculture and climate change risk management into the agricultural sector.

Data and Information

- Develop early-warning systems about dangerous hydrometeorological phenomena and climate risk management.
- Ensure maintenance and enhancement of nationwide climate change and atmosphere monitoring systems, including through monitoring networks at appropriate spatial density and frequency.

Institutional

- Integrate National Environmental Strategy goals within sectoral and regional plans.
- Implement cross-sectoral climate-smart solutions at national and subnational levels.
- Integrate climate change concerns into relevant policies and planning processes at state and national levels.

1 World Bank. 2022. "South Africa –Current climate > Climatology" in Climate Change Knowledge Portal. <https://climateknowledgeportal.worldbank.org/country/south-africa/climate-data-historical>

2 World Bank. 2022. "South Africa – Climate projections" in Climate Change Knowledge Portal. <https://climateknowledgeportal.worldbank.org/country/south-africa/climate-data-projections>

3 Authors' summary based on data from: Centre for Research on the Epidemiology of Disasters (CRED) EM-DAT database. Université catholique de Louvain, Brussels, Belgium: <http://www.emdat.be> (accessed June 2022).

4 ThinkHazard! 2020. "South Africa: Urban flood." <http://thinkhazard.org/en/report/227-south-africa/UF>

5 ThinkHazard! 2020. "South Africa: Wildfire." <http://thinkhazard.org/en/report/227-south-africa/WF>

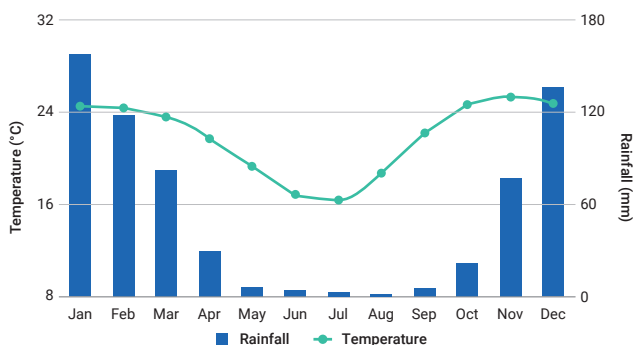
6 Notre Dame Global Adaptation Initiative (ND-GAIN) Country Index. <https://gain.nd.edu/our-work/country-index/>

Zimbabwe Climate Risk and Adaptation Overview

Adapted from the World Bank's Climate Risk Country Profiles Series, 2021

Climate Trends

Average Monthly Temperature (T) and Precipitation (Ppt), 1991–2020¹



Country Context

Population 14.6 m (2019)	GDP US\$21.4 bn (2019)	Annual growth rate -8.1% (2019)
GDP per capita US\$1,215 (2020)	GNI per capita US\$1,140 (2020)	

Literacy rate adult female/male: 88.28% / 89.19% (2014).

Geography: Landlocked country in Southern Africa. Total land area: 390,757 km².

Broad climate: Northern area: subtropical climate with dry winters and hot summers; southern area: hot arid and steppe climate.

Climate Projections²

CMIP5 Ensemble Projection	2020–2039	2040–2059	2060–2079	2080–2099
Annual Temperature Anomaly (°C)	+1.1 to +1.5 (+1.2°C)	+1.9 to +2.7 (+2.2°C)	+3.2 to +4.0 (+3.4°C)	+4.2 to +5.8 (+4.6°C)
Annual Precipitation Anomaly (mm)	-12.5 to +1.0 (-3.3°C)	-19.6 to +1.9 (-5.1°C)	-27.8 to -1.3 (-7.4°C)	-32.3 to -0.1 (-8.2°C)

Note: The table shows CMIP5 ensemble projection under RCP8.5. Bold value is the range (10th–90th Percentile) and values in parentheses show the median (or 50th Percentile).

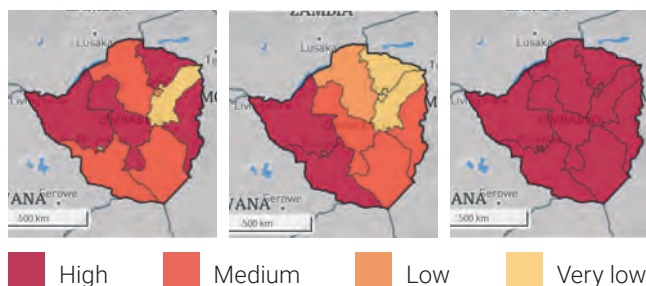
Climate Hazards

- The frequency and intensity of natural disasters, especially droughts, floods, and storms, have increased over the past decades, and are predicted to further increase as a consequence of climate change.
- The country's GDP growth has been severely impacted by a series of major droughts. For instance, the drought episode in 2007 affected 6 million individuals; and the drought in 2013 caused economic damage of up to US\$500 million and affected over 4 million residents.
- Floods also generate large human and economic losses. As of 2017, riverine floods had led to monetary loss of over US\$270 million.
- Wildfire has historically been one of the most dangerous natural hazards in the country, especially in the northern and southeastern areas. Wildfire is associated with more than 1 million hectares of loss in rangelands and forests per year.

Natural Hazards Occurrence, 1991–2022³

Hazard	Subtype	Events	Deaths	Affected
Drought		9	–	546,382,077
Flood	Unstated	2	13	30,000
	Riverine	9	271	260,275,897
	Flash	2	29	1,000
Storm	Tropical	6	890	375,400
	Convective	2	41	2,000
Total		30	1244	807,066,374

Risk of River Flooding (left)⁴, Risk of Water Scarcity (center)⁵, Risk of Wildfire (right)⁶



ENABLING ENVIRONMENT

Leadership and Governance

- National Focal Point on Climate Change: Ministry of Environment, Water and Climate (MEW)—guides national compliance in all multilateral environmental agreements, including Intended Nationally Determined Contribution (INDC) efforts and the National Adaptation Plan (NAP) development process.
- The High Level National Steering Committee is responsible for providing policy direction in the implementation of the NDC in line with National Development Objectives.
- The Environmental Management Agency (EMA) is responsible for ensuring the sustainable management of natural resources and protection of the environment, the prevention of pollution and environmental degradation, and the preparation of Environmental Plans for environmental management and protection.

Key Adaptation Policies

Key Policy Documents: National Adaptation Plan (2019); Third National Communication to the UNFCCC (2017); National Climate Policy (2016); Zimbabwe Agriculture Investment Plan (2013–2017); Nationally Determined Contribution (2016); National Climate Change Response Strategy (2015).

Disaster Risk Management (DRM):

- The Ministry of Local Government, Public Works and Urban Development has established a DRM Bill focused exclusively on the reactive aspect of DRM.
- Options for DRM include: Enhance early-warning systems and capacity of hydrometeorological services; invest in climate-resilient social infrastructure; promote climate-indexed insurance solutions and enabling market frameworks; scale up community-based DRM initiatives; conduct risk mapping of transboundary risks; coordinate DRM (prevention, mitigation, preparedness, response, and recovery) across technical staff at provincial/district, ward, and village levels; guarantee availability of cash reserves for rapid disbursement through fast-track mechanisms to support disaster response operations.

ND-GAIN Index⁷

Country Index rank (score): 174 (33.1)

Vulnerability: 0.554

Ecosystem Services 19%, Food 21%, Human Habitat 21%, Health 25%, Water 13%

Readiness: 0.216

Economic 40%
Governance 39%
Social 20%



ND-GAIN Evolution

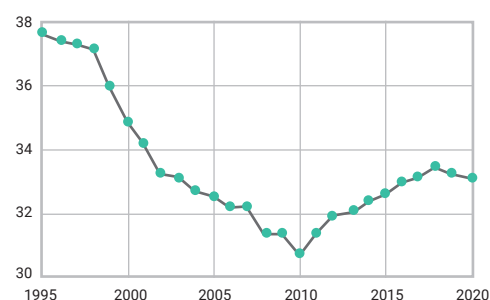
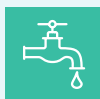


Photo: VV Shots/iStock

SECTORAL ADAPTATION PLANNING



WATER

There are seven river catchments in Zimbabwe: Gwayi, Manyame, Mazowe, Mzingwane, Runde, Sanyati, and Save. Total annual water generation amounts to over 23 bn m³: surface water resources: 90%; groundwater resources: 10%.

Main Climate Change Impacts

- Warming temperatures can contribute to increased water loss through evapotranspiration.
- Mean annual runoff is projected to decline in all seven basins under the majority of scenarios for the 2041–2050 period compared with the 1961–1990 baseline. Such changes in runoff could limit hydropower generation.
- Zimbabwe is highly susceptible to groundwater drought risk resulting from decreases in rainfall.
- Decreased water availability due to changes in annual precipitation could increase the cost for water treatment and wastewater management.
- Increasing temperatures may increase water demand for agriculture and energy generation.

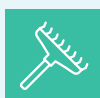
Proposed Adaptation Strategies

- Promote and support water-harvesting.
- Develop, rehabilitate, and maintain surface and groundwater resources.
- Strengthen and intensify monitoring systems for hydrometeorological parameters.

- Promote efficient water-use practices in the economy across all sectors.
- Strengthen institutional capacity, research, and extension for integrated water resources management.
- Strengthen biodiversity conservation management and integrity of natural ecosystems to adapt to climate change.
- Conduct more frequent yield assessments of surface- and groundwater resources.
- Incorporate climate change into water infrastructure planning and design, and rehabilitate water infrastructure (e.g. existing reservoir storage systems).
- Employ water-demand management approaches and put in place appropriate water allocation and water pricing mechanisms.

Milestones

- A National Water Resources Master Plan for 2020–2040 (NWRMP) is being developed. It will serve as the blueprint for sustainable water resources development, utilization, and management in the country.



AGRICULTURE

Total agricultural land area: 42% of total land area. The sector accounts for 67% of total employment (2016); 80% of agricultural production is rainfed; total irrigated land area is 123,000 ha.

- **Main grain crops:** maize, sorghum, mhunga, rapoko, oilseeds.
- **Main industrial crops:** tobacco, cotton, edible dry beans, paprika.
- In terms of market value, tobacco, cotton, and maize are the most important crops.

Main Climate Change Impacts

- Changes to Zimbabwe's agroecological regions (AERs) indicate that the country is trending toward more arid and non-arable climatic conditions, which could potentially lead to food insecurity, an increase in unemployment, and a reduction in economic growth.
- Diminished rangeland productivity, as well as decreased livestock production, especially in the southwest and northwest areas of the country, are expected due to limited precipitation and extreme heat.
- Threats to rainfed agriculture due to increasing frequency and intensity of droughts and floods.
- Challenges for irrigated agriculture as water demand increases and water availability declines. Major cash crops, such as tobacco, cotton, tea, coffee, and horticultural crops are likely to be affected.

Proposed Adaptation Strategies

- Strengthen early-warning systems on cropping season quality, rangelands conditions, droughts, floods, disease/pest outbreaks, and wildlife movement to enhance farmer preparedness.
- Develop frameworks for promoting science-based crop production and post-harvest technologies and management practices.
- Strengthen capacity to identify and promote adoption of indigenous and improved livestock breeds that are tolerant to climate-related stresses.
- Incorporate resistance through biotechnology to reduce production costs and livestock mortality, and combat new and re-emerging zoonotic diseases.
- Strengthen national research and extension capacity for development and integrated management of agricultural water resources.



FORESTRY

Forest rents make up 4.1% of the country's total GDP (2016). The three major forest ecosystems in the country are the Baikiaea (25% of total forest cover), Miombo (30%), and Mopane (45%).

Main Climate Change Impacts

- Climate change will potentially influence the extent of forest ecosystems, composition of plantation species in forest ecosystems, species volume and density, and biodiversity characteristics.
- The forest cover of Baikiaea and Miombo ecosystems are both projected to decrease dramatically by 2050, to 18% and 10% of total forest cover, respectively. Mopane forests are expected to expand to 70% of total forest cover by 2050.
- Increased frequency and intensity of wildfires due to heat stress, droughts, and reduced rainfall.
- Increased drought due to sustained high temperatures and decreased precipitation.

Proposed Adaptation Strategies

- Develop and enforce policies that regulate change from one land use to another, and establish land-use plans at district, ward, village, and farm management levels that clearly recognize forestry as a land use.
- Build forest management capacity.
- Strengthen research, planning, and financial support to forestry and natural resources management.
- Promote and strengthen biodiversity conservation management and the integrity of natural ecosystems by using an ecosystem-based approach to adapt to climate change and strengthen the effectiveness of Trans-Frontier Conservation Areas.
- Promote appropriate climate-smart land-use options for the drier natural regions where cattle production and wildlife ranching are the most suitable land-use options.
- Promote non-timber forest products and sustainable agroforestry practices to enhance forest-based adaptation.
- Strengthen community governance systems for common-property forestry management.
- Promote risk management of pest, diseases, invasive species, and wildfire through the deployment of surveillance drones and early-warning systems.

1 World Bank. 2022. "Zimbabwe – Current climate > Climatology" in Climate Change Knowledge Portal.

<https://climateknowledgeportal.worldbank.org/country/zimbabwe/climate-data-historical>

2 World Bank. 2022. "Zimbabwe – Climate projections" in Climate Change Knowledge Portal. <https://climateknowledgeportal.worldbank.org/country/zimbabwe/climate-data-projections>

3 Authors' summary based on data from: Centre for Research on the Epidemiology of Disasters (CRED) EM-DAT database. Université catholique de Louvain, Brussels, Belgium. <http://www.emdat.be> (accessed June 2022).

4 ThinkHazard! 2020. "Zimbabwe: River flood." <https://thinkhazard.org/en/report/271-zimbabwe/FL>

5 ThinkHazard! 2020. "Zimbabwe: Water scarcity." <https://thinkhazard.org/en/report/271-zimbabwe/DG>

6 ThinkHazard! 2020. "Zimbabwe: Wildfire." <https://thinkhazard.org/en/report/271-zimbabwe/WF>

7 Notre Dame Global Adaptation Initiative (ND-GAIN) Country Index. <https://gain.nd.edu/our-work/country-index/>