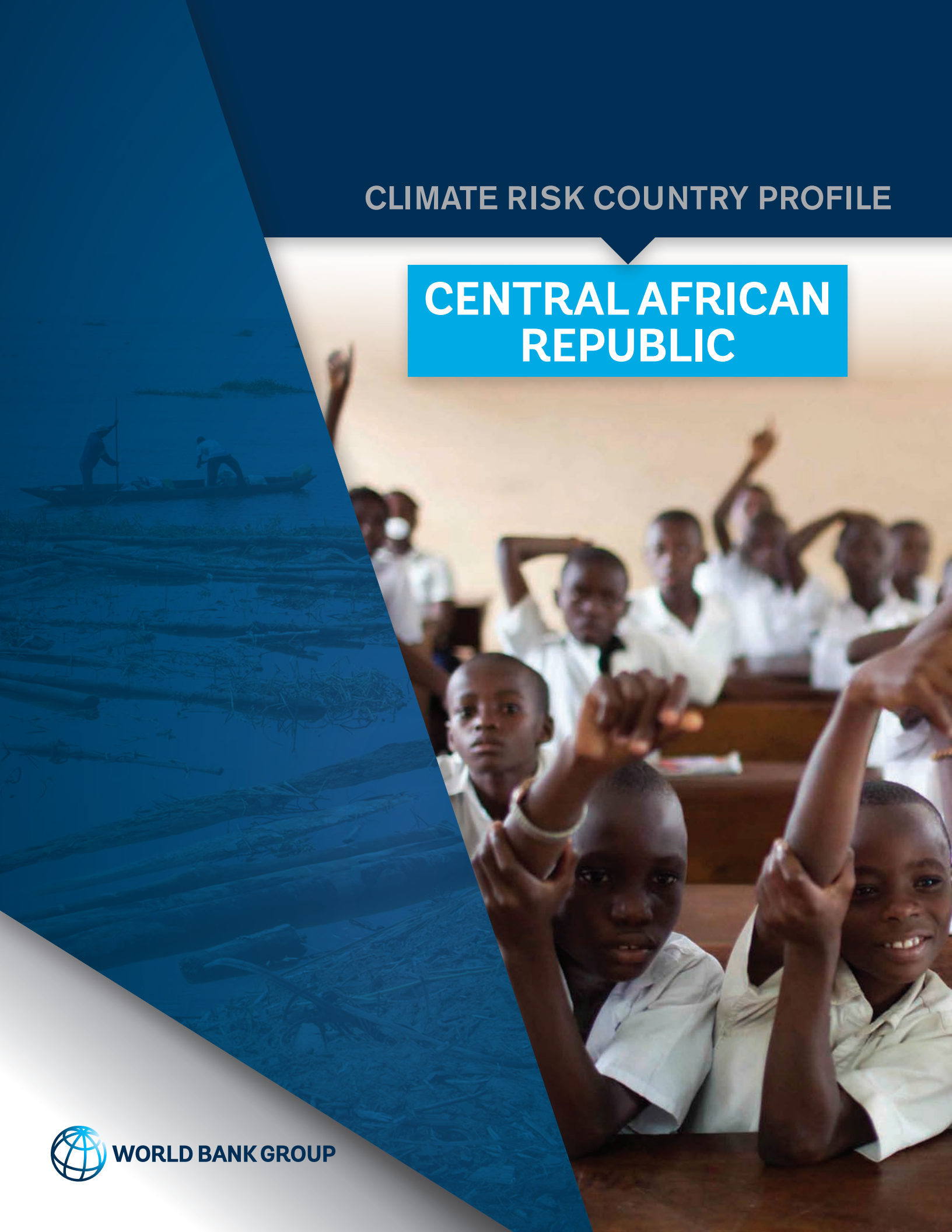
CLIMATE RISK COUNTRY PROFILE

CENTRAL AFRICAN REPUBLIC



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Telephone: 202-473-1000; Internet: www.worldbank.org

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This profile is part of a series of Climate Risk Country Profiles developed by the World Bank Group (WBG). The country profile synthesizes most relevant data and information on climate change, disaster risk reduction, and adaptation actions and policies at the country level. The country profile series are designed as a quick reference source for development practitioners to better integrate climate resilience in development planning and policy making. . This effort is managed and led by Veronique Morin (Senior Climate Change Specialist, WBG) and Ana E. Bucher (Senior Climate Change Specialist, WBG).

This profile was written by MacKenzie Dove (Senior Climate Change Consultant, WBG). Additional support was provided by Jason Johnston (Operations Analyst, WBG) and Yunziyi Lang (Climate Change Analyst, WBG).

Climate and climate-related information is largely drawn from the Climate Change Knowledge Portal (CCKP), a WBG online platform with available global climate data and analysis based on the latest Intergovernmental Panel on Climate Change (IPCC) reports and datasets. The team is grateful for all comments and suggestions received from the sector, regional, and country development specialists, as well as climate research scientists and institutions for their advice a

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FOREWORD

Climate change is a major risk to good development outcomes, and the World Bank Group is committed to playing an important role in helping countries integrate climate action into their core development agendas. The World Bank Group is committed to supporting client countries to invest in and build a low-carbon, climate-resilient future, helping them to be better prepared to adapt to current and future climate impacts.

The World Bank Group is investing in incorporating and systematically managing climate risks in development operations through its individual corporate commitments.

A key aspect of the World Bank Group's Action Plan on Adaptation and Resilience (2019) is to help countries shift from addressing adaptation as an incremental cost and isolated investment to systematically incorporating climate risks and opportunities at every phase of policy planning, investment design, implementation and evaluation of development outcomes. For all IDA and IBRD operations, climate and disaster risk screening is one of the mandatory corporate climate commitments. This is supported by the Bank Group's Climate and Disaster Risk Screening Tool which enables all Bank staff to assess short- and long-term climate and disaster risks in operations and national or sectoral planning processes. This screening tool draws up-to-date and relevant information from the World Bank's Climate Change Knowledge Portal, a comprehensive online 'one-stop shop' for global, regional, and country data related to climate change and development.

Recognizing the value of consistent, easy-to-use technical resources for client countries as well as to support respective internal climate risk assessment and adaptation planning processes, the World Bank Group's Climate Change Group has developed this content. Standardizing and pooling expertise facilitates the World Bank Group in conducting initial assessments of climate risks and opportunities across sectors within a country, within institutional portfolios across regions, and acts as a global resource for development practitioners.

For developing countries, the climate risk profiles are intended to serve as public goods to facilitate upstream country diagnostics, policy dialogue, and strategic planning by providing comprehensive overviews of trends and projected changes in key climate parameters, sector-specific implications, relevant policies and programs, adaptation priorities and opportunities for further actions.

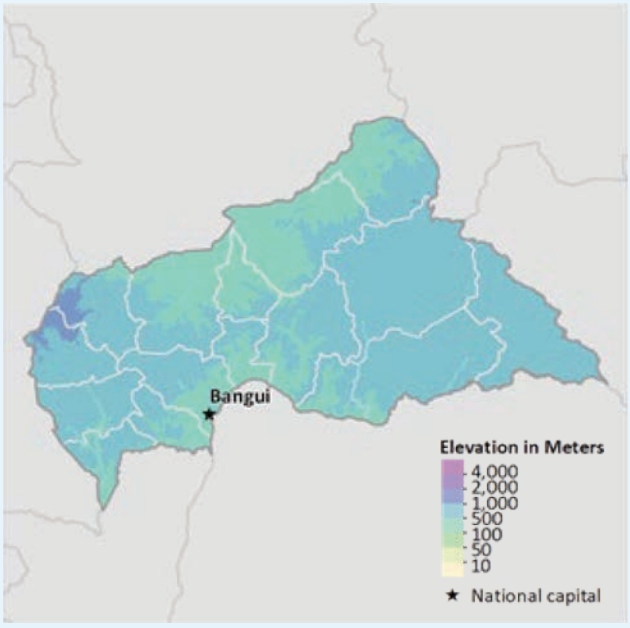
It is my hope that these efforts will spur deepening of long-term risk management in developing countries and our engagement in supporting climate change adaptation planning at operational levels.

Bernice Van Bronkhorst
Global Director
Climate Change Group (CCG)
The World Bank Group (WBG)

COUNTRY OVERVIEW

The Central African Republic, herein CAR, is a landlocked country in Central Africa, located between 2° and 11° latitude north, and 13° and 27° longitude east. It has a total land area of 623,000 km^2 and shares borders to the north with Chad, to the northeast with Sudan, to the east with South Sudan, in the south by the Congo and Democratic Republic of Congo, and to the west with Cameroon.[1] The country's terrain consists of a vast peneplain dominated by two mountain ranges at the eastern and western ends. These are joined by a central 'spine', which separates the two principal drainage sources for the country: the Chari-Longue Basin in the north, and Congo Basin in the south. Due to the country's location, CAR has a relatively favorable climate conditions, that are primarily hot and humid, characterized by a dry and rainy season. CAR has a high degree of biological diversity and is composed of five large phytogeographic zones, each characterized by a specific fauna: the Guinean forest zone of dense humid forests in the south; the Sudano-Ubangian zone, sheltering dense semi-humid, as well as open and dry forests; the Sudano-Guinean and Sudano-Sahelian zones, composed of various types of savannahs; and the Sahelian zone, consisting of steppes in the north (**Figure 1**).[2] The country is endowed with rich agricultural lands and enormous natural resources, such as wood, gold, and diamonds, the exploitation of which remains rudimentary and artisanal,[3] however intense poverty, conflict, and a stagnated economy has resulted in CAR ranked 188 out of 189 countries on the UNDP's Human Development Index (2019).[4]

FIGURE 1. Elevation of Central African Republic[5]



CAR is a least-developed country and one of the poorest countries in the world and continues to be impacted by its long history of conflict, poor governance, weak institutions. It is still recovering from the latest series of conflicts that broke out in 2013. The country held its first democratic elections in 1993 with the accession of Ange Félix Patassé and the establishment of the country's new National Assembly. However, the country continues to be plagues by violence, conflict and internal displacement. At the time of writing, it is estimated that, there are currently over 729,000 internally displaced persons in the Central African Republic[6] and 575,000 refugees in neighboring

1 UNDP (2019). Central African Republic — Climate Change Adaptation Overview. URL: https://www.adaptation-undp.org/explore/middle-africa/central-african-republic
2 Central African Republic (2016). Nationally-Determined Contributions. URL: https://www4.unfccc.int/sites/ndcstaging/PublishedDocuments/Central%20African%20Republic%20First/INDC_R%C3%A9publique%20Centrafricaine_EN.pdf
3 UNDP (2019). Central African Republic — Climate Change Adaptation Overview. URL: https://www.adaptation-undp.org/explore/middle-africa/central-african-republic
4 UNDP (2020). Human Development Reports — Human Development Index. URL: http://hdr.undp.org/en/data
5 World Bank (2019). Internal Climate Migration Profile — CAR.
6 UNHCR (20201). Operational Porta — Central African Republic Regional Response. Data accessed May 2021. URL: https://www.worldbank.org/en/country/centralafricanrepublic/overview

countries. Conflict and political instability continue to undermine the country's development agenda. On February 6, 2019, the Government of the Central African Republic signed an African Union-mediated peace agreement with 14 armed groups.[7]

CAR has a population of just over 4.7 million people (2019) with an annual population growth rate of 1.7%.[8] The country has a Gross Domestic Product (GDP) of $2.2 billion (2019) and a current annual growth rate of 3.0% (2019) (**Table 1**).[9] Approximately 41.4% of the population currently lives in urban areas. This is projected to increase to 48% and 60% of the population by 2030 and 2050, respectively.[10] Despite its relatively recent positive growth, poverty remains pervasive and elevated and as of 2019 it is estimated that approximately 71% of the population lives below the extreme poverty rate (<$1.90 per day); up from 66%.[11] The high levels of poverty and low-degree of development in CAR limits capacity of poor households and communities to manage climate risk, increasing their vulnerability to climate-related shocks. Impacts of climate change will affect the poorest and most vulnerable the most and also hinder CAR's development agenda and efforts at economic sustainability and political stability, further impacting poor and vulnerable groups. While the most recent estimates show that more than 71% of the population is poor, there have been improvements in the provision of key public services in the country's southwestern region.[12]

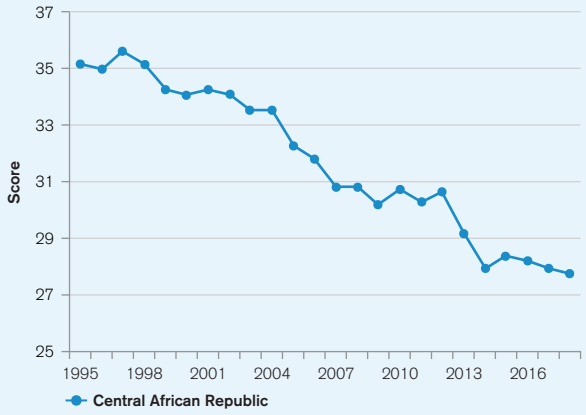
TABLE 1. Data snapshot: Key development indicators[13]

Indicator	
Life Expectancy at Birth, Total (Years) (2019)	53.3
Population Density (People per sq. km Land Area) (2018)	7.2
% of Population with Access to Electricity (2018)	32.4%
GDP per Capita (Current US$) (2019)	$467.90

[7] World Bank (2021). CAR — Overview. URL: https://www.worldbank.org/en/country/centralafricanrepublic/overview
[8] World Bank Data Bank (2021). World Development Indicators, CAR. URL: https://databank.worldbank.org/source/world-development-indicators
[9] World Bank (2021). CAR — Overview. URL: https://www.worldbank.org/en/country/centralafricanrepublic/overview
[10] World Bank Data Bank (2021). Population estimates and projections, CAR. URL: https://databank.worldbank.org/source/population-estimates-and-projections
[11] World Bank (2021). CAR — Overview. URL: https://www.worldbank.org/en/country/centralafricanrepublic/overview
[12] World Bank (2021). CAR — Overview. URL: https://www.worldbank.org/en/country/centralafricanrepublic/overview
[13] World Bank (2021). DataBank — World Development Indicators. URL: https://databank.worldbank.org/source/world-development-indicators

The ND-GAIN Index[14] ranks 181 countries using a score which calculates a country's vulnerability to climate change and other global challenges as well as their readiness to improve resilience. This Index aims to help businesses and the public sector better identify vulnerability and readiness in order to better prioritize investment for more efficient responses to global challenges. Due to a combination of political, geographic, and social factors, Central African Republic is recognized as highly vulnerable to climate change impacts, ranked 180 out of 181 countries in the 2020 ND-GAIN Index. The more vulnerable a country is the lower their score, while the more ready a country is to improve its resilience the higher it will be. Norway has the highest score and is ranked 1st. **Figure 2** is a time-series plot of the ND-GAIN Index showing the CAR's progress over time.

FIGURE 2. ND-GAIN Index for the Central African Republic



The CAR submitted its Nationally-Determined Contribution to the UNFCCC in 2016 and its Second National Communication to the UNFCCC (2015), which outlines the country's vision in building an economy that is diversified and sustainable, which also adheres to the country's needs to protect its environmental resources. It is focused on a low-carbon development approach to build and diversify the country's economy, committed to technological innovation. Key adaptation priorities include the country's agricultural, forestry, livestock, land use planning, energy security, water resources management, and public health sectors.[15]

Green, Inclusive and Resilient Recovery

The coronavirus disease (COVID-19) pandemic has led to unprecedented adverse social and economic impacts. Further, the pandemic has demonstrated the compounding impacts of adding yet another shock on top of the multiple challenges that vulnerable populations already face in day-to-day life, with the potential to create devastating health, social, economic and environmental crises that can leave a deep, long-lasting mark. However, as governments take urgent action and lay the foundations for their financial, economic, and social recovery, they have a unique opportunity to create economies that are more sustainable, inclusive and resilient. Short and long-term recovery efforts should prioritize investments that boost jobs and economic activity; have positive impacts on human, social and natural capital; protect biodiversity and ecosystems services; boost resilience; and advance the decarbonization of economies.

[14] University of Notre Dame (2020). Notre Dame Global Adaptation Initiative. URL: https://gain.nd.edu/our-work/country-index/
[15] Central African Republic (2016). Nationally-Determined Contributions. URL: https://www4.unfccc.int/sites/ndcstaging/PublishedDocuments/Central%20African%20Republic%20First/INDC_R%C3%A9publique%20Centrafricaine_EN.pdf

Climate Baseline

Overview

CAR has a tropical, humid equatorial climate in the south and a Sahelo-Sudanian climate in the north. The country experiences hot, dry winters and mild to hot, wet summers (June to August). Only the northernmost part of the country, near the borders to Chad and Sudan, have a hot semi-arid climate. CAR is a relatively homogenous territory, which receives abundant rainfall. Across the country, annual average temperatures range from 23°C in the south to 26°C in the north. The country's altitude does play a role in temperature variation. Highest temperatures are typically observed in march and the lowest in July during the rainy season.[16] Two high pressure zones are responsible for the alternation between rainy and dry seasons in CAR. In winter (December to March) the Libyan anticyclone in the north brings dry air to the country together with the north-east wind (Harmattan). In the northern summer, the St. Helena high pressure zone pushes moist air from south-west to north-east across the country, bringing decreasing amounts of rainfall towards the north-east. The dry season is typically from November to February but is longer in the north, and with little to no rainfall from October to April. The rainy season varies in length from over 300 days in the south to about 125 days in the north-east.[17]

CAR has five main regions, with differing climate characteristics. The Guinean forest zone is characterized in the western band, with nine months of rainy season and one dry season. In its eastern band total precipitation is almost everywhere higher than 1,600 mm. This area has the area of largest forest coverage. The Sudano-Ubangian zone occupies a narrow band between Bossembélé and Baboua and a small section of Bambari and Yalinga. The area has semi-humid forests with less coverage. The Sudano-Guinean zone is dominated by savannas and a noticeable deterioration of the rainy season. The Sudano-Sahelian zone extends from Paoua to Ouadda-Djallé, is characterized by relative humidity and more annual sunshine. It is dominated by the country's savanna. And the Sahel zone centers around Birao and is experiences longer dry seasons than rainy seasons, with rainfall less than 700 mm per year.[18] Climate variability and longer-term change are likely to exacerbate the country's existing vulnerabilities of high poverty rates, food insecurity, political instability and conflict. Food security is of primary concern as the majority of the country's agriculture is rain-fed and produced by small-holder farmers.[19]

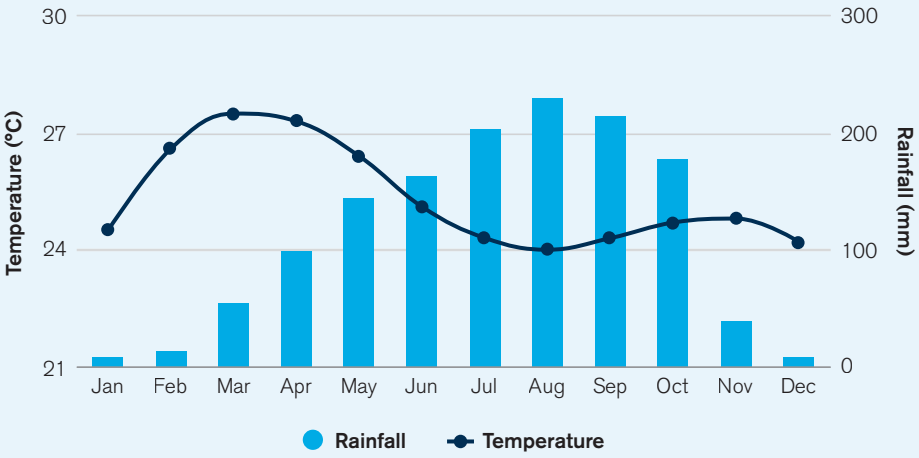
[16] Ministry of Environment, Ecology and Sustainable Development (2015). Second National Communication to the UNFCCC — Central African Republic. URL: https://unfccc.int/sites/default/files/resource/cafnc2.pdf
[17] GERICS (2015). Climate-Fact-Sheet, Central African Republic.
[18] Ministry of Environment, Ecology and Sustainable Development (2015). Second National Communication to the UNFCCC — Central African Republic. URL: https://unfccc.int/sites/default/files/resource/cafnc2.pdf
[19] Central African Republic (2016). Nationally-Determined Contributions. URL: https://www4.unfccc.int/sites/ndcstaging/PublishedDocuments/Central%20African%20Republic%20First/INDC_R%C3%A9publique%20Centrafricaine_EN.pdf

Analysis of data from the World Bank Group's Climate Change Knowledge Portal (CCKP) (**Table 2**) shows historical information for 1901–2020. Mean annual temperature for CAR is 25.1°C, with average monthly temperatures ranging between 27 (August). Mean annual precipitation is 1,369.6 mm. Most significant rainfall is experienced in the country from May to October as shown in the seasonal cycle for the country's latest climatology, 1991–2020 (**Figure 3**).[20] **Figure 4** shows the spatial variation of observed average annual precipitation and temperature across CAR.

TABLE 2. Data snapshot: Summary statistics

Climate Variables	1901–2020
Mean Annual Temperature (°C)	**25.1°C**
Mean Annual Precipitation (mm)	**1396.6 mm**
Mean Maximum Annual Temperature (°C)	**31.6°C**
Mean Minimum Annual Temperature (°C)	**18.6°C**

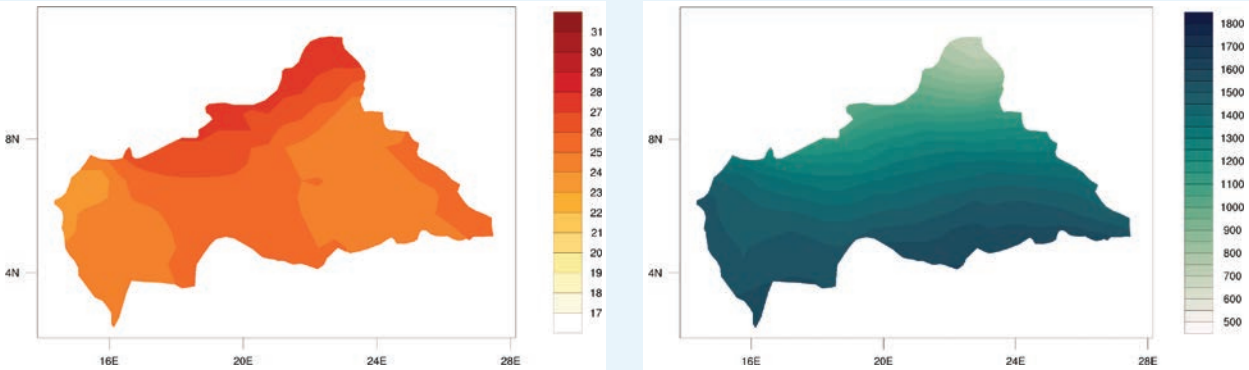
FIGURE 3. Average monthly temperature and rainfall for CAR, 1991–2020[21]



[20] WBG Climate Change Knowledge Portal (CCKP, 2021). CAR. URL: https://climateknowledgeportal.worldbank.org/country/central-african-republic/climate-data-historical

[21] WBG Climate Change Knowledge Portal (CCKP, 2021). CAR. URL: https://climateknowledgeportal.worldbank.org/country/central-african-republic

FIGURE 4. Map of average annual temperature (°C) (left); annual precipitation (mm) (right) of CAR for 1991–2020[22]

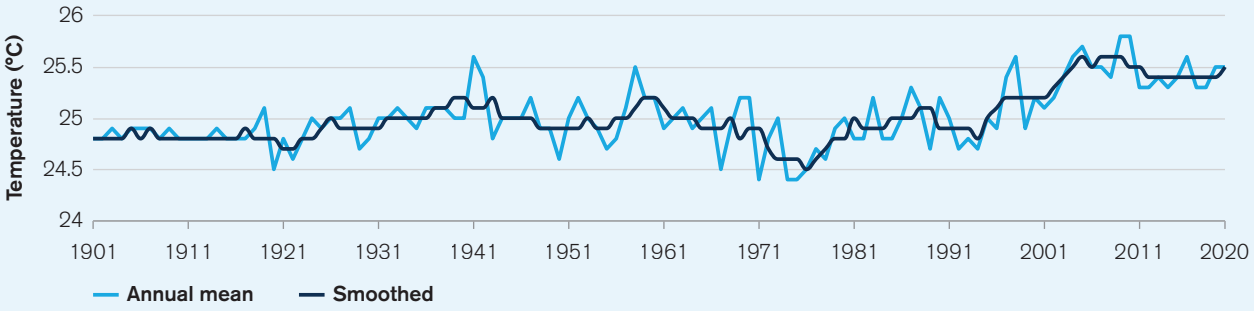


Key Trends

Temperature

Since the 1970s, mean annual temperature has significantly increased at a rate of 0.35°C per decade (**Figure 5**). In the south-western areas of the country, significant increase in maximum temperature has been observed since the 1950s.[23] Between 1955 and 2006, warming trends were observed across the central regions. Very hot days were observed to have increased by 0.25°C per decade with very hot nights increasing by 0.21°C per decade.[24]

FIGURE 5. Observed temperature for Central African Republic, 1901–2020[25]



[22] WBG Climate Change Knowledge Portal (CCKP, 2021). CAR, Historical Climate. URL: https://climateknowledgeportal.worldbank.org/country/central-african-republic/climate-data-historical

[23] GERICS (2015). Climate-Fact-Sheet, Central African Republic.

[24] Sonwa, D. et al. (2014). Climate Change and Adaptation in Central Africa: Past, Scenarios and Options for the Future. URL: https://www.researchgate.net/publication/268871188_Climate_change_and_Adaptation_in_Central_Africa_Past_Scenarios_and_Options_for_the_Future

[25] WB Climate Change Knowledge Portal (CCKP, 2021). Central African Republic URL: https://climateknowledgeportal.worldbank.org/country/central-african-republic/climate-data-historical

Precipitation

CAR's precipitation regime is variable and while over the last century, there has been no substantial observed increase in precipitation trends, however over the last 30 years precipitation has been observed to have increased approximately 8%.[26] Reduction in the number of consecutive days with 1 mm of precipitation has decreased and the number of days with precipitation of 10 mm has increased. This indicates not only an increase in precipitation received, but an increase of rainfall received through intense and extreme rainfall events.[27] Multiple significant flood events have occurred in CAR over the past decade and while many go unreported, the most commonly reported flood events occur around the capital city of Bangui. Heavy, near continuous rains in August – September of 2012, affected nearly 14,000 people and destroyed property and infrastructure and farmland in five localities surrounding Bangui and Begoua.[28] 2017 flooding destroyed homes and infrastructure in Kouango (415 km form Bangui) and destroyed over 350 houses, affecting mover 1,750 people.[29] Most recent flooding occurred in August 2019 near the city of Paoua and Poumadji village causing significant material and human damage. Perhaps most impactful is the destruction of water and sanitation infrastructure resulting in the damage or complete destruction of 94 water wells and 107 latrines.[30]

Climate Future

Overview

The main data source for the World Bank Group's CCKP is the CMIP5 (Coupled Inter-comparison Project Phase5) data ensemble, which builds the database for the global climate change projections presented in the Fifth Assessment Report (AR5) of the Intergovernmental Panel on Climate Change (IPCC). Four Representative Concentration Pathways (i.e. RCP2.6, RCP4.5, RCP6.0, and RCP8.5) were selected and defined by their total radiative forcing (cumulative measure of GHG emissions from all sources) pathway and level by 2100. The RCP2.6 for example represents a very strong mitigation scenario, whereas the RCP8.5 assumes business-as-usual scenario. For more information, please refer to the RCP Database. For simplification, these scenarios are referred to as a low (RCP2.6); a medium (RCP4.5) and a high (RCP8.5) emission scenario in this profile. **Table 3** provides CMIP5 projections for essential climate variables under high emission scenario (RCP 8.5) over 4 different time horizons. **Figure 6** presents the multi-model (CMIP5) ensemble of 32 Global Circulation Models (GCMs) showing the projected changes in annual precipitation and temperature for the periods 2040–2059 and 2080–2099.

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[26] GERICS (2015). Climate-Fact-Sheet, Central African Republic.

[27] Sonwa, D. et al. (2014). Climate Change and Adaptation in Central Africa: Past, Scenarios and Options for the Future. URL: https://www.researchgate.net/publication/268871188_Climate_change_and_Adaptation_in_Central_Africa_Past_Scenarios_and_Options_for_the_Future

[28] UNHCR (2020). UNHCR assisting displaced families affected by floods in the Sahel. [24 September, 2020]. URL: https://www.unhcr.org/en-us/news/press/2020/9/5f6b79f44/unhcr-assisting-displaced-families-affected-floods-sahel.html

[29] OCHA Services (2019). Humanitarian Response — Central African Republic. URL: https://www.humanitarianresponse.info/ru/disaster/fl-2017-000134-caf

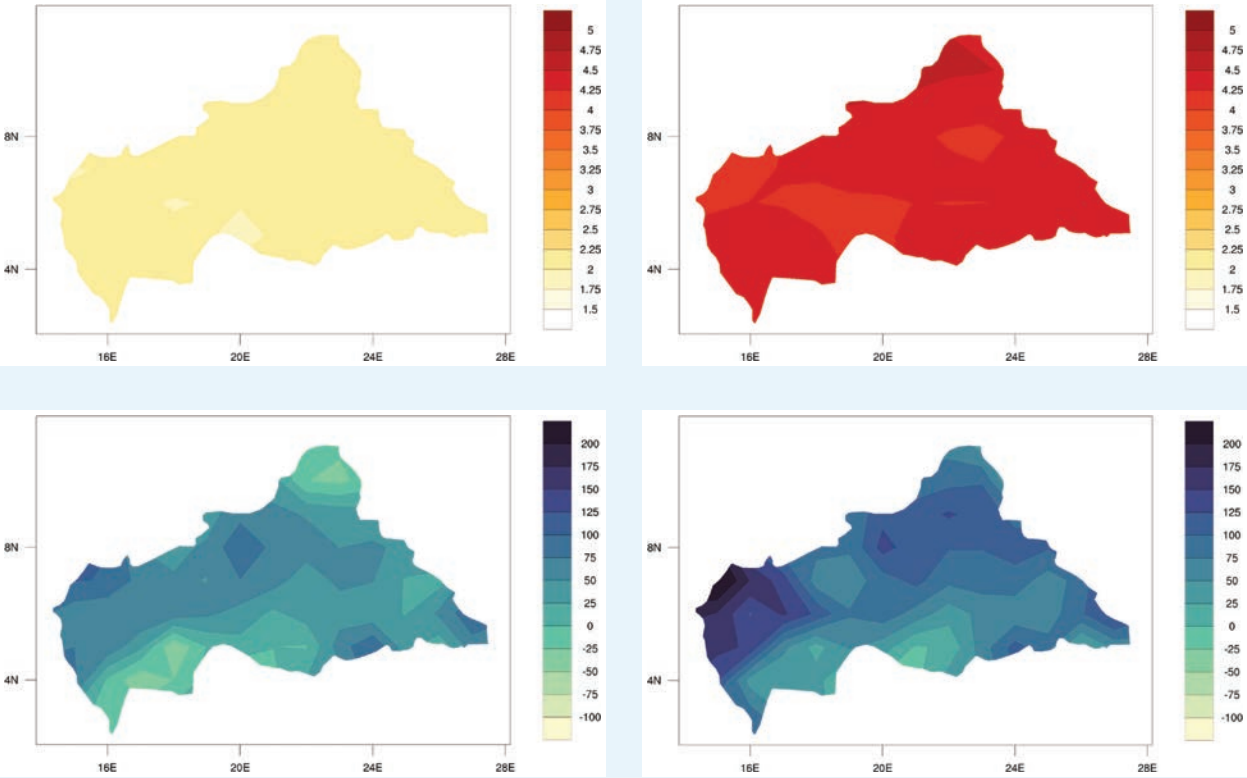
[30] IFRC (2019). Emergency Plan of Action — Central African Republic: Floods in Paoua. URL: https://reliefweb.int/sites/reliefweb.int/files/resources/CAR_2.pdf

TABLE 3. Data snapshot: CMIP5 ensemble projection

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 +2.7** (+1.9°C)	**+2.3 to +4.2** (+2.8°C)	**+3.1 to +5.7** (+3.8°C)
Annual Precipitation Anomaly (mm)	**–18.4 to +21.9** (0.8 mm)	**–21.0 to +29.6** (1.7 mm)	**–21.5 to +38.5** (5.5 mm)	**–28.2 to +50.4** (6.6 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).

FIGURE 6. Multi-model (CMIP5) ensemble projected changes (32 GCMs) in annual temperature (top) and precipitation (bottom)by 2040–2059 (left) and by 2080–2099 (right), relative to 1986–2005 baseline under RCP8.5[31]



[31] WBG Climate Change Knowledge Portal (CCKP, 2021). Central African Republic Projected Future Climate. URL: https://climatedata.worldbank.org/CRMePortal/web/agriculture/crops-and-land-management?country=CAF&period=2080-2099

Key Trends

Temperature

Temperatures across CAR are expected to increase and projections show a change in annual mean temperature from 3.1°C to 5.7°C by end of the century. An increase in the number of hot days, extreme temperatures are projected as well as a strong increase in the duration of heat waves; a significant decrease in cold spell length is projected.[32] The projected change in the duration of long-lasting heat waves is expected to be an additional 7 to 81 days by 2085, with cold spells likely to decrease by 1 to as much as 13 days.[33]

Across all emission scenarios, temperature increase for CAR are projected throughout the end of the century. As seen in **Figure 7**, under a high-emission scenario, average temperatures are expected to increase rapidly by mid-century. An increase is also expected for the change in the number of hot days (Tmax >35°C), and the change in number of days across the seasonal cycle. The most significant increase in the number of hot days (**Figure 8**) are expected to come in the late summer and fall, a time coinciding with rainfall and planting seasons for much of the country. Increased heat and extreme heat conditions will result in significant implications for human and animal health, agriculture, and ecosystems. The increasing number of hot days (Tmax >35°C) are expected to be most pronounced in the northern and central regions of the country (**Figure 9**).

FIGURE 7. Historical and projected average temperature for CAR from 1986 to 2099 (Reference Period, 1986–2005)[34]

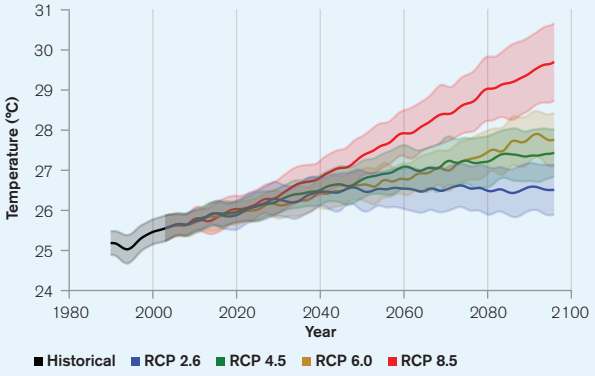
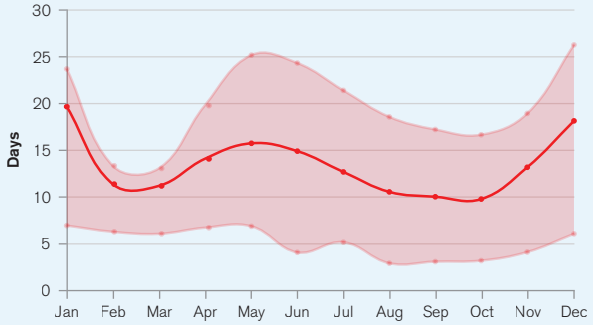


FIGURE 8. Projected Change in hot day (Tmax >35°C) (RCP8.5, Reference Period, 1986–2005)[35]



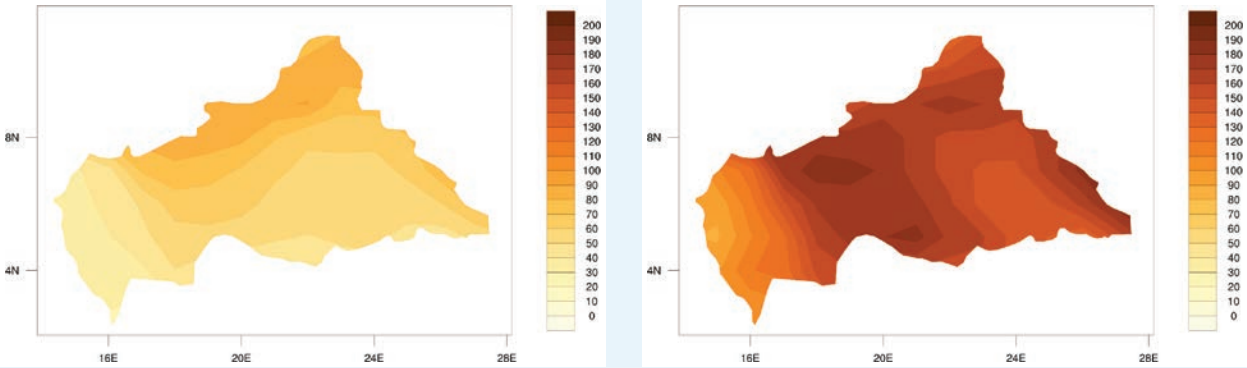
[32] Dosio, A. (2016). Projection of temperature and heat waves for Africa with an ensemble of CORDEX Regional Climate Models. *Climate Dynamics*. 49. pp. 493–519. URL: https://link.springer.com/article/10.1007/s00382-016-3355-5

[33] GERICS (2015). Climate-Fact-Sheet, Central African Republic.

[34] WBG Climate Change Knowledge Portal (CCKP, 2021). CAR Agriculture Dashboard. URL: https://climatedata.worldbank.org/CRMePortal/web/agriculture/crops-and-land-management?country=CAF&period=2080-2099

[35] WBG Climate Change Knowledge Portal (CCKP, 2021). CAR Climate Data — Projections. URL: https://climateknowledgeportal.worldbank.org/country/central-african-republic/climate-data-projections

FIGURE 9. Projected change in the number of hot days (Tmax >35°C) in CAR for the period 2040–2059 and 2080–2099, against the baseline 1986–2005, under RCP8.5[36]



Precipitation

Meteorological observations and meteorological station networks across CAR are scarce, providing limited information and making projections on future rainfall levels more difficult. However, it is generally understood that although annual total precipitation amounts for CAR are not likely to change dramatically, however rainfall is projected to become substantially more variable and with a likely increase in frequency and intensity of extreme rainfall events. The country's drought risk will decrease.[37] This is expected to significantly impact agriculture, water, energy, forestry, and health sectors, as well as agricultural land and freshwater resources and ecosystems.[38]

While precipitation trends in CAR are highly variable, mean annual rainfall is expected increase across the country throughout the end of the century. More rainfall amounts are expected to be received through these intense and more frequent rainfall events. According to analysis from the German Climate Service Center (GERICS) of 32 Global Climate Models (GCMs), rainfall is expected to increase by 12% to as much as 19% by the end of the century. However, the projected change in precipitation throughout the year does not have a clear trend. Only for the dry months of November and December is a distinct increase tendency shown. There is also a likely increase in the intensity of heavy rain events, which are also likely to lead to increased flood events.[39] Heavy precipitation events are expected to coincide with an additional occurrence of extreme rainfall and extreme events with flooding are

[36] WBG Climate Change Knowledge Portal (CCKP, 2021). CAR Climate Data — Projections. URL: https://climateknowledgeportal.worldbank.org/country/central-african-republic/climate-data-projections

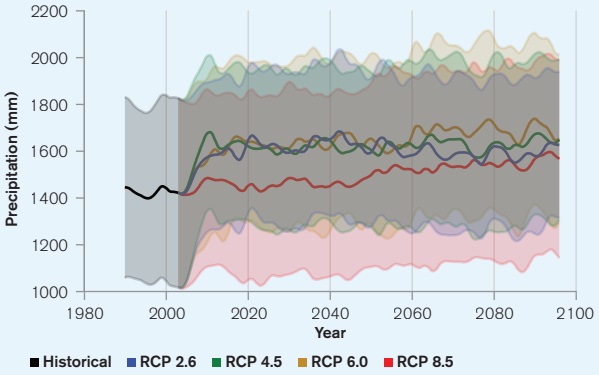
[37] Ahmadalipour, A. et al. (2019). Future drought risk in Africa: Integrating vulnerability, climate change, and population growth. *Science of the Total Environment*. 662. pp. 672–686. DOI: https://doi.org/10.1016/j.scitotenv.2019.01.278

[38] Serge, S.B. et al. (2017). Impacts of Climate change in Central African Republic. *Journal of Science and Engineering Technology*. 5, pp. 52–63. E-ISSN: 2311-8741/17

[39] GERICS (2015). Climate-Fact-Sheet, Central African Republic.

expected to impact rivers and surface water runoff during the summer rainy seasons. Natural disasters due to the increase in the frequency and intensity of floods and droughts are also expected to increase. The **Figure 10** shows the projected average precipitation in CAR across all emission scenarios, through the end of the century. Water routing and storage and other management options, are often very different if the precipitation input comes as many weak or a series of heavy rainfall events.[40] While precipitation is expected to increase across all scenarios, under the highest emissions scenario, RCP8.5, precipitation rates are projected to increase, but at a slower rate than lower emission scenarios.

FIGURE 10. Annual average precipitation in CAR for 1986 to 2099 (Reference Period, 1986–2005)[41]



CLIMATE RELATED NATURAL HAZARDS

Overview

The Central African Republic is at risk to numerous natural hazards, which are dominated by floods, wildfires and droughts. Vulnerability to these hazards is exacerbated in the country by poverty and political insecurity. This has also heightened the country's vulnerability and ability to recover from natural disasters. Excess rainfall is expected to be strongest felt in the central and southern areas of the country.[42] Heavy rainfall is also expected to result in flooding, causing riverbank erosion and/or overflows, landslides and waterlogging of agricultural fields leading to likely crop failures. Recent disasters from floods in the southwest areas surrounding the urban areas of the capital city Bangui left over 14,500 people homeless in 2009 and is estimated to have cost $6 million, with losses estimated at $2.6 million.

Increased food insecurity is also of specific concern following disasters which result in land and infrastructure degradation due to erosion, direct crop failure due to floods and heavy rains, and possible nutrient leaching and fungal growth due to increased humidity.[43] Water availability will be affected by possible periods of drought in

[40] Balogun, R. A. et al. (2019). Intra-seasonal and seasonal variability of convective properties of monsoon precipitation systems over West and Central Africa. *Theoretical and Applied Climatology.* 137. pp. 1715–1728. URL: https://link.springer.com/article/10.1007/s00704-018-2692-1

[41] WBG Climate Change Knowledge Portal (CCKP, 2021). CAR Water Dashboard. URL: https://climateknowledgeportal.worldbank.org/country/central-african-republic/climate-sector-water

[42] UNHCR (2020). UNHCR assisting displaced families affected by floods in the Sahel. [24 September, 2020]. URL: https://www.unhcr.org/en-us/news/press/2020/9/5f6b79f44/unhcr-assisting-displaced-families-affected-floods-sahel.html

[43] GFDRR (2019). Central African Republic — Floods. URL: https://www.gfdrr.org/en/central-african-republic-2009-subsequent-floods-bangui-which-left-14500-people-homeless-gfdrr

southern zones, but no serious water stress is expected for agriculture. While the country is focused on increasing infrastructure for water access, increasing population density combined with erratic rainfall does make these efforts at wider coverage more challenging.[44]

Data from the Emergency Event Database: EM-Dat,[45] presented in **Table 4**, shows the country has endured various natural hazards, including floods, landslides, wildfires, and storms.

TABLE 4. Natural Disasters in CAR, 1900–2020

Natural Hazard 1900–2020	Subtype	Events Count	Total Deaths	Total Affected	Total Damage ('000 USD)
Drought	Drought	1	0	0	0
Epidemic	Bacterial Disease	7	607	3,580	0
	Viral Disease	4	307	2,609	0
Flood	Flash Flood	3	3	15,873	0
	Riverine Flood	6	6	77,990	0
Storm	Convective Storm	8	5	32,246	0
Wildfire	Forest Fire	2	1	835	0

Key Trends

Climate change trends in CAR are expected to increase the risk and intensity of flooding, increase the amount of heavy rainfall received during heavy rainfall events as well as increase the likelihood of aridity water scarcity for some areas, particularly the country's northeast zones. Increased incidence of extreme rainfall may also result in soil erosion and water logging of crops, thus decreasing yields and increasing food insecurity. Increases in temperature is also likely to increase the periods of extreme heat in northern areas. Importantly, higher temperatures and aridity threatens to reduce water storage capacities. This may result in significant economic losses, damage to agricultural lands and infrastructure as well as human casualties.[46] Land degradation and soil erosion, exacerbated by recurrent flood adversely impacts agricultural production, disproportionately affecting the livelihoods of the rural poor. The country's underpinning political instability and poverty will further exacerbate these issues with potential to also exacerbate potential for violence and conflict.[47]

Climate change, deforestation, watershed degradation, land use, urbanization and poor management of settlements, and slash and burn agricultural techniques have exacerbated issues and impacts from flooding and droughts and increased the risk of wildfires. Heavy rainfall can also trigger riverine and flash floods. Heavy rainfall and flash floods

[44] World Bank (2011). Water Supply and Sanitation in Central African Republic — Turning finance into services for 2015 and beyond. URL: https://openknowledge.worldbank.org/bitstream/handle/10986/17754/7240900REPLACE0box00PUBLIC00CSO0CAR.pdf?sequence=1&isAllowed=y

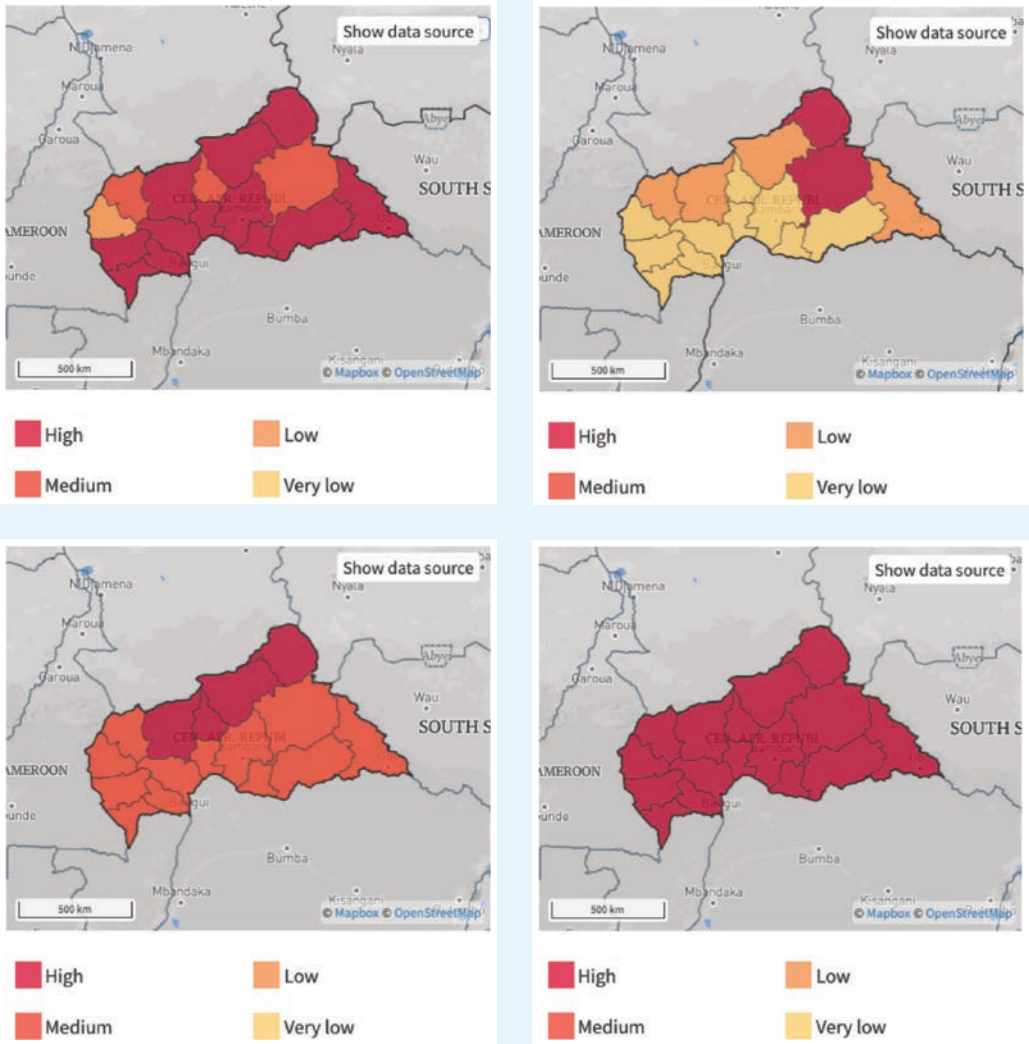
[45] EM-DAT: The Emergency Events Database — Universite catholique de Louvain (UCL) — CRED, D. Guha-Sapir, Brussels, Belgium. URL: http://emdat.be/emdat_db/

[46] Serge, S.B. et al. (2017). Impacts of Climate change in Central African Republic. *Journal of Science and Engineering Technology*. 5, pp. 52–63. E-ISSN: 2311-8741/17

[47] IFRC (2019). Central African Republic. URL: https://www.ifrc.org/what-we-do/disaster-management/responding/ongoing-operations/central-african-republic/

are common in the country's mountain areas and can also trigger landslides and mudslides.[48] Additionally, in CAR water stress during the traditional dry periods (November-February) may be further exacerbated with competing demands from household consumption and agriculture. Infrastructure projects are being developed to enable the construction of dams and irrigation networks. Increased heat will further strain existing water resources and impacts from changing rainfall patterns.[49] **Figure 11** below shows different risk ratings from river flooding, water scarcity, extreme heat, and wildfires respectively.

FIGURE 11. Risk of river flood (top left); risk of water scarcity (top right);[50] risk of extreme heat (bottom left); risk of wildfires (bottom right)[51]



[48] Ngulmalet, C.R. (2018). Comparison of community-based adaptation strategies for droughts and floods in Kenya and the Central African Republic. *Water International.* 43(2). pp. 183–204. URL: https://www.tandfonline.com/doi/full/10.1080/02508060.2017.1393713

[49] World Bank (2011). Water Supply and Sanitation in Central African Republic — Turning finance into services for 2015 and beyond. URL: https://openknowledge.worldbank.org/bitstream/handle/10986/17754/7240900REPLACE0box00PUBLIC00CSO0CAR.pdf?sequence=1&isAllowed=y

[50] ThinkHazard! (2020). CAR Water Scarcity. URL: http://thinkhazard.org/en/report/49-central-african-republic/DG

[51] ThinkHazard! (2020). CAR Wildfires. URL: http://thinkhazard.org/en/report/49-central-african-republic/WF

Implications for DRM

The government of the Central African Republic does not have a specific disaster risk management entity wholly responsible for disaster preparedness, response and recovery. Following the 2009 Bangui floods, the government established a team across different government departments under the leadership of the Ministry of Planning, Economy and International Cooperation. CAR has also partnered with the World Bank and received resources from the Global Facility for Disaster Reduction and Recovery (GFDRR) which has helped to develop and conduct risk assessments and institutional capacity building efforts to improve the country's ability to prepare for and respond to natural disasters, especially floods. A primary element of this work is the implementation of short- and medium-term flood mitigation programs which combines community education measures with infrastructure works and public management reforms across key urban areas.[52] CAR would also greatly benefit from the improved quality of hydro-meteorological services through the expansion of observation and forecasting infrastructure, which can increase the accuracy and quality of forecasted natural disaster events.[53] As part of the country's adaptation efforts, CAR has committed to integrating climate change related activities into development plans and strategies, including its disaster risk management efforts. To increase its capacity to prepare for and respond to natural disasters, the country has committed to implementing a national early warning program, flood and drought management programs, riverbank development projects and a national investment program for agriculture to improve the country's food security situation, especially after disaster events.[54]

CLIMATE CHANGE IMPACTS TO KEY SECTORS

The CAR is highly vulnerable to seasonal variability and long-term climate change. Increasing vulnerability is expected to result in cumulative impacts across the country's political, security, social, economic, and environmental structures. Heavy rainfall and floods in particular are likely to have significant consequences on the environment, society, food security situation, and the wider economy. Significant impacts are expected for the country's water resources, agriculture, health, and forestry sectors. Extreme heat, flooding, increased aridity, and soil erosion puts both urban and rural communities at risk, particularly for poor and vulnerable groups. Environmental degradation, impacted water resources, and loss of biodiversity and ecosystem services constitute serious obstacles to the country's continued development and responsible management of its natural resources. In addition, the increase in temperature will also have a negative impact on key parts of the economy, e.g. forestry, agriculture and livestock. Changes in precipitation parameters can have far-reaching consequences for ecosystems and biodiversity, food production, the water industry and rivers.[55]

[52] GFDRR (2019). Central African Republic. URL: https://www.gfdrr.org/en/central-african-republic-2009-subsequent-floods-bangui-which-left-14500-people-homeless-gfdrr

[53] Ngulmalet, C.R. (2018). Comparison of community-based adaptation strategies for droughts and floods in Kenya and the Central African Republic. *Water International.* 43(2). pp. 183–204. URL: https://www.tandfonline.com/doi/full/10.1080/02508060.2017.1393713

[54] Central African Republic (2016). Nationally-Determined Contributions. URL: https://www4.unfccc.int/sites/ndcstaging/PublishedDocuments/Central%20African%20Republic%20First/INDC_R%C3%A9publique%20Centrafricaine_EN.pdf

[55] World Bank (2013). Deforestation Trends in the Congo Basin — Reconciling Economic Growth and Forest Protection. URL: https://openknowledge.worldbank.org/bitstream/handle/10986/12477/9780821397428.pdf?sequence=1&isAllowed=y

Projected trends of climate variability and longer-term change are likely to exacerbate these concerns, as the majority of agricultural production is rainfed, and provides livelihoods for the majority of the population.[56] Increased temperatures and variable rainfall will also impact the country's forests, also critical to livelihoods and ecosystem services, which are already under threat from land use change and growing demand for charcoal and tropical forest products. More extreme weather events such as intense rainfall after prolonged dry spells can lead to erosion and flash flooding, damage roads and infrastructure, wipe out crops and put additional lives at risk.[57]

Gender

An increasing body of research has shown that climate-related disasters have impacted human populations in many areas including agricultural production, food security, water management and public health. The level of impacts and coping strategies of populations depends heavily on their socio-economic status, socio-cultural norms, access to resources, poverty as well as gender. Research has also provided more evidence that the effects are not gender neutral, as women and children are among the highest risk groups. Key factors that account for the differences between women's and men's vulnerability to climate change risks include: gender-based differences in time use; access to assets and credit, treatment by formal institutions, which can constrain women's opportunities, limited access to policy discussions and decision making, and a lack of sex-disaggregated data for policy change.[58]

Agriculture

Overview

The agricultural sector is critical to CAR's economy and food security situation and is considered to be one of the most vulnerable sectors to projected climate change trends. The agricultural sector accounts for employment of approximately 72% of the country's population and is the primary source of income and food sourcing for most people. Agricultural activities are mainly rainfed and subsistence, combining farming, hunting/gathering/fishing and small animal husbandry. Crop production varies by region, with beans, maize and cassava considered major staples.[59] Of the approximately 15 million hectares of suitable agricultural land in the country, only an estimated 7,000 km^2 are cultivated each year. The pastoral area of 160,000 km^2 is recognized to be significantly underutilized. The country's primary agriculture zone is concentrated in the south-west due to the drier the north-east and central Savannah areas. Less than 5% of this area is occupied by smallholder farms, which average 1.7 hectares per household of 5 people. Food crops represent 75% of cultivated areas and are typically self-consumed.[60]

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[56] Baoto, S., Song, S. and Fagariba, C. (2018). Climate Change Adaptation and Agricultural Development in Central Africa Republic-Evidence of North-West. *J. of Food Processing and Technology.* 9(11). DOI: 10.4172/2157-7110.1000761

[57] USAID (2018). Climate Risks in the Central African Regional Program for the Environment (CARPE) and Congo Basin. URL: https://www.climatelinks.org/sites/default/files/asset/document/20180604_USAID-ATLAS_ClimateRiskProfile_CARPE.pdf

[58] World Bank Group (2016). Gender Equality, Poverty Reduction, and Inclusive Growth. URL: http://documents1.worldbank.org/curated/en/820851467992505410/pdf/102114-REVISED-PUBLIC-WBG-Gender-Strategy.pdf

[59] USAID (2018). Climate Risks in the Central African Regional Program for the Environment (CARPE) and Congo Basin. URL: https://www.climatelinks.org/sites/default/files/asset/document/20180604_USAID-ATLAS_ClimateRiskProfile_CARPE.pdf

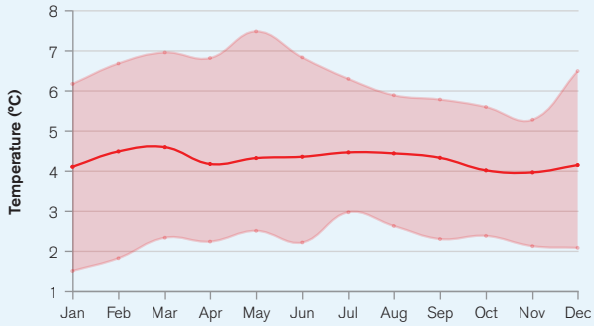
[60] Serge, S.B. et al. (2017). Impacts of Climate change in Central African Republic. *Journal of Science and Engineering Technology.* 5, pp. 52–63. E-ISSN: 2311-8741/17

Armed conflict remains a major driver for food insecurity in CAR and a major disruption to the country's agricultural potential. Basic services are dysfunctional or non-existent in many areas and the disruption of already limited services further hinders people's access to livelihood opportunities. Trans-human movements remain difficult, particularly in northwestern areas, generating tensions between pastoralists and farmers. This has exacerbated existing intercommunal tensions; leading to armed conflict. As households and communities have been unable to engage in agricultural and livestock activities it has resulted in a depletion of food stocks, rising prices, the adoption of negative coping mechanisms by nearly half of the population and increased dependency on food aid.[61]

Climate Change Impacts

Projected climate change trends for the region are expected to result in increased rainfall through more frequent and intense extreme rainfall events as well as prolonged dry spells and rising temperatures, which will impact crop selection and productivity, alter farming practices and put increased pressure on farmers to expand their cropland into forests.[62] Rising temperatures may also alter pest and pathogen existence, with particular concern for the cassava mosaic virus. Additionally, increasing temperatures and humidity may negatively impact the ability to effectively process agricultural products and safely store seeds, grains and other perishable products.[63] Damage to the region's already severely limited ground transportation infrastructure from floods and heavy rains (as well as political instability and conflict) is likely to lead to increased erosion, raising transport costs and/or prevent products from reaching market before spoilage, negatively impacting farmers. Increased and/or prolonged dry spells are also likely to alter planting timelines.[64] **Figure 12** shows the average daily max-temperature across seasonal cycles. These higher temperatures have implications for impacts to soil moisture and crop growth. Precipitation is also expected to increase, but marginally, in the southern and southeast areas.

FIGURE 12. Average daily max temperature for CAR (RCP8.5, Reference Period, 1986–2005)[65]



[61] FAO (2019). Central African Republic — Situation Report, July 2019. URL: http://www.fao.org/fileadmin/user_upload/emergencies/docs/FAOCARsitrep_July2019.pdf

[62] Baoto, S., Song, S. and Fagariba, C. (2018). Climate Change Adaptation and Agricultural Development in Central Africa Republic-Evidence of North-West. *J. of Food Processing and Technology.* 9(11). DOI: 10.4172/2157-7110.1000761

[63] USAID (2018). Climate Risks in the Central African Regional Program for the Environment (CARPE) and Congo Basin. URL: https://www.climatelinks.org/sites/default/files/asset/document/20180604_USAID-ATLAS_ClimateRiskProfile_CARPE.pdf

[64] World Bank (2018). Breaking down barriers to regional agricultural trade in Central Africa. URL: https://openknowledge.worldbank.org/bitstream/handle/10986/30397/127883-REPORT-CEMAC-Agriculture.pdf?sequence=1&isAllowed=y

[65] WBG Climate Change Knowledge Portal (CCKP, 2021). CAR Agriculture Dashboard. URL: https://climateknowledgeportal.worldbank.org/country/central-african-republic/climate-sector-agriculture

Adaptation Options

Both the sensitivity of the agricultural sector to the climate and the high reliance of this sector on rainfall and water resources have important implications for the CAR's farmers, livestock owners, fisheries, its wider economy, and political stability. The structure of the economy, which is fragile and based mainly on natural resources, particularly agriculture (80% of the active population, 50% of GDP and 95% of food sources) and forests, depends heavily on variability and climate change. Improved development and implementation of environment and agricultural protection policies should be put in place. Improved financing mechanisms can help small-scale farmers and commercial industries re-start investment and production following displacement and conflict. The sector would benefit from targeted research to increase knowledge on specific climate change related impacts to the agriculture sector. Improved access to seasonal information is necessary to better inform farmers regarding planting. The sector should target the preservation of the natural ecosystems in relation to its various functions: habitats for flora and fauna, support for agriculture, maintenance for soil conservation and fertility. Improved training and awareness raising of local farmers can be used to improve sowings, and soil enrichment techniques; increased agricultural support should be provided through increased and reinforced agricultural extension programs. Increased involvement from local communities, including farmers, should be sought in the improved management of local forest ecosystems. Improved roads and transport networks can improve market access.[66] CAR has also committed to improving the resilience of its agriculture sector through the introduction of new varieties more suited to climate extremes, diversifying its crops and varieties grown, establishing a seed bank, promoting more sustainable soil management that is linked with forest management systems which can also support the reforestation of degraded landscapes.[67]

Water

Overview

The CAR has a dense hydrological network spread throughout the country, which are distributed primarily between the two watersheds, the Eastern Logone basin to the west and the Chari in the center and east. The Central African Basin of Chari covers 202,351 km^2. The Congolese watershed covers the southern two-thirds of the country and consists of two major sub-basins: Oubangui and Sangha. The main rivers in the Chari-Logone basin are, the Pendé, the Lim and the Ngou which, flow in to Mount Ngaoui. The Central African basin of Chari, which covers 202,351 km^2 is subdivided into two parts, the Ouham and its tributaries, and the Aouk-Bamingui complex and their tributaries, with the western branch of the Chari consisting of the Ouham-Bahr Sara and the Eastern Chari from Gribingui Bamingui and Bahr Aouk. The Congolese hydrographic basin, covers the southern two-thirds of the country on 404,004 km^2. It is made up of two major sub-basins, those of the Ubangi and the Sangha. The basin of Ubangui occupies more than three quarters of the Congo Basin. It stretches from east to west over 350,684 km^2, up to the DRC with Uélé which is the main contributor. The Ubangi is made up of the union of the Uélé and Mbomou

[66] Ministry of Environment, Ecology and Sustainable Development (2015). Second National Communication to the UNFCCC — Central African Republic. URL: https://unfccc.int/sites/default/files/resource/cafnc2.pdf

[67] Central African Republic (2016). Nationally-Determined Contributions. URL: https://www4.unfccc.int/sites/ndcstaging/PublishedDocuments/Central%20African%20Republic%20First/INDC_R%C3%A9publique%20Centrafricaine_EN.pdf

downstream from the city of Ouango. Upstream to downstream, the Central African part of this basin includes major tributaries, such as the Mbomou, Kotto, Ouaka, Kémo, Ombella, M'Poko and Lobaye.[68] However, despite the large availability of water resources, the country has little institutionalized water supply infrastructure, impacting urban and rural supply as well as water sanitation and hygiene for local populations.[69]

Climate Change Impacts

Most of the CAR's population depends on groundwater and local springs largely located in dense gallery and equatorial forests for drinking water. However, the changing characteristics of annual and seasonal precipitation is expected to alter the Congo Basin's dynamics across the central African region, also impacting CAR, could affect 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 and in drier zones. Additionally, the 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. The pollution and contamination of drinking water is also a significant public health concern.[70] Furthermore, floods on navigable rivers can be dangerous and disrupt transportation of people and goods.[71] For CAR increased aridity and drought is also expected to result in land degradation a loss in biodiversity and surface water, adverse impacts to crop production (including yield and quality) and increase the likelihood of wildfires. Heavy rainfall events are also expected to lead to increased flooding and water logging in agricultural areas, impacting crop production, especially for tuber crops (cassava, taro, yam) with changing rainfall patterns.[72]

Changes in rainfall and evaporation translate directly to changes in surface water infiltration and groundwater re-charge. This has the potential for further decreased reliability of unimproved groundwater sources and surface water sources during droughts or prolonged dry seasons. Increased strain on pumping mechanisms leading to breakdowns if maintenance is neglected and the potential for falling water levels in the immediate vicinity of well or borehole, particularly in areas of high demand. Additionally, temperature increases have the potential to result in increased soil moisture deficits even under conditions of increasing rainfall. The figure below shows the projected annual Standardized Precipitation Evapotranspiration Index (SPEI) for drought through the end of the century. The SPEI is an index which represents the measure of the given water deficit in a specific location, accounting for contributions of temperature-dependent evapotranspiration and providing insight into increasing or decreasing

[68] Ministry of Environment, Ecology and Sustainable Development (2015). Second National Communication to the UNFCCC — Central African Republic. URL: https://unfccc.int/sites/default/files/resource/cafnc2.pdf

[69] Ministry of Environment, Ecology and Sustainable Development (2015). Second National Communication to the UNFCCC — Central African Republic. URL: https://unfccc.int/sites/default/files/resource/cafnc2.pdf

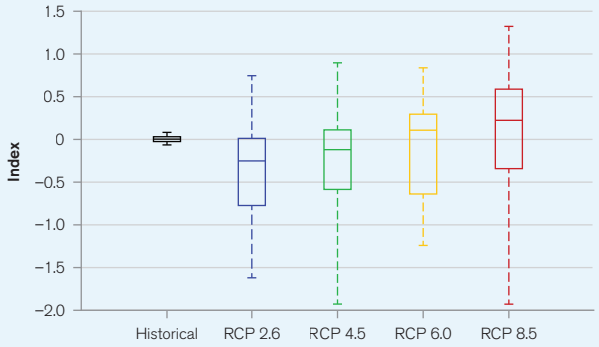
[70] Kamba, F. and Sangija, F. (2016). Impact of Water Pollution on Human Health in the Central African Republic. Advances in Social Sciences Research Journal. 3(1). DOI: 10.14738/assrj.31.1764

[71] USAID (2018). Climate Risks in the Central African Regional Program for the Environment (CARPE) and Congo Basin. URL: https://www.climatelinks.org/sites/default/files/asset/document/20180604_USAID-ATLAS_ClimateRiskProfile_CARPE.pdf

[72] Serge, S.B. et al. (2017). Impacts of Climate change in Central African Republic. *Journal of Science and Engineering Technology*. 5, pp. 52–63. E-ISSN: 2311-8741/17

pressure on water resources. Negative values for SPEI represent dry conditions, with values below –2 indicating severe drought conditions, likewise positive values indicate increased wet conditions. This is an important understanding for the water sector in regards to quantity and quality of supply for human consumption and agriculture use as well as for the energy sector as reductions in water availability impacts river flow and the hydropower generating capabilities. As seen in **Figure 13**, CAR is projected to experience significantly reduced dry conditions by end of the century.

FIGURE 13. Annual SPEI Drought Index in CAR for the period, 1986 to 2099 (Reference Period, 1986–2005)[73]



Adaptation Options

The CAR Government recognizes the importance of water resource management and is working to ensure the viability and sustainability of the sector. In recent years a roadmap for the promotion of integrated water resources management (2005) was developed as well as the development of a national water policy and water code. Efforts include more effective coordination of programs across public, private and local actions and more effective mobilization of financial investment opportunities to support key infrastructural investment in water access, irrigation and the potential for hydropower generation. Comparative assessments remain ongoing and well as collaborative efforts to support public-private partnerships of sector management. Improvements of hydro-meteorological forecasting will greatly enhance planning and investment capabilities as well as the ability to more effectively plan and prepare for major rainfall events and the likelihood of flooding. Research should also be undertaken concerning the quality of the surface and underground water for enhanced resource allocation (and conservation) planning.[74] Adaptation infrastructure should be developed, which is capable of supporting the projected hydrological variations and river flow. Improved infrastructure can also reduce flooding disasters and improve transport networks. Improved water management and usage will benefit agriculture, water quality and availability and help to ensure adequate food security and water access. Improved efficiency in water management practices, currently considered to be low, will benefit households and communities.[75] CAR is also committed to improving the country's supply of potable water and establishing systems for monitoring water quality as well as underground and surface water resources.[76]

[73] WBG Climate Change Knowledge Portal (CCKP, 2021). CAR Water Portlet. URL: https://climateknowledgeportal.worldbank.org/country/central-african-republic/climate-sector-water

[74] Central African Republic (2016): Nationally-Determined Contributions. URL: https://www4.unfccc.int/sites/ndcstaging/PublishedDocuments/Central%20African%20Republic%20First/INDC_R%C3%A9publique%20Centrafricaine_EN.pdf

[75] Ministry of Environment, Ecology and Sustainable Development (2015): Second National Communication to the UNFCCC — Central African Republic. URL: https://unfccc.int/sites/default/files/resource/cafnc2.pdf

[76] Central African Republic (2016): Nationally-Determined Contributions. URL: https://www4.unfccc.int/sites/ndcstaging/PublishedDocuments/Central%20African%20Republic%20First/INDC_R%C3%A9publique%20Centrafricaine_EN.pdf

Forestry

Overview

CAR has significant amounts of forest coverage which is used not only for products extracted and used by humans (timber, fuel wood, palm oil, etc.), but also serves as habitat for wildlife and for the environmental services they provide, such as carbon sinks, controlling erosion and filtering water (and regulating water flow). The forest heritage in CAR consists of natural forest formations, trees outside forests and block plantations, which have undergone changes due to human activities.[77] Primary impacts to the country's forests are the conversion of forests and grasslands and the abandonment of exploited land and soils used for agriculture. Furthermore, increasing pressure is being placed on CAR's forest lands due to socio-economic and agricultural pressures, most significantly in the south-western areas of the country.[78]

Climate Change Impacts

Climate change trends in CAR is expected to have a range of impacts on its forest ecosystems. With increased temperatures and more variable rainfall and heavy precipitation events increasing in intensity and frequency as well as the increase in dry spells biodiversity and soil health will be impacted. This may 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, this could lead animals to stray farther away from the relative security of protected areas in search of preferred habitat, putting endangered species at greater risk of conflict with human settlements, and put both humans and wildlife at risk from disease transmission, and negatively impact local livelihoods dependent on tourism revenue.[79]

For CAR's forest ecosystems, the increase in temperature may, overall, improve the plant productivity despite the extinction of heat-sensitive species. However, extreme events (heat waves, floods, storms, etc.) may lead to changes in breeding periods of certain species, in the duration of the seasons of plant cultivation. Additionally, the mortality of sensitive animal and plant species may increase leading to a fluctuation of populations and a variation in the specific composition of communities. Importantly, changes will affect the forest industry, ecotourism, product supply non-timber forest, traditional pharmacopoeia, etc. and therefore reduce the means livelihoods of people mainly in rural areas where poverty predominates. Weak governance and weak/limited institutional capacity to control deforestation and enforce regulations is also an underlying challenge.[80]

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[77] Junior, D. et al. (2016). Forest Management and Deforestation in Central African Republic. *American Journal od Engineering Research.* 5(4). pp. 79–90. URL: http://www.ajer.org/papers/v5(04)/I0504079090.pdf

[78] Ministry of Environment, Ecology and Sustainable Development (2015). Second National Communication to the UNFCCC — Central African Republic. URL: https://unfccc.int/sites/default/files/resource/cafnc2.pdf

[79] USAID (2018). Climate Risks in the Central African Regional Program for the Environment (CARPE) and Congo Basin. URL: https://www.climatelinks.org/sites/default/files/asset/document/20180604_USAID-ATLAS_ClimateRiskProfile_CARPE.pdf

[80] Ministry of Environment, Ecology and Sustainable Development (2015). Second National Communication to the UNFCCC — Central African Republic. URL: https://unfccc.int/sites/default/files/resource/cafnc2.pdf

Adaptation Options

Within CAR, strategic options for adapting forests and biodiversity to change climate change is focused on improved spatial planning, strengthening the country's sustainable forest management, establishing seed banks for reforestation activities, extending the network of protected areas on land and in the wetlands and strategic investment to restore the country's degraded ecosystems.[81] CAR is also looking to promote more sustainable agricultural as well as forest systems management for improved and sustainable soil management. The country is also committed to restoring degraded forest landscapes and improve its land-use planning especially for forest areas and natural preserves.[82]

Energy

Overview

Access to electricity is one of the lowest in Africa. In CAR, the Department of Energy and Hydraulics administers the electricity sub-sector, as well as new and renewable energy opportunities. In CAR, the majority of energy, more than 90% is sourced through wood energy, with 7% by imported petroleum and 2% by electricity. Only 14% of the population has access to electricity, mainly in the capital Bangui. As of 2015, 88% of electricity was generated by hydropower. The capital city of Bangui is supplied by two hydroelectric generators and one thermal plant. A new dam on the Mbali River (a joint project with the Democratic Republic of the Congo), which permits year-round hydroelectric generation, opened in late 1991. The country's low levels of energy generation and access are due to a number of reasons, notable slow sector growth, hindered by weak institutions, low population density, the country's large size and years of unrest.[83]

Climate Change Impacts

Energy generation and access is critical for CAR's development agenda and continued efforts to improve its population's standard of living. Constraints in the current energy supply exist and include limited generation, low access to modern services, high cost, irregular supply and high cost for energy investments. Biomass (including wood fuel, charcoal, and agricultural waste), continues to be the main sources of energy in the country and fuelwood is the dominant source of energy for cooking. Traditional biomass used for heating and lighting is prevalent. As over 50% of the country is covered with some form of forest and approximately 10% is currently being used as an energy resource, the continued use of biomass for energy generation is considered sustainable. However, increasing demands from agriculture and slash and burn practices is cause for concern about proper forest resource management.

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[81] Ministry of Environment, Ecology and Sustainable Development (2015). Second National Communication to the UNFCCC — Central African Republic. URL: https://unfccc.int/sites/default/files/resource/cafnc2.pdf

[82] Central African Republic (2016). Nationally-Determined Contributions. URL: https://www4.unfccc.int/sites/ndcstaging/PublishedDocuments/Central%20African%20Republic%20First/INDC_R%C3%A9publique%20Centrafricaine_EN.pdf

[83] SEA4All (2016): Central African Republic. URL: https://wedocs.unep.org/bitstream/handle/20.500.11822/20497/Energy_profile_CentralAfricanRep.pdf?sequence=1&isAllowed=y

Hydropower is considered as a primary opportunity for expanded energy generation for the country. Currently the Mbali River, a tributary of the Oubangui in the Boali region north-east of Bangui, is considered to have significant hydro-electric potential. This region is also the main center for hydropower production in the country. Additional potential priorities for small or micro hydro development include: Bocaranga, Paoua, Baboua, Bossangoa; Sibut, Bangassou, Bria, Kembe, Bambari, Bouar, Carnot, Berbeacute, Kaga-Bandoro and Mba. Major potential large-hydropower developments include the 300 MW Palambo project, 65 km north of Bangui, initially proposed as part of a wider project to improve water flow into Lake Chad. However, the necessary investment for this project was estimated at approximately US$ 450 million, and further project development has been slow since the initial proposal.[84]

While hydro and micro-hydropower facilities present promising opportunities for needed electricity generation across the region, given the abundance of surface water resources and the likely increase in precipitation. However, the changing characteristics of annual and seasonal precipitation as well as the increase in heavy rainfall events can disrupt river flow, increase investment and construction costs, and increase challenges to sustained energy generation. Extreme weather events such as heavy rains can damage infrastructure, roads, communication networks and disrupt supply lines. An increase in the frequency and intensity of heavy rains and flooding is also likely to impact fragile infrastructure systems which can also hydro-power generation.[85] The CAR does, however, have high potential for other renewables such as solar and wind to expand the country's clean energy portfolio. This would require significant investment opportunities and improved business regulation to promote private sector action and to support optimal action on developing renewable energy infrastructure.[86]

Cooling Degree Days show the relationship between daily heat and cooling demand, typically sourced through a form of active cooling or an evaporative process. The change in cooling degree days provides insight into the potential for extended seasons of power demand or periods in which cooling demand (power demands) might increase (**Figure 14)**. Seasonal increases for cooling demands are expected to increase throughout the year. Warm Spell Duration represents the number of days in a sequence of at least six days in which the daily maximum temperature is greater than the 90th percentile of daily maximum temperature. As shown **Figure 15**, warm spells are expected to sharply increase in the second half of the century.

[84] REEP (2013): Central African Republic. URL: https://www.reeep.org/central-african-republic-2012

[85] USAID (2018). Climate Risks in the Central African Regional Program for the Environment (CARPE) and Congo Basin. URL: https://www.climatelinks.org/sites/default/files/asset/document/20180604_USAID-ATLAS_ClimateRiskProfile_CARPE.pdf

[86] Kenfack, J. et al. (2017). How can we promote renewable energy and energy efficiency in Central Africa? A Cameroon case study. *Renewable and Sustainable Energy Reviews*. 75. pp. 1217–1224. DOI: https://doi.org/10.1016/j.rser.2016.11.108

FIGURE 14. Projected Cooling Degree Days (65°F) in CAR for the period 1986-2099, (Reference Period, 1986–2005)[87]

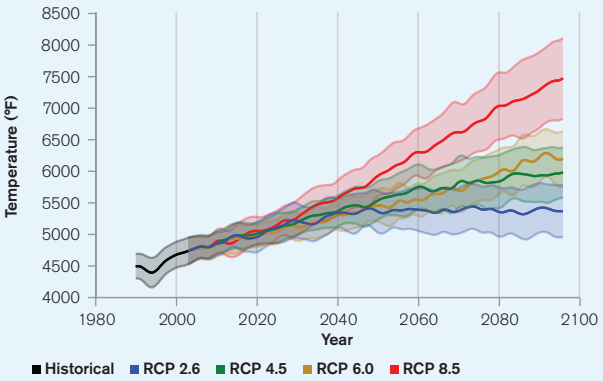
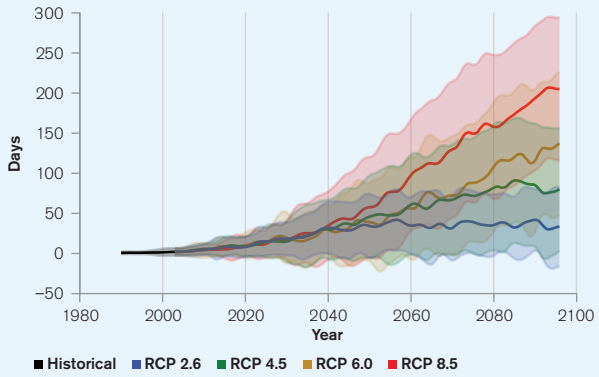


FIGURE 15. Warm Spell Duration Index in CAR for the period 1986 to 2099 (Reference Period, 1986–2005)[88]



Adaptation Options

Wood fuel consumption in CAR is expected to stay at very high levels in future decades and charcoal consumption is also expected to grow.[89] While CAR is committed to diversifying its energy sources it should also focus on the implementation of improved environmental protection schemes and sustainable land and forest use. The country is focused on the development of hydroelectric installations (including micro-dams), which should improve energy access and availability for urban areas. Multiple projects (from the World Bank, the European Union and the Central African Forest Commission[COMIFAC] have invested in the sector to improve sustainable forest management. Efforts are ongoing to increase awareness regarding use of efficient cookstove technology and increased communication around this behavior change should be promoted. Additional efforts include the promotion of the use of wood waste as fuel for forestry companies and the promotion of the use of improved and more efficient cook stoves for household cooking needs. The country is committed to diversifying its energy sources and is prioritizing hydro-electric installations, including micro-dams as well as expand its renewable energy generation potential and usage.[90]

Health

Overview

The health situation in CAR has deteriorated as a result of the multiple crises affecting the country. The HIV/AIDS epidemic in the Central African Republic, together with significantly worsening living conditions and the fragile state of the health system (owing to violence and staff dislocation) are some factors that explain the worsening rates of

[87] WBG Climate Change Knowledge Portal (CCKP, 2021). CAR Water Sector. URL: https://climateknowledgeportal.worldbank.org/country/central-african-republic/climate-sector-energy

[88] WBG Climate Change Knowledge Portal (CCKP, 2021). CAR Energy Sector. URL: https://climateknowledgeportal.worldbank.org/country/central-african-republic/climate-sector-energy

[89] World Bank (2013): Deforestation Trends in the Congo Basin — Reconciling economic growth and forest protection. URL: http://www.zaragoza.es/contenidos/medioambiente/onu/newsletter15/970-eng.pdf

[90] Central African Republic (2016): Nationally-Determined Contributions. URL: https://www4.unfccc.int/sites/ndcstaging/PublishedDocuments/Central%20African%20Republic%20First/INDC_R%C3%A9publique%20Centrafricaine_EN.pdf

neonatal, infant and maternal mortality. The primary health challenges for the country are its poor governance; high maternal mortality (882 per 100,000 live births in 2015) and morality in children under 5 (130.1 per 1000); the high prevalence of communicable diseases, specifically malaria and diarrheal diseases, and of noncommunicable diseases such as high blood pressure and diabetes; the failing health system, specifically in terms of governance, extremely limited supply of medicines, facilities and human resources; and health-sector financing remains strongly dependent on external aid and is poorly coordinated, thereby limiting its efficiency and effectiveness.[91] Additionally, food insecurity, under-nutrition, and mal-nutrition are of critical concern for the country. Currently, 40% of children under 5 years' experience stunting.[92]

Climate Change Impacts

CAR is vulnerable to adverse health impacts due to increasing temperatures and altered precipitation trends. Projected trends are expected to impact bacteria, disease and virus trends in the country, with a concern of an increase in epidemics due to transference into new areas. Given the implications for increased temperature and precipitation on the lifecycle and habitat of malaria-carrying mosquito and parasite species, warmer temperatures may open up new locations suitable for transmission.[93] However, in drier areas in CAR such as in the country's savannah zones, malaria transmission is likely to be shorter (7–9 months compared with 10–12 months). In addition, 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. As such, diarrheal diseases already represent a significant public health burden in CAR and are likely to increase.

Higher temperatures, water scarcity, flooding, drought, conflict, and displacement, will negatively impact agricultural production, causing further breakdown in food systems. This will disproportionally affect most vulnerable people at risk to hunger and can lead to increased food insecurity nationwide. This is especially critical for CAR as the majority of the population is reliant upon subsistence agriculture, which is reliant upon rainfall, making it highly vulnerable to changing weather patterns and long-term climate change trends. Poor and vulnerable groups risk further deterioration into food and nutrition crises if exposed to extreme climate events. Furthermore, more severe and frequent flooding may displace communities and increase the risk of water-borne diseases, and higher temperatures may threaten food and nutritional security, agricultural livelihoods, and increase heat-related deaths, specifically in children and the elderly. Vulnerable groups risk further deterioration into food and nutrition crises if exposed to extreme climate events of flooding, drought and extreme heat. Increasing temperatures also remain of significant concern, although is often overlooked as a public health risk.[94]

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[91] WHO (2016): Country Cooperation Strategy — Central African Republic. URL: https://apps.who.int/iris/bitstream/handle/10665/250223/ccsbrief_caf_en.pdf?sequence=1

[92] WHO (2019): Global Nutrition Monitoring Framework Country Profile: Central African Republic. Nutrition Landscape Information System. URL: http://apps.who.int/nutrition/landscape/global-monitoring-framework?ISO=caf

[93] Ruckstuhl, L. et al. (2017). Malaria case management by community health workers in the Central African Republic from 20092014: overcoming challenges of access and instability due to conflict. *Malaria Journal*. 16. URL: https://link.springer.com/article/10.1186/s12936-017-2005-7

[94] Ministry of Environment, Ecology and Sustainable Development (2015). Second National Communication to the UNFCCC — Central African Republic. URL: https://unfccc.int/sites/default/files/resource/cafnc2.pdf

Rising temperatures are of increasing concern. The annual distribution of days with a high-heat index provides insight into the health hazard of heat. **Figure 16** shows the expected Number of Days with a Heat Index >35°C for the 2090s; showing a sharp increase in very hot days, starting to accelerate by mid-century and continuing to sharply increase under a high-emission scenario by end of the century. It also shows night temperatures (>20°C), which are expected to rapidly increase in a high-emission scenario. Increased health threats can be projected and monitored through the frequency of tropical nights. Tropical Nights (**Figure 17**) represents the projected increase in tropical nights for different emission scenarios to demonstrate the difference in expected numbers of tropical nights.

FIGURE 16. Days with a Heat Index>35°C (Reference Period, 1986–2005)[95]

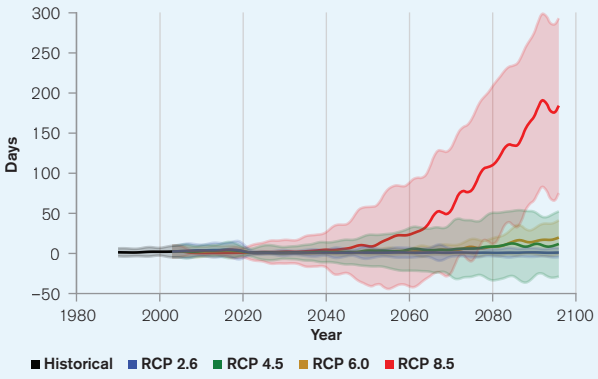
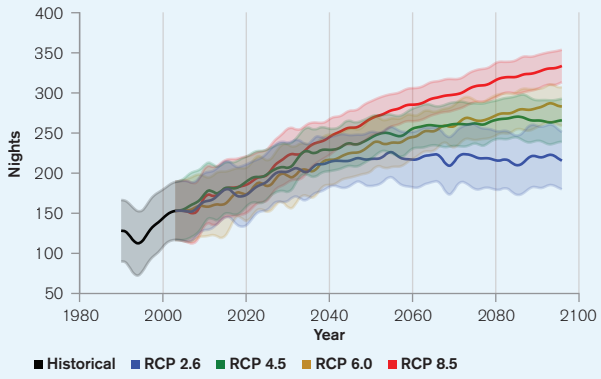


FIGURE 17. Number of Tropical Nights (Tmin >20°C) (Reference Period, 1986–2005)[96]



Adaptation Options

The CAR's limited access, expansion and availability of its health care system remains a significant challenge to the country's development goals and improved public health status. Health financing, including the supply of medicines, is a priority. The WHO and the European Union have made international experts available to work with local healthcare services regarding issues around supplying medicines in the context of a lacking central pharmaceutical facility. However, identification of health service mechanisms to ensure access to essential services for the most vulnerable groups of the population, specifically children and mothers, remains a major challenge. Technical support is being provided to strengthen institutional governance and improve availability of technical assistance through the Ministry of Health to operationalize health districts, strengthen capacity to manage the district and regional health teams, and organize the monitoring and evaluation of service delivery in health facilities at health-district level. An Integrated Disease Surveillance and Response mechanism is being reviewed and established along with the establishment of a human resources observatory and provision of technical and financial assistance to develop a human resources plan, including reform of the Health Sciences Faculty and its annexes in the short and longer term.[97]

[95] WBG Climate Change Knowledge Portal (CCKP, 2021). CAR Health Sector Dashboard. URL: https://climatedata.worldbank.org/CRMePortal/web/health/systems-and-service?country=CAF&period=2080-2099

[96] WBG Climate Change Knowledge Portal (CCKP, 2021). CAR Health Sector Dashboard. URL: https://climatedata.worldbank.org/CRMePortal/web/health/systems-and-service?country=CAF&period=2080-2099

[97] WHO (2019). Global Nutrition Monitoring Framework Country Profile: Central African Republic. Nutrition Landscape Information System. URL: http://apps.who.int/nutrition/landscape/global-monitoring-framework?ISO=caf

Impacts on water quality, water resources, changes in habitat, increasing exposure of vulnerable groups, sanitation and drainage, and vector-borne diseases are all areas for concern. These impacts require not only continued investment and focus on climate sensitive health issues, but also full integration of climate change into the CAR's planning to strengthen and expand its healthcare services. The government should undertake a climate vulnerability and risk assessment regarding the impacts of climate change and variability on human health. Investments should also be made into data collection and database development in support of epidemiological tracking of risks and to implement appropriate measures for surveillance and monitoring of climate change related diseases in order to enhance health early warning systems.[98] National adaptation plans for the healthcare sector were established in the Second-Generation National Health Development Plan (2006–2015). Priority elements include, improving the knowledge of pathologies across CAR, strengthening the national health service, establishing an epidemiological surveillance and information system, and increase the involvement of NGOs, civil society and the private sector actors in CAR's healthcare services nationwide.[99] Additionally, health care system personnel may not be fully aware of the relationship between climate change, seasonal variability and health impacts. Increases in training and capacity can improve the level of knowledge and skills to prevent diseases connected with climatic factors, however this knowledge remains relatively limited among the general population. CAR is also committed to improve its public health system by developing systems in order to monitor, prevent and effectively respond to human diseases associated with climate change, establish a waste management plan with oversight from a waste management unit. Interest exists in the exploration of finding and developing uses for waste, such as energy generation, however more research is needed.[100]

ADAPTATION

Institutional Framework for Adaptation

CAR is at the same time in a post-conflict situation and in political transition, which exposes it to a considerable level of socio-economic vulnerability. As such, the country's adaptation initiatives are focused on development needs and ensuring environmental sustainability and appropriate natural resource management in line with a low-carbon development path. Adaptation options are focused on the integration of climate change adaptation into the policies and programs for the development of the most vulnerable and priority sectors and to improve awareness, education and communication regarding adaptation needs and the risks associated with climate change across the country and through public and private sectors. The Ministry of Environment, Ecology and Sustainable Development is responsible for guiding the country's environment sustainability plans and climate change responsibilities and it has the mandate to administer the country's National Adaptation Plan of Action, which was adopted in 2008.[101] CAR is a member of

[98] Ruckstuhl, L. et al. (2017). Malaria case management by community health workers in the Central African Republic from 20092014: overcoming challenges of access and instability due to conflict. *Malaria Journal*. 16. URL: https://link.springer.com/article/10.1186/s12936-017-2005-7

[99] Ministry of Environment, Ecology and Sustainable Development (2015). Second National Communication to the UNFCCC — Central African Republic. URL: https://unfccc.int/sites/default/files/resource/cafnc2.pdf

[100] Central African Republic (2016). Nationally-Determined Contributions. URL: https://www4.unfccc.int/sites/ndcstaging/PublishedDocuments/Central%20African%20Republic%20First/INDC_R%C3%A9publique%20Centrafricaine_EN.pdf

[101] USAID (2018). Climate Risks in the Central African Regional Program for the Environment (CARPE) and Congo Basin. URL: https://www.climatelinks.org/sites/default/files/asset/document/20180604_USAID-ATLAS_ClimateRiskProfile_CARPE.pdf

the Central African Forest Commission (COMIFAC), a treaty organization established to harmonize regional policies on forestry and biodiversity conservation. CAR has also ratified two climate change adaptation and mitigation regarding biofuels and the establishment of the country's Forestry Code.[102] To date, progress has been limited and the CAR's ability to engage with the development process and implement laws over the medium term has often been challenged by instability, uprising conflict, weak institutions and extreme poverty.[103]

Policy Framework for Adaptation

The CAR submitted its Second National Communication to the UNFCCC in 2016 and its Nationally Determined Contributions in 2016. Its National Adaptation Plan of Action was finalized in 2008. CAR is committed to integrating climate change into its development plans and strategies, to develop a National Climate Change Adaptation Plan, and to prepare the country's eligibility for the Green Climate Fund. To reach its adaptation goals, CAR envisages a holistic approach, integrating adjustment of national policies and strategies, improvement of the legislative and regulatory frameworks, and capacity development and transfer of technology in certain priority areas. Continued adaptation efforts are focused on its most vulnerable sectors, agricultural, forestry, water, health, and land-use, and on increasing the country's resilience capabilities, and strengthen the country's social and economic structures against vulnerability.[104]

National Frameworks and Plans

- Nationally Determined Contributions (2016)
- Second National Communication (2015), French
- Law on the Protection of Nature (2014), French
- Environmental Law on Biofuels (2008), French
- Forestry Code (2008), French
- National Adaptation Program of Action (2008), French
- Poverty Reduction Strategy Paper (2007)

Recommendations

Research Gaps

- Improve, support and reinforce the teaching of meteorology, climatology and general hydrology in the higher education and university channels of natural sciences
- Enhance capabilities for collecting, analyzing and managing climate change data at the national, regional and local levels[105]

[102] Ministry of Environment, Ecology and Sustainable Development (2015). Second National Communication to the UNFCCC — Central African Republic. URL: https://unfccc.int/sites/default/files/resource/cafnc2.pdf
[103] LSE Grantham Institute (2019). CAR — Overview, Approach to Climate Change. URL: http://www.lse.ac.uk/GranthamInstitute/country-profiles/central-african-republic/
[104] Central African Republic (2016). Nationally-Determined Contributions. URL: https://www4.unfccc.int/sites/ndcstaging/PublishedDocuments/Central%20African%20Republic%20First/INDC_R%C3%A9publique%20Centrafricaine_EN.pdf
[105] Central African Republic (2016). Nationally-Determined Contributions. URL: https://www4.unfccc.int/sites/ndcstaging/PublishedDocuments/Central%20African%20Republic%20First/INDC_R%C3%A9publique%20Centrafricaine_EN.pdf

- Conduct dedicated research into the existing resilience mechanisms of the energy, agriculture, forestry and animal husbandry systems in the country
- Develop a system for monitoring underground and surface water resources and establish an early warning network for flooding and hydrologic hazards
- Strengthen environmental monitoring capabilities for strengthened and more effective environmental management
- Rehabilitate the network for collecting meteorological, climatological and hydrological data throughout the national territory[106]
- Evaluate needs and develop a national strategy for technology transfer to support NDC adaptation measures

Data and Information Gaps

- Improve technical capacity to analyze hydro-met data and project impacts across sectors; specifically, regarding health and natural disaster events
- Improve the standards for infrastructure construction[107]
- Establish institutional capacity for providing timely early warning systems to farmers for improved decision making and understanding seasonal variability for key agricultural zones
- Increase 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
- Improve data collection and analysis on forest loss and land degradation, to establish a national REDD and REDD+ programs[108]

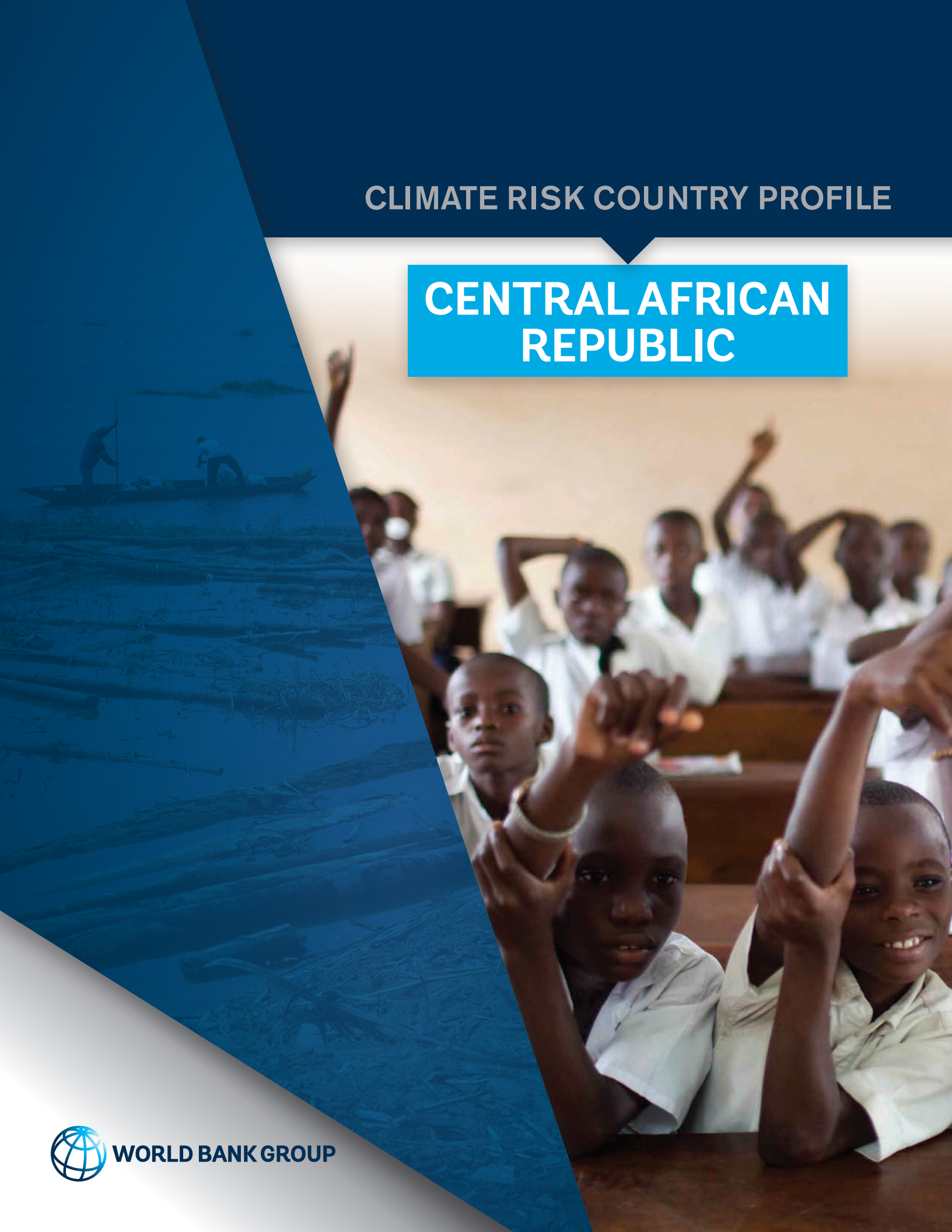
Institutional Gaps

- Establish land-use plans by type of use (road infrastructure, mines/petroleum, agriculture, animal husbandry, forests, protected areas or wildlife reserves, urban spaces etc.).
- Integrate climate change concerns into relevant policies and planning processes at the state and national levels
- Finalize and adopt the framework bill on the environment as well as outstanding nature conservation bills
- Finalize regulations to fund and implement impact studies regarding climate change impacts for the country and key sectors[109]

[106] Central African Republic (2016). Nationally-Determined Contributions. URL: https://www4.unfccc.int/sites/ndcstaging/PublishedDocuments/Central%20African%20Republic%20First/INDC_R%C3%A9publique%20Centrafricaine_EN.pdf
[107] Central African Republic (2016). Nationally-Determined Contributions. URL: https://www4.unfccc.int/sites/ndcstaging/PublishedDocuments/Central%20African%20Republic%20First/INDC_R%C3%A9publique%20Centrafricaine_EN.pdf
[108] World Bank (2013). Deforestation Trends in the Congo Basin — Reconciling Economic Growth and Forest Protection. URL: https://openknowledge.worldbank.org/bitstream/handle/10986/12477/9780821397428.pdf?sequence=1&isAllowed=y
[109] Central African Republic (2016). Nationally-Determined Contributions. URL: https://www4.unfccc.int/sites/ndcstaging/PublishedDocuments/Central%20African%20Republic%20First/INDC_R%C3%A9publique%20Centrafricaine_EN.pdf

CLIMATE RISK COUNTRY PROFILE

CENTRAL AFRICAN REPUBLIC



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