

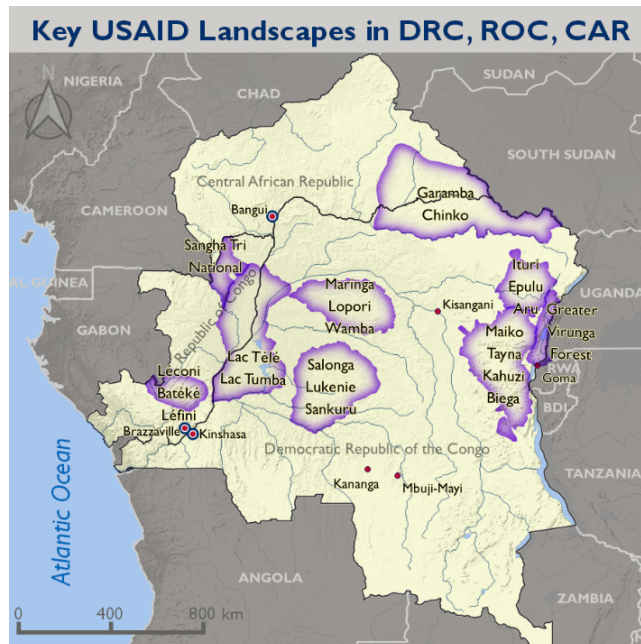


# CLIMATE RISKS IN THE CENTRAL AFRICA REGIONAL PROGRAM FOR THE ENVIRONMENT (CARPE) AND CONGO BASIN

## OVERVIEW

The Congo Basin is the world's second largest tropical rainforest, home to rare biodiversity, and acts as a massive carbon sink, mitigating greenhouse gas (GHG) emissions. To preserve this important ecosystem, USAID established the Central Africa Regional Program for the Environment (CARPE). Rising temperatures and rainfall changes impact landscapes targeted by CARPE in Democratic Republic of the Congo (DRC), Republic of the Congo (ROC) and Central African Republic (CAR) (see map). These regions are characterized by significant social vulnerability, political instability and poverty. The livelihoods of some 80 million people depend on natural resources and forests, which cover nearly 2 million km<sup>2</sup> across these three countries. Other livelihood activities include mining, climate-sensitive rainfed agriculture, fishing and hunting. Biodiversity across the region, including some of the only remaining populations of great apes and forest elephants, is highly endangered and will be further impacted as climate change alters species distribution and habitats.

Urbanization has increased demand for charcoal and tropical forest products, placing additional pressure on the region's forests. This profile describes climate risks across key sectors – forestry, agriculture, energy, water and health – in CARPE countries. (19, 21, 22, 24, 25)



## CLIMATE PROJECTIONS



1.4–2.7°C increase in temperatures by 2050 across the region



Increased variability in precipitation



Increased risk of floods and droughts

## KEY CLIMATE IMPACTS

### Forests & Biodiversity



Loss of habitat, biodiversity and tourism revenue; increased carbon sequestration

### Agricultural Livelihoods



Reduced crop yields; increased reliance on forest products; food insecurity

### Water Resources & Energy



Increased hydropower production in some seasons; reduced production in others

### Health



Reduced water quality; spread of vector- and waterborne diseases; heat stress

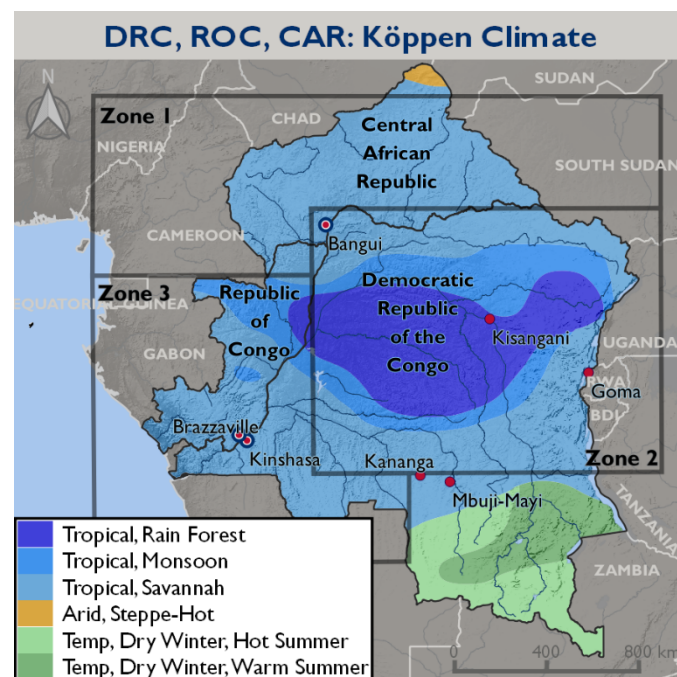
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This document was prepared under the Climate Change Adaptation, Thought Leadership and Assessments (ATLAS) Task Order No. AID-OAA-I-14-00013 and is meant to provide a brief overview of climate risk issues. The key resources at the end of the document provide more in-depth country and sectoral analysis. The contents of this report do not necessarily reflect the views of USAID.

## CLIMATE SUMMARY

Three major climate zones are recognized across the CARPE activity area and broader Congo Basin; these are presented in the table and map below.

Zones and Landscapes	Climate and Seasons	Temp.
<b>Zone 1: CAR</b> <i>Chinko Protected Area</i>	Tropical savanna with a dry season from Dec.–Feb.	Averages range from 24–27°C
<b>Zone 2: DRC</b> <i>Ituri-Epulu-Aru Forest; Greater Virunga Forest; Maiko-Tayna-Kahuzi Biéga Forest; Salonga-Lukenie-Sankuru Forest; Garamba Protected Area; Maringa-Lopori-Wamba</i>	Tropical rainforests along the Congo River and its tributaries. Two rainy seasons: March–May and Sept.–Dec.; followed by two short dry seasons: June–Aug. and Jan.–Feb.	Averages range from 24–25°C
<b>Zone 3: DRC and ROC</b> <i>Lac Télé-Lac Tumba Swamp Forest; Sangha Tri-National; Lecon-Baté-Léfini Landscape</i>	Mountainous, with dense grasslands; mainly tropical wet and dry climates; rainy season from July–Aug.	Averages range from 24–25°C





## HISTORICAL AND FUTURE CLIMATE

Meteorological data are scarce for the region, and for DRC in particular, posing limits to climate model projections, which are highly uncertain for the region. Nevertheless, all models consistently indicate that temperatures will rise between 1.4–2.7°C by the 2050s. The future of rainfall is less certain, with projections suggesting both increases and decreases. However, there is agreement that the characteristics (timing, intensity, duration) of rainfall will change. Intense, extreme rainfall events are likely to increase, while average rainfall will be less uniformly distributed, with an increased tendency for dry spells. Historical trends and future projections for DRC, ROC and CAR are summarized in the table below. (3, 4, 5)

### Key Climate Trends and Projections in DRC, ROC and CAR

Sources: World Bank Climate Change Knowledge Portal

	Observed trends	Climate projections
<b>Temperature</b> 	<p><b>DRC:</b> Warm extremes increased (e.g., warmest day increased by about 0.25°C per decade)</p> <p><b>ROC:</b> Mean annual temperature increased 0.6°C between 1951–1999</p> <p><b>CAR:</b> Mean annual temperature has increased at a rate of 0.3°C per decade since 1978, with faster increases in northeastern parts of the country</p>	<p><b>DRC:</b> Rise in minimum temperatures will exceed rise in maximum temperatures; increase in average daily temperatures</p> <p><b>ROC:</b> 1°C increase in mean annual temperature by 2050; increases in heat wave durations by 2046–2065, particularly in northern and northeastern ROC</p> <p><b>CAR:</b> 0.7–3°C increase in mean annual temperatures by 2080</p>
<b>Rainfall</b> 	<p><b>DRC:</b> Increased frequency of intense rainfall events</p> <p><b>ROC:</b> Average annual rainfall decreased between 1950s and 1980s</p> <p><b>CAR:</b> Decrease in precipitation over the period 1978–2009, with more interannual variability</p>	<p><b>DRC:</b> Continued increase in frequency of intense rainfall events</p> <p><b>ROC:</b> Increase in mean annual rainfall by 2046–2065; increase in rainfall intensity</p> <p><b>CAR:</b> Increase in mean annual rainfall; rainfall becomes more erratic</p>

## SECTOR IMPACTS AND VULNERABILITIES

### FORESTS AND BIODIVERSITY

Forests are a valuable natural resource in the region, not only for the products extracted and used by humans (timber, fuel wood, palm oil, etc.), but also as habitat for wildlife and for the environmental services they provide, such as serving as carbon sinks, controlling erosion and filtering water (and regulating water flow). The extensive forest network across the region represents about 18 percent of the world's tropical forests and is important for local ecosystems and economies, as well as regulating the regional and global climate. For example, deforestation within the Congo Basin has been linked to drying over the Basin itself and changes in precipitation over the Sahel, Ethiopian highlands and Guinean coast. (9, 17)

Climate change will have a range of impacts on forest ecosystems. As temperatures rise, and rainfall becomes more variable by 2030 and continuing through to the end of the 21<sup>st</sup> century, extreme weather events are more likely, as are prolonged dry spells, all of which will impact biodiversity and soil health. When considering only climatic conditions (without taking into consideration nonclimate stressors such as population growth, land use change and deforestation), models suggest the broader Congo Basin will see a moderate increase in ecosystem carbon in the first decades of the 21<sup>st</sup> century as a result of a north- and southward expansion of tropical evergreen forests and an eastern shift in seasonal forest. Projections suggest that areas throughout all of Zone 3 (ROC) and northeastern areas of Zone 2 (particularly around Garamba National Park) will experience a decline in grassland by 2100, whereas tropical evergreen forest and seasonal forest cover are expected to increase by 2100 across all zones. A change in temporal distribution of rainfall and higher rates of evaporation resulting from increased temperatures could lead to faster decomposition and a loss of carbon from peatlands in Zone 3 around the Lac Télé-Lac Tumba Swamp Forest Landscape. The projected overall increase in forest cover increases the potential for carbon capture in both vegetal biomass and soils; this potential is estimated to be between 11 and 41 tC ha<sup>-1</sup> by 2050. (6, 3)

In addition to plant biodiversity, protected forests in the Central Africa region are home to megafauna such as highland gorillas in Virunga National Park and forest elephants in Dzanga Dzanga National Park. While in theory protected areas safeguard these species from development encroachment, climate change could put additional pressure on these parks, by both altering ecosystem dynamics and encouraging human encroachment into these areas. For example, the climate impacts mentioned above could shrink the physical extent of habitats that currently have protected status or shift the distribution of specific plant species upon which endangered species depend to areas outside of protection. Additionally, changing climate patterns could lead animals to stray farther away from the relative security of protected areas in search of preferred habitat. This could put endangered species at greater risk of conflict with human settlements, put both humans and wildlife at risk from disease transmission, and negatively impact local livelihoods dependent on tourism revenue. (22)

According to the United Nations Collaborative Programme on Reducing Emissions from Deforestation and Forest Degradation in Developing Countries (UN-REDD), human activity is the primary driver of deforestation or forest degradation in the Congo Basin. Increasing population, particularly in urban and urbanizing areas like Kisangani (approximately 279 kilometers from the Maiko-Tayna-Kahuzi Biéga Forest Landscape), Kananga and Mbuji-Mayi (some 600 kilometers from the boundary of the Salonga-Lukenie-Sankuru Forest Landscape) and Goma (on the periphery of Greater Virunga), require increasing amounts of charcoal and fuel wood, threatening forests that hold large stores of carbon. Infrastructure development such as roads for extractive activities, agricultural expansion (which may itself be impacted by climate change) and clear-cutting of forests for timber products and charcoal production are major contributors to deforestation. In addition, illegal logging is significant, especially in the south of DRC. (2)

Climate Stressors and Climate Risks FORESTS AND BIODIVERSITY	
Stressors	Risks
<b>Rising temperatures</b>  <b>Prolonged dry spells</b>  <b>Increased extreme weather events</b>	Decreased vegetative cover in Zone 3; increased cover in all other zones
	Decrease in biodiversity as more climate-sensitive plant species fail to adapt
	Change in forest species composition
	Extreme rain and wind storms, causing tree-falls, flood risk and soil erosion
	Loss/shift of habitats outside of protected areas; putting endangered species and wildlife in possible conflict with human settlements

## AGRICULTURAL LIVELIHOODS

Agriculture employs the majority of people in the region – 72 percent in CAR, 65 percent in DRC and 41 percent in ROC. Agricultural activities are mainly rainfed and subsistence in nature, combining farming, hunting/gathering/fishing and small animal husbandry. Crop production varies by region, with beans, maize and cassava considered major staples, and local rice production on the rise in parts of Zone 2 (around Greater Virunga). Exports of coffee and cocoa are on the rise, but their production is highly susceptible to climate change. Climate variability and change including increased rainfall intensity, prolonged dry spells and rising temperatures will impact crop selection and productivity, alter farming practices and put pressure on farmers to expand their cropland into forests. Rising temperatures will also alter pest and pathogen dynamics – for example, cassava mosaic virus and coffee rust have damaged these important crops in past years. Given the likely increase of tropical forest cover, potential may exist for expansion of agroforestry systems and small cocoa plantations beyond current producing areas in the easternmost areas of the Lac Télé-Lac Tumba and Greater Virunga Landscapes. However, increased rainfall intensity can lead to brown rot disease and severely reduce cocoa output, as seen in similar cocoa-producing environments in Ghana and Côte d'Ivoire. Increasing temperatures and humidity may negatively impact the ability to effectively process agricultural products and safely store seeds, grains and other perishable products. Damage to the region's already severely limited ground transportation infrastructure through increased floods, heavy rains and erosion can raise transport costs and/or prevent products from reaching market before they spoil, negatively impacting farmers. (7, 8, 19, 21, 22, 24, 25, 26, 27)

Climate Stressors and Climate Risks AGRICULTURAL LIVELIHOODS	
Stressors	Risks
Rising temperatures	Changes in soil fertility and in crop yield: potential increases, reductions or failure/loss
More variable rainfall – or displacement of key activity seasons	Increased pests/pathogens – cassava mosaic, leaf rust, coffee rust, berry borer, potato taste defect, brown rot disease
Prolonged dry spells	Increased postharvest losses; spoilage of animal products
Increased extreme weather and floods	Shifts in timing of planting/harvesting
	Increased food insecurity and/or hunger
	Damage to road network (decreasing access to markets); increased erosion and pesticide runoff

## WATER RESOURCES AND ENERGY

The Congo River has the largest discharge volume of any river in Africa and 62 percent of the Congo Basin lies within DRC. Most of the region's population depends on groundwater and springs located in dense gallery and equatorial forests for drinking water. Hydro- and micro-hydropower are promising sources of much-needed electricity for the region, given the abundance of surface water resources and the likely increase in precipitation. However, the changing characteristics of annual and seasonal precipitation in the region will alter the Congo Basin's dynamics. This in turn could affect stability of hydropower production, as well as water availability for both household and commercial consumption. The reliability of existing and potential irrigation schemes (although currently limited) may be affected given climate impacts on the hydrological system, especially in savannas at the periphery of the Congo Basin. In addition to impacting water supply, an increased frequency of intense rainfall events can exacerbate poor water quality, especially in urban areas, and increase the risk of flooding in rivers, streams and drainage ditches. Furthermore, floods on navigable rivers can be dangerous and disrupt transportation of people and goods. (20, 1, 3, 10)

Climate Stressors and Climate Risks WATER RESOURCES AND ENERGY	
Stressors	Risks
Rising temperatures	Reduced surface water quality
	Increased sedimentation and erosion
Increased frequency of intense precipitation	Reduced water quantity and quality in shallow wells and springs due to increased rates of evaporation
Decreased dry season precipitation	Increased damage to water infrastructure and transportation networks
	Unreliability of hydroelectricity production



## HUMAN HEALTH

In DRC and ROC, malaria is a leading cause of morbidity and mortality. Areas at an altitude of 300–1,000m experience stable transmission for most of the year, with higher levels of transmission coinciding with the boundaries of the Lac Télé-Lac Tumba Swamp Forest, Garamba National Park and Ituri-Epulu-Aru Forest Landscapes. Mountainous areas, like Greater Virunga and Maiko-Tayna-Kahuzi-Biéga Landscapes, experience short transmission seasons but are prone to malaria epidemics. Given the impact of temperature on the lifecycle and habitat of malaria-carrying mosquito and parasite species, warmer temperatures may open up new locations suitable for transmission across the Congo Basin and CARPE landscapes. Specifically, a forthcoming analysis conducted by USAID based on mosquito suitability and rising temperatures suggests that by 2030 an additional 65,000–80,000 people in DRC will be at risk from endemic malaria (10–12 months of transmission suitability) in areas previously unsuitable for malaria transmission, mainly in the south and pockets of Maiko-Tayna-Kahuzi-Biéga and Greater Virunga Landscapes. However, in other areas of DRC (center and northwest within the Lac Télé-Lac Tumba Landscape), and much of ROC and CAR, the season for malaria transmission is likely to be shorter (7–9 months compared with 10–12 months). (11, 23)

In addition to expected changes in malaria transmission, increases in temperature and episodes of more intense rainfall are likely to impact the spread of waterborne diseases and emerging infectious diseases. Although this is one of the wettest regions of the world, the majority of its people do not have access to safe drinking water and sanitation. Diarrheal diseases already represent a significant public health burden in DRC and CAR, and to a lesser extent in ROC. High air temperatures and periods of excessive rainfall create conditions that favor growth and spread of bacteria, such as *Vibrio cholerae* (cholera). For example, following intense rains and flooding events in January 2018, the number of cases of cholera reported weekly increased from less than 5 to more than 100 in Kinshasa. Forest clearing and climate are significant drivers of transmission of the Monkeypox virus (MPX) from wildlife to humans under current climate conditions. Future model projections show range shifts into regions where MPX has not been recorded previously, including increased suitability for MPX in eastern DRC. (12, 18, 28, 29, 30, 31)

Climate Stressors and Climate Risks HUMAN HEALTH	
Stressors	Risks
Rising temperatures  Increased frequency of intense rainfall	Expanded ranges of disease vectors (e.g., mosquitos) and increased transmission of infectious diseases such as malaria and Monkeypox virus
	More pronounced heat stress as numbers of warm days and nights increase
	Increased incidence of diarrheal diseases (particularly cholera)
	Increased stress on health of HIV/AIDS population

## POLICY CONTEXT

CENTRAL AFRICAN REPUBLIC		
Institutional Framework	National Strategies and Plans	
In CAR, the Ministry in Charge of the Environment (MEFCPE) has the mandate to administer the National Adaptation Plan of Action, adopted in 2008. CAR is a member of the Comité National de Pilotage de la Convention sur les Changements Climatiques and the Central African Forest Commission (COMIFAC), a treaty organization established to harmonize regional policies on forestry and biodiversity conservation.	CAR's Intended Nationally Determined Contribution (INDC) stated a goal of reducing GHG emissions by 5 percent by 2030 compared to a business-as-usual scenario, and CAR ratified the Paris Agreement in 2016. CAR has two laws on the books related to climate change mitigation and adaptation: Law No. 08-18 regarding biofuels, and Law No. 08.222 establishing the Forestry Code. (13)	<ul style="list-style-type: none"> <li>• <a href="#">National Adaptation Plan of Action</a> (2008)</li> <li>• <a href="#">Intended Nationally Determined Contribution</a> (2015)</li> <li>• <a href="#">Initial National Communication</a> (2003)</li> <li>• <a href="#">Second National Communication</a> (2015)</li> </ul>

REPUBLIC OF THE CONGO		
Institutional Framework	National Strategies and Plans	
ROC assigned both the Ministry of Forest Economy and Sustainable Development (MEFDD) and the Ministry Environment and Tourism to manage climate change-related activities. The country is a member of COMIFAC and submitted its INDC in 2015.	ROC participates in the World Bank's Forest Carbon Partnership Facility (FCPF) and UN-REDD. The country began a forest and biodiversity mapping project in 2013 led by the National Centre for Surveys and Forest and Fauna Resources Management (CNIAF). ROC ratified the Paris Agreement in 2017 and has several policies on the books related to climate adaptation and mitigation. (14)	<ul style="list-style-type: none"> <li>• <a href="#">Intended Nationally Determined Contribution</a> (2015)</li> <li>• <a href="#">Initial National Communication</a> (2001)</li> <li>• <a href="#">Second National Communication</a> (2009)</li> </ul>
DEMOCRATIC REPUBLIC OF CONGO		
Institutional Framework	National Strategies and Plans	
DRC recently accelerated efforts toward further decentralization, which could result in some uncertainty regarding mandates for administering/implementing climate change policies, especially in the provinces. At the time of this writing, climate adaptation efforts are under the mandate of the Sustainable Development Directorate in the Ministry of Environment, Nature Conservation and Tourism. The country is a member of COMIFAC and UN-REDD.	DRC ratified the Paris Agreement in December 2017 and submitted its INDC in 2015. The DRC is developing a NAMA (Nationally Appropriate Mitigation Actions) with support from the EU, UNDP, and German and Australian assistance. As an active participant in the REDD+ program, DRC was the first in the Congo Basin to beta test a forest monitoring system and is further along the REDD+ planning continuum than its neighbors. The Ministry in Charge of Economy and Land Management (MINEPAT) is responsible for REDD+ implementation. (15, 16, 9)	<ul style="list-style-type: none"> <li>• <a href="#">National Adaptation Plan of Action</a> (2006)</li> <li>• <a href="#">Intended Nationally Determined Contribution</a> (2016)</li> <li>• <a href="#">Initial National Communication</a> (2000)</li> <li>• <a href="#">Second National Communication</a> (2009) (<a href="#">Executive Summary</a>)</li> <li>• <a href="#">Third National Communication</a> (2015)</li> </ul>

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