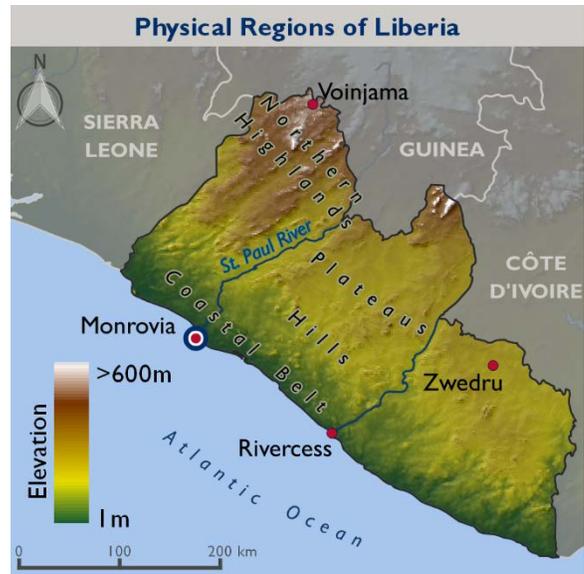




# CLIMATE CHANGE RISK PROFILE LIBERIA

## COUNTRY OVERVIEW

Liberia has made significant economic and development progress since emerging from civil war in 2003. But the country remains in a fragile situation, confronting widespread poverty, high inequality and unemployment, and limited access to basic services (water, sanitation, energy). Agriculture, fisheries and forestry are instrumental to Liberia's inclusive economic growth and poverty reduction goal. High reliance on climate-sensitive activities renders Liberia vulnerable to climate variability and change, expected to manifest in higher temperatures, more extreme weather events such as heavy rains, and rising sea levels. Agricultural productivity, which already suffers from land degradation and extreme weather events, is even more vulnerable to a changing climate given its reliance on climate-sensitive staple crops such as rice and the rising incidence of pests and disease. Saltwater and freshwater fisheries, a key economic and nutritional resource, are likely to suffer as sea temperatures increase and coastal ecosystems (mangroves and wetlands) are damaged. Coastal zones, home to the majority of the population, infrastructure, and economic activity, are at risk from flooding and erosion associated with sea level rise, which will lead to salinization of coastal agricultural fields.



## CLIMATE PROJECTIONS



0.9°–2.6°C increase in temperature by 2060



Increase in frequency and intensity of extreme weather events



0.13–0.56 m increase in sea levels by 2100

## KEY CLIMATE IMPACTS

### Agriculture Production

Increased crop loss/failure due to extreme weather events  
Increased pests, weeds, pathogens

### Water Resources

Diminished water quality  
Insufficient water levels for basic sanitation infrastructure

### Coastal Zones

Coastal flooding and erosion  
Damage to houses and infrastructure  
Salinization of land and aquifers

### Fisheries

Shift in distribution of species  
Biodiversity loss  
Loss of livelihoods

### Human Health

Increased risk of vector-, air- and waterborne diseases  
Increased food insecurity

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## CLIMATE SUMMARY

Liberia has a predominantly equatorial climate with four distinct elevation zones: the coastal belt, rolling hills, plateaus and northern highlands. Rainfall is highest along the coast (4,770 mm/year) and decreases toward the interior plateaus and low mountains, where the average annual rainfall level is 2,030 mm. With the exception of the southernmost parts of the country, which receive rainfall year-round, most of Liberia experiences two seasons, a function of the West African Monsoon: a wet season (“summer”) between May and November, when temperatures hover around 25°C; and a dry season (“winter”) between December and April, when the dry and dusty harmattan winds blow off the Sahara Desert and temperatures fluctuate between 24°–27°C. (2, 3, 6, 7)

### HISTORICAL CLIMATE

Key climate trends since the 1960s include:

- Increased average annual temperatures of 0.8°C throughout the country.
- An additional 57 “hot” nights per year on average (a 15.7 percent increase).
- Decline in mean annual rainfall (difficult to determine whether this is part of a long-term trend because of the variable nature of rainfall in the region).
- Increased frequency and unpredictability of intense rainfall events.
- Rising sea level.

### FUTURE CLIMATE

Projected climate changes include:

- Increase in annual temperatures between 0.9°–2.6°C by the 2060s, with rate of warming most rapid in the northern inland regions.
- Substantial increase in the frequency of “hot” days and nights.
- No consistent projections for rainfall exist but trends suggest an overall increase in average annual rainfall, with an increase in wet season rainfall of 3 percent by 2050. Dry season rainfall in the south will decline by 2050.
- Rise in sea level of 0.13–0.56 meters by 2100.

## SECTOR IMPACTS AND VULNERABILITIES

### AGRICULTURE

Agriculture has been an important source of economic growth since the collapse of the formal economy during the civil war. The sector contributes 35.2 percent of GDP and provides livelihoods to 67 percent of the population. Rice is the country’s primary staple crop, cultivated by 74 percent of farmers. Rice is highly sensitive to increased humidity, temperatures and intense rainfall, and to the pests that thrive in these conditions. However, rising temperatures may render areas in the north suitable for rice production where it previously was not. Intense rainfall and associated flooding and erosion of sowed fields may counteract these gains, depleting nutrient-rich topsoil and reducing the total arable land area. Cassava, Liberia’s second most important staple crop, is far more resilient to climate changes (particularly higher temperatures) and may provide an alternative food source in an increasingly erratic climate. Liberia’s major agricultural exports (rubber, cacao, and coffee) are also sensitive to changing weather conditions. Increasing intensity of rainfall events could damage rubber production and increase costs to maintain proper drainage on plantations. Cacao and coffee (both Arabica and Robusta) have specific climatic requirements for

optimal productivity levels that may come under pressure as rising temperatures reduce moisture levels and exacerbate pest and diseases that thrive in hot conditions. (1, 3, 8, 9)

Climate Stressors and Climate Risks AGRICULTURE	
Stressors	Risks
Increased temperatures  Increased frequency of intense precipitation	Yield reductions; crop loss
	Increased incidence of pests (e.g., grasshoppers) and diseases (e.g., black pod and coffee rust)
	Increased heat stress on coffee and cacao trees, particularly during dry season
	Reduced growing season, maturation and drying period for crops as a result of an overall increase in average annual rainfall
	Accelerated erosion of topsoil
	Waterlogging of rubber plantations

## WATER RESOURCES

Liberia has one of the highest rates of water resources per capita in Africa. Changes in seasonal rainfall patterns and rising temperatures, however, will negatively impact the water balance by either decreasing total water levels or degrading water quality through contamination. Runoff in the St. Paul River Basin is projected to decrease 0.7–25 percent by the 2020s due to precipitation and temperature changes, impacting potential hydropower production at the Mount Coffee plant and the water supply for Monrovia, the capital. In rural areas, water is largely supplied from shallow wells whose levels fluctuate with rainfall variability, particularly during the dry season (December – April). Reduced water levels further stress water quality as pollutants are concentrated. This is a particularly serious potential adverse impact as people rely heavily on surface water when wells dry up. Increased temperatures and intense rainfall are putting greater pressure on the water and sanitation sector, which was severely damaged due to fighting and vandalism sustained over 14 years of civil war.

## COASTAL ZONES

Sea level rise, and associated coastal flooding and erosion, are putting increasing stress on Liberia’s extensive and productive coastal zone. In addition to supporting key agriculture and fishing activities, the coast is home to almost 60 percent of the population, much of which resides in areas already at risk from inundation. Liberia’s Environmental Protection Agency is concerned that the rise in sea level will increase migration to higher lands and/or result in shock waves of migration to the interior when coastal inhabitants seek refuge from flooding. Areas of Monrovia such as the West Point Slums have had to be evacuated because of storm surges. If sea levels rise one meter, areas of major cities such as Monrovia, New Kru Town, River Cess, Buchanan and Robertsport will be submerged, incurring losses of land and infrastructure worth \$250 million. In addition, rapid coastal erosion (both from sea level rise and sand mining) already puts settlements and infrastructure at risk in areas like Buchanan, Greenville, Harper and Robertsport. Rising sea temperatures and intense rainfall levels will impact unique mangrove ecosystems through erosion, leaving the coast even more exposed to storms and wave damage.

Climate Stressors and Climate Risks WATER RESOURCES	
Stressors	Risks
Increased temperatures	Reduced runoff in major river basins
	Reduced water availability; drying of shallow wells
Increased frequency of intense precipitation	Insufficient water levels for agriculture, fishing and energy generation
	Degraded water quality for commercial and domestic use

Only 16.9 percent of the total population has access to an improved sanitation facility, causing many communities to resort to basic pit latrines and open defecation. Poor waste management practices, which contaminate water sources, are even more problematic during flooding and heavy rainfall. (3, 9)

Climate Stressors and Climate Risks COASTAL ZONES	
Stressors	Risks
Sea level rise	Coastal flooding, leading to displacement/migration of coastal populations; loss of life/crops/livestock; damage to infrastructure and settlements
Increased temperatures	Beach erosion, leading to loss of settlements; damage to infrastructure; loss of tourism/industry potential
Increased frequency of intense precipitation	Damage to wetland and mangrove systems

These factors will also negatively impact fish and other marine species that rely on mangroves as a habitat and food source. (2, 5, 7, 8)

## FISHERIES

Fish are an important component of the Liberian diet and the primary source of protein in coastal areas. Liberia’s fisheries include: coastal marine fisheries, involving industrial and artisanal activities; inland river and lake fisheries, which are underdeveloped and artisanal; and aquaculture, which consists of small, freshwater ponds producing tilapia in rural areas of non-coastal communities. The fisheries sector suffered during the civil war, and now faces risks from climate change and climate variability. Rising sea surface temperatures are reducing biodiversity and overall stocks as a result of death, diminished reproductive cycles and migration to cooler waters. Changing rainfall patterns, particularly during the dry season when inland river and pond levels are low, are causing significant numbers of

## HUMAN HEALTH

Liberia’s population already suffers from a range of environmental problems that will likely be intensified by climate change. Malaria is one of the leading causes of morbidity and mortality, accounting for 38 percent of all hospital visits. Increased rainfall and flooding are likely to cause outbreaks of malaria, cholera (expected to increase 10 percent by 2100) and diarrheal diseases of epidemic proportions. The incidence of Lassa Virus (LASV), the third highest cause of morbidity, is also expected to rise as heavy rainfall increases. Cases of LASV, carried by the multimammate rat, double or triple during the rainy season when rat populations grow rapidly. Dengue fever, already present in neighboring Côte d’Ivoire, could expand into Liberia as temperatures rise. Respiratory diseases may be exacerbated by heat stress and increased rainfall levels.

## FOREST ECOSYSTEMS

Liberia is home to 40 percent of West Africa’s forest cover, which is used for food (non-timber forest products and wildlife), fuelwood, medicinal products and energy. Rainfall projections are too inconclusive to predict with certainty if climate change will significantly impact tropical forests. However, substantial evidence shows that increased duration and intensity of rainfall leads to slower tree growth and, in more severe cases, rotting because of waterlogged tree roots. Increased runoff due to heavy rain, combined with root loss may cause greater siltation of surrounding reservoirs and rivers. Rising temperatures have also created

Climate Stressors and Climate Risks FISHERIES	
Stressors	Risks
Increased temperatures	Disruption to reproductive patterns and migratory routes
	Reduced aquatic biodiversity and productivity
Increased frequency of intense precipitation	More frequent loss of fishing days due to bad weather
	Loss of income and livelihoods
	Reduced protein intake and nutrition deficits for human population

fish to die. Those that survive are often confront waters contaminated from pesticide runoff and other pollutants. (2, 4, 8)

Climate Stressors and Climate Risks HUMAN HEALTH	
Stressors	Risks
Increased temperatures	Increased incidence of vector-borne diseases (e.g., malaria, dengue fever and yellow fever) due to extended breeding range to higher elevations
	Increased incidence of food- and waterborne diseases (e.g., cholera, typhoid and diarrhea)
Increased frequency of intense precipitation	Exacerbation of respiratory diseases (e.g., asthma)

Increased flooding and extreme events will also increase the contamination levels of rivers and farms from human waste (leading to increased incidence of food- and waterborne diseases). (3)

Climate Stressors and Climate Risks FOREST ECOSYSTEMS	
Stressors	Risks
Increased temperatures	Increase in the incidence of pests and diseases
Increased frequency of intense precipitation	Decline in forest cover and health due to increased rainfall
	Increased erosion and runoff as a result of root loss

environments where pests, including the pine caterpillar (*Dendrolmus punctatu*), can thrive. (2, 7, 8)

## POLICY CONTEXT

### INSTITUTIONAL FRAMEWORK

The Environmental Protection Agency (EPA) of Liberia is the primary agency responsible for preparing the National Communication under the United Nations Framework Convention on Climate Change (UNFCCC) and the National Adaptation Programme of Action (NAPA). In coordination with its partners, the EPA is focused on integrating climate change across government ministries including the Ministry of Agriculture and the Ministry of Land, Mines and Energy. The National Environmental Policy Council shapes priorities for environmental targets and objectives. Last but not least, the National Climate Change Steering Committee and Secretariat, established in 2010, are charged with creating an intergovernmental framework for combatting climate change in Liberia.

### NATIONAL STRATEGIES AND PLANS

Liberia joined the UNFCCC in 2002. It drafted its second Poverty Reduction Strategy Paper, which outlines an approach toward graduating to middle-income status by 2030. Liberia is one of the first recipients of the Green Climate Fund and a signatory to the 2015 Paris Climate Change Agreement. The 2017 National Policy and Response Strategy on Climate Change will guide the country's efforts to mitigate the risks of climate change and reduce vulnerability. This document, in addition to those below, addresses climate change as a major obstacle to long-term development and growth:

- [Initial National Communication](#) (2013)
- [National Adaptation Programme of Action \(NAPA\)](#) (2008)
- [Environmental Protection and Management Law](#) (2002)

### KEY RESOURCES

1. CGIAR. 2015. [Climate vulnerability and adaptation of the smallholder cocoa and coffee value chains in Liberia](#).
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3. EPA. 2013. [Initial National Communication to the UNFCCC](#).
4. FAO. 2007. [Fishery Country Profile](#).
5. Lucas, J. 2014. [Liberia's Rising Waters](#). Center for Climate and Security.
6. UNDP. 2012. [Climate Change Country Profiles: Liberia](#).
7. USAID. 2012. [Climate Change Adaptation in Liberia](#).

8. USAID and US Forest Service Office of International Programs. 2013. [Liberia Climate Change Assessment](#).
9. CIA. 2016. [The World Factbook: Liberia](#).

#### Map Sources:

- Jarvis, A., H.I. Reuter, A. Nelson, E. Guevara. 2008. Hole-filled SRTM for the globe Version 4, available from the CGIAR-CSI SRTM 90m Database, <http://srtm.csi.cgiar.org>.
- Encyclopedia Britannica. Liberia. <https://www.britannica.com/place/Liberia>

## SELECTED ONGOING EXPERIENCES

Selected Program	Amount	Donor	Year	Implementer
Liberia Energy Efficiency and Access Project (LEEAP)	\$29.75 million	African Development Bank Group (AfDB)	N/A	Liberia Water-Sewerage Corporation
Strengthening Liberia's Capability to Provide Climate Information and Services to Enhance Climate Resilient Development and Adaptation to Climate Change	\$18.7 million	GEF (Least Developed Countries Fund)	TBD	UNDP, Liberia Environmental Protection Agency (EPA), Ministry of Land, Mines and Energy
West Africa Regional Fisheries Program in Liberia - ACGF	\$4.19 million	World Bank	N/A	Ministry of Agriculture, Bureau of National Fisheries
Fostering Innovative Sanitation and Hygiene in Monrovia	€1.13 million	AfDB	N/A	Monrovia City Corporation
Enhancing Resilience of Vulnerable Coastal Areas to Climate Change Risks in Liberia	\$9.65 million	GEF (Least Developed Countries Fund)	2010–2014	EPA
Enhancing Resilience to Climate Change by Mainstreaming Adaptation Concerns into Agricultural Sector Development	\$6.35 million	GEF (Least Developed Countries Fund)	2011–2016	Ministry of Agriculture, UNDP
Governance Advocacy and Leadership for Water, Sanitation and Hygiene (GoAL WASH)	N/A (Multi-country)	UNDP: SIDA, Basque Water Agency	2012–2015	Ministry of Lands, Mines and Energy
Installation of Multipurpose Mini-Hydro Infrastructure (for energy and irrigation)	\$5.76 million	GEF: Trust Fund	2011–2014	Liberia Electricity Corporation, MLME, EPA, UNIDO
Agriculture Sector Rehabilitation Project (ASRP)	\$26.9 million	IFAD, AfDB, ADF	2009–2017	
Post-Ebola Health System Strengthening and Epidemic Prevention	€7 million	GIZ	2016–2019	Ministry of Health
West Africa Biodiversity and Climate Change (WA BiCC)	\$49 million	USAID/West Africa	2015 – 2020	Tetratech, EPA