CLIMATE RISKS TO RESILIENCE & FOOD SECURITY IN BUREAU FOR HUMANITARIAN ASSISTANCE GEOGRAPHIES

DEMOCRATIC REPUBLIC OF THE CONGO

COUNTRY OVERVIEW

The Democratic Republic of the Congo (DRC) is the second-largest country in Africa (2.3 million square kilometers [km^2]). The country experiences a predominantly equatorial climate and is characterized by large swaths of tropical rainforest and arable land. The United States Agency for International Development (USAID)'s resilience and food security investments are focused in the Tanganyika, Kasai, and Kasai Central provinces, located in the southeastern and central southern portions of the country, south of the most dense tropical rainforest region (see Figure 1). These regions experience climate hazards including heat waves, drought, and heavy precipitation and flooding (potentially leading to landslides and erosion). Agriculture within the regions is highly dependent on rainfall, and current climate variability already negatively affects crop productivity. Future climate projections indicate increasing temperatures, greater frequency and duration of heat waves, more variable and more intense precipitation, and increased dry spell and drought frequency. These climatic changes are likely to further stress crop production, potentially contributing to worsening food insecurity. USAID resilience and food security investments in these areas will need to consider and adapt to these changing conditions to reduce the risk posed by climate change.

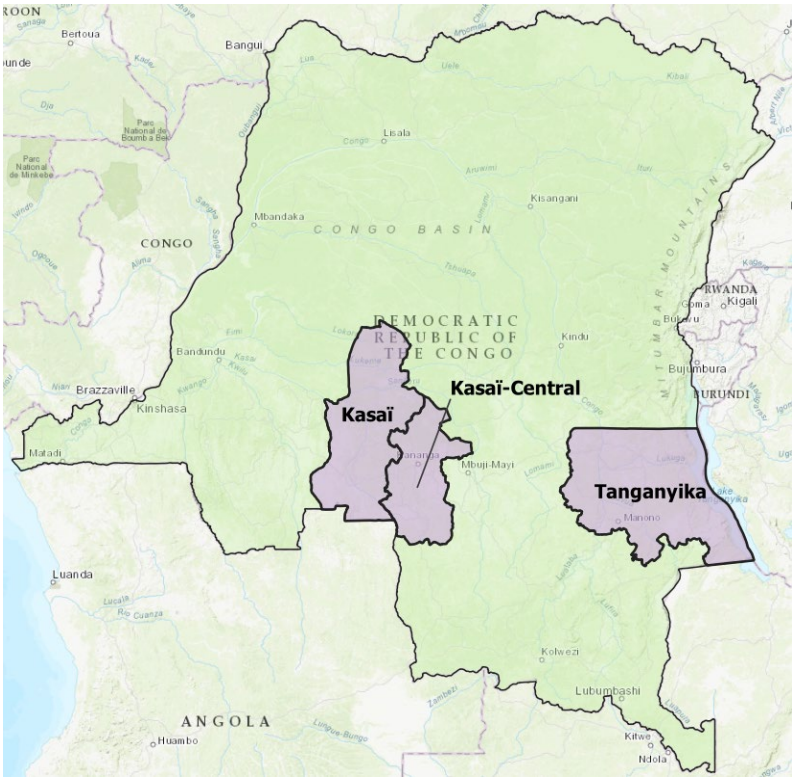

Figure 1: Purple indicates USAID food security investment regions within the Democratic Republic of the Congo.

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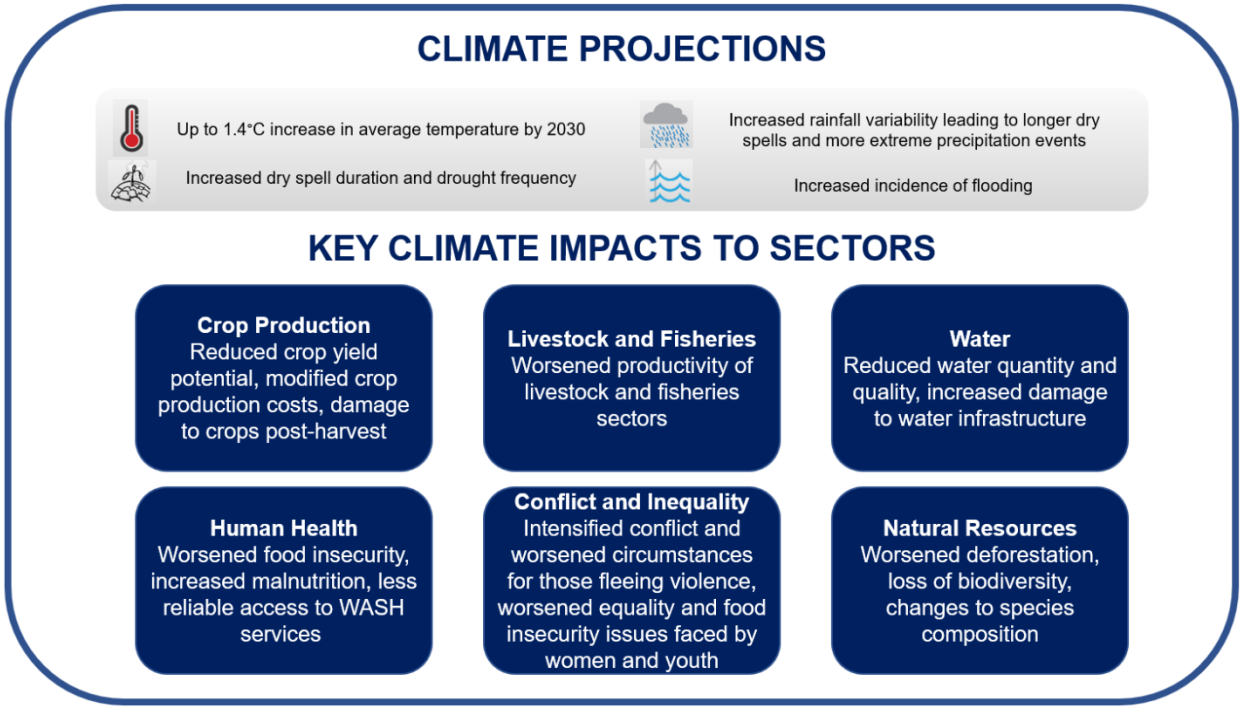

Figure 2. Summary of climate projections and key climate impacts to resilience and food security program areas.

CLIMATE SUMMARY

Historical Climate

The DRC experiences high regional variability in its climate. In the country's equatorial regions, temperatures and humidity are high with annual averages of 24.6 degrees Celsius (°C), and rainfall ranges from 1,600–2,000 millimeters (mm) annually. The country's tropical climate zones north and south of the equatorial zone experience distinct dry (April to October) and rainy (November to March) seasons driven by the Intertropical Convergence Zone (ITCZ). The country's eastern highlands experience southeastern trade winds and snow at high altitudes. (1)

USAID recognizes three major climatic zones (Figure 3) (2):

- **Zone 1** (parts of Kasai and Tanganyika): This zone contains tropical rainforests along the Congo River and its tributaries and is characterized by two rainy seasons (March to May, September to December)

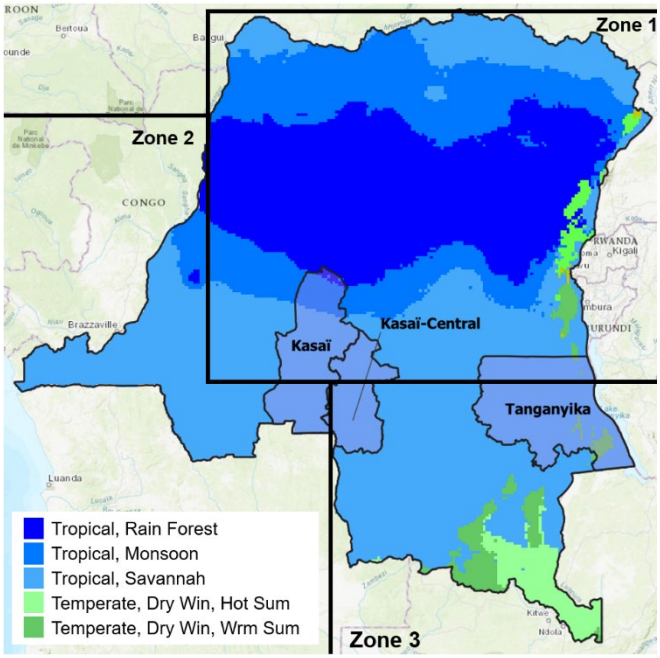

Figure 3: Climate zones and Koeppen-Geiger climate classification of the DRC, overlaying provinces of interest. Climate zones are from the Climate Service Center (CSC)'s Climate Change Scenarios for the Congo Basin.

followed by two short dry seasons (June to August, January to February). Average temperatures range from 24–25°C throughout the year.

- **Zone 2** (parts of Kasai): This zone has mountainous terraces, dense grasslands, and mostly tropical wet and dry climates with one rainy season (July to August). Average temperatures range from 24–25°C throughout the year.
- **Zone 3** (parts of Kasai and Tanganyika): This zone contains savannas in the south and southeast and a subtropical climate with one rainy season (December to February). Average temperatures range from 22–23°C throughout the year.

Changes to the climate have already begun to affect the country. Over the last 30 years, the DRC has experienced temperature increases of 0.17°C per decade, while the warmest day of the year has increased by about 0.25°C per decade. Furthermore, the temperature of deep lake waters in Lake Tanganyika has increased 0.20–0.70°C since the 1960s. Increased frequency of extreme weather events, such as intense rainfall that follows prolonged dry spells, has led to erosion and flash flooding. For example, heavy rains in January 2018 resulted in severe flooding and landslides in communities near Kinshasa that killed 51 people and affected 15,700 others. These climate change impacts disproportionately affect women and youth, increasing their risk of food insecurity, poverty, health problems, violence, and displacement. Youth in the DRC are especially vulnerable to climate change; the DRC is ranked ninth among the top countries where children are most at risk to climate and environmental impacts. (1, 3, 4)

Future Climate

Future climate projections indicate that temperatures will continue to rise in the DRC (Table 1). The country is expected to experience an increase in the frequency and duration of heat waves, and cold days and nights may decrease 6–10 percent by the end of the century. The highest rise in temperature will likely occur from October to March. Higher temperatures are also associated with an increase in evapotranspiration rate. (3)

While rainfall projections are more uncertain, future rainfall is likely to increase in variability, with projections indicating higher frequency of extreme events and increases of heavy rain intensity by up to 27 percent. This increase in rainfall is more likely to occur during the October to April wet season. Heavy rains could lead to increased runoff from the Congo River system by as much as 50 percent (under a high-emissions RCP 8.5 scenario), leading to increased flood risk throughout the basin. (5)

Dry spell duration and drought frequency, as well as natural disasters driven by more frequent and intense floods, are also expected to increase. Future flooding risk, as well as wildfire risk (driven by dryness), are high throughout the country. (1)

Table 1: Key climate projections in the DRC for the near and mid-term. Data for projections comes from RCP 8.5 CMIP5 ensemble projections and show values in the 10th to 90th percentile. Source: World Bank 2021

Climate Variable	Baseline (1901–2020)	Near-term future (2020–2039)	Mid-term future (2040–2059)
Average annual temperature	24.1°C	+0.5 to +1.4°C	+1.2 to +2.4°C
Total annual precipitation	1,508.3 mm	-13.7 to +21.6 mm	-17.1 to +25.2 mm

°C = degrees Celsius; mm = millimeters

Climate projections have slight regional variability. The southern parts of the country may experience higher temperature increases by the end of the century (2100) compared to other parts of the country (Figure 4), as well as decreases in dry season rainfall and increased aridity and drought. The eastern parts of the country may see up to a 5 percent increase in total annual precipitation by late-century (Figure 5). The central part of the country is projected to experience more intense high precipitation events, which could result in flooding causing riverbank erosion, landslides, and waterlogging. (1, 3, 6)

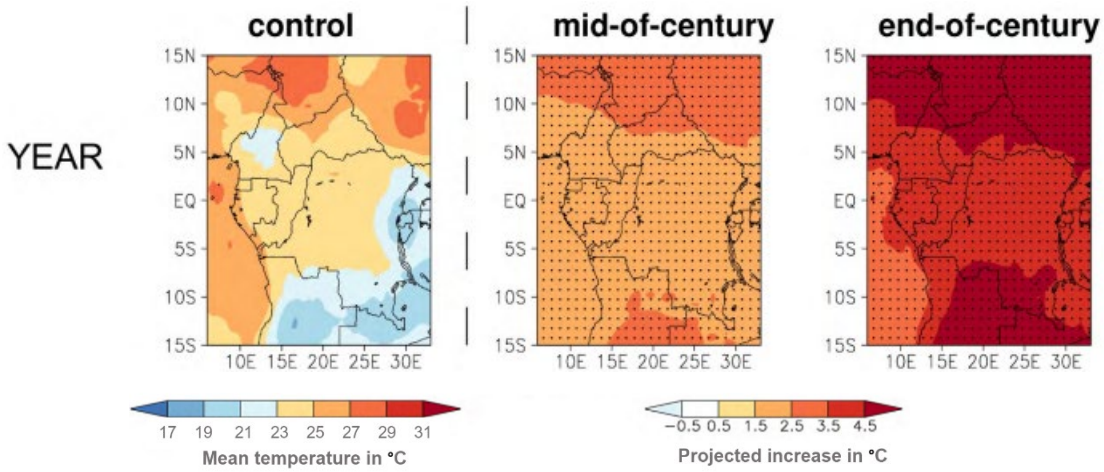

Figure 4: Maps of projected changes for mean temperature under a high emission scenario. Stippled areas indicate "robust" changes where 66 percent of all models project a climate change signal in the same direction. Source: CSC 2013

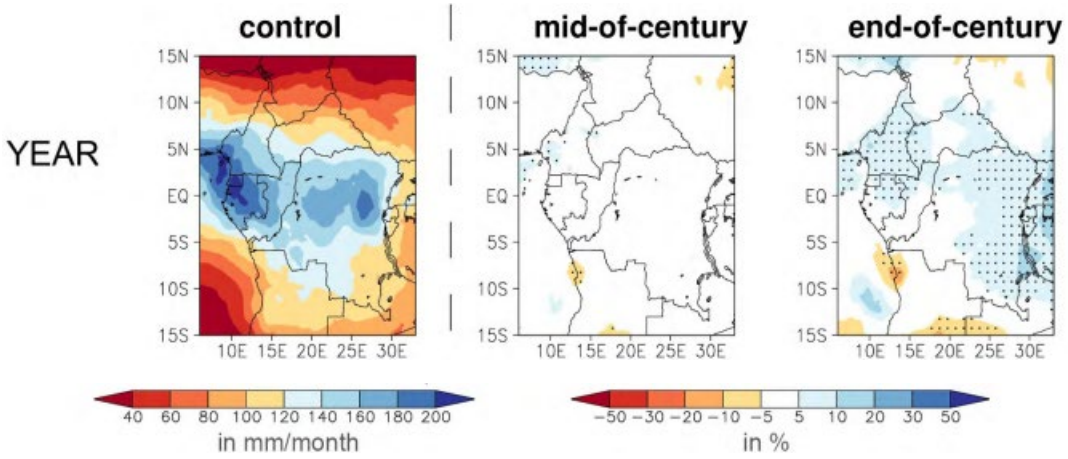

Figure 5: Maps of projected changes for total precipitation under a high emission scenario. Stippled areas indicate "robust" changes where 66 percent of all models project a climate change signal in the same direction. Source: CSC 2013

Of the three major climatic zones, Zone 3 (Southern DRC) may experience slightly higher average annual temperature increases but lower increases in extremes, such as hot days and nights (Table 2). For all zones, there is uncertainty surrounding how total annual precipitation will change, but dry spells during the rainy season are likely to increase significantly (up to 78 percent); the intensity of heavy rain events is expected to have slight increases as well. (7)

Table 2: Climate projections for three major climatic zones in the DRC by mid-century (2036–2065). Ranges represent low-emission and high-emission scenarios. Baselines represent data from an observed 1961-1990 period (baselines are not available for the "hot days and nights" variable). Source: CSC 2013

Climate variable	Zone 1	Zone 2	Zone 3
Annual average surface air temperature	+1.4 to 2.7°C (baseline of 24.1°C)	+1.4 to 2.5°C (baseline of 24.6°C)	+1.5 to 2.7°C (baseline of 21.9°C)
Hot days and nights*	+12 to 31 percent (days) +31 to 64 percent (nights)	+17 to 39 percent (days) +36 to 67 percent (nights)	+9 to 21 percent (days) +23 to 46 percent (nights)
Total precipitation	0 to +6 percent (baseline of 1,716 mm)	-3 to +7 percent (baseline of 2,100 mm)	-4 to +7 percent (baseline of 1,284 mm)
Dry spells during rainy season**	-2 to +78 percent (baseline of 2.4 dry spells)	-6 to +77 percent (baseline of 3.3 dry spells)	-19 to +68 percent (baseline of 1.8 dry spells)
Intensity of heavy rain events***	+3 to +13 percent (baseline of 31 mm/d)	+2 to +13 percent (baseline of 46 mm/d)	+3 to +12 percent (baseline of 29 mm/d)

*Number of days and nights with daily maximum near surface air temperature above the 90th percentile of daily maximum near surface air temperatures of the period 1961–1990.
**Number of periods in rainy season with at least six consecutive days with daily rain amounts less than 1 mm/day.
***95th percentile of daily precipitation amounts on wet days (days with daily rain amounts of at least 1 mm/day).

Policy Context

The DRC is undergoing a period of decentralization and the Ministry of Environment, Nature Conservation, and Tourism is the responsible agency for climate change adaptation efforts. In addition to the below strategies and plans, the DRC ratified the Paris Agreement in December 2017 and participates in the United Nations Reducing Emissions from Deforestation and forest Degradation plus (REDD+) program. The DRC is also a member of the Central African Forest Commission (COMIFAC), which aims to strengthen the preservation and management of forest ecosystems in the Congo Basin. In 2021 the DRC updated their Nationally Determined Contribution (NDC) and identified the following priority sectors for climate action: agriculture, forestry, coastline protection, and energy/transportation. In addition, the DRC has recently published their National Adaptation Plan to Climate Change, which outlines the country's legal and institutional framework, historical and future projected climate data, and priority adaptation programs for the near-term. Legal frameworks and documents guiding climate action in DRC include the following:

- Nationally Determined Contribution (updated second version 2021)
- Law on the Protection of Nature (2014)
- Third National Communication to the UNFCCC (2015)
- Climate Change Profile (2018)
- National Adaptation Plan to Climate Change, 2022-2026 (2021)

IMPACTS AND VULNERABILITIES

Climate change is likely to bring about adverse consequences across the DRC's agricultural value chain, affecting the country's food security. Agricultural value chains for the DRC differ by specific crop and scale at which crop production and distribution occurs. This considered, Figure 6 provides a broad and illustrative example of what a simplified agricultural value chain could resemble in the DRC, detailing potential impacts from the climate stressors discussed above at particular stages and potential adaptation and resilience measures to limit these impacts. Additionally, while impacts of changing climate conditions are largely negative across the DRC's agricultural value chains, they may also bring about the potential for opportunities, such as better growing conditions for certain crops or less favorable conditions for certain pests and diseases that reduce crop production.

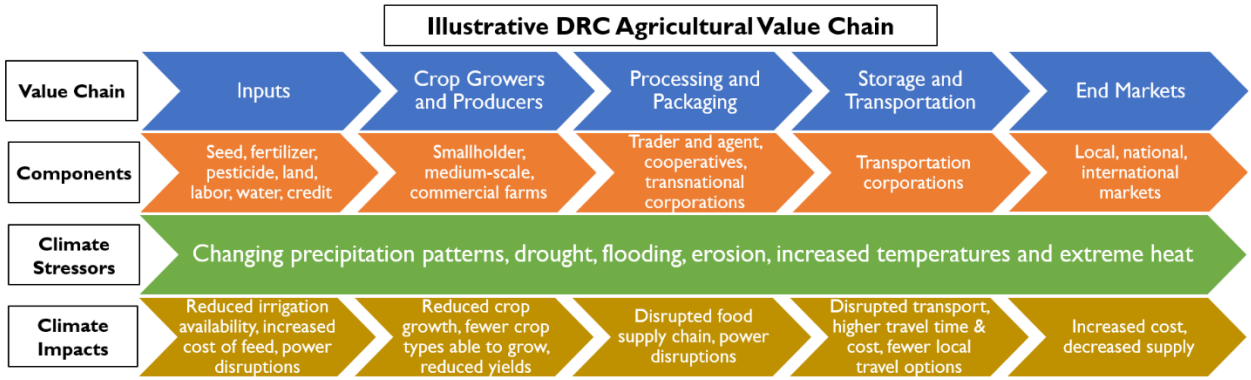

Figure 6. Illustrative DRC agricultural value chain.

The following sections provide more detailed insight into impacts of a changing climate across the agricultural value chain. Sectors that may have a more indirect impact on the country's food security in the face of climate change (e.g., conflict management, ecological sensitivity and biodiversity) are also considered.

Crop Production

Agriculture is a critical sector to the DRC economy and livelihoods. In recent years agriculture accounted for about 20 percent of the national gross domestic product (GDP) and employed approximately 60 percent of the country's population, serving as a primary source of livelihood for the Congolese people. The country has the most available farmland of any country in Africa, with an estimated 80 million hectares of available arable land; however, only about 10 percent of that land is currently cultivated. The sector is mainly subsistence in nature, with Congolese supplementing farming with hunting, small animal husbandry, and some fishing in communities close to lakes. Crop production varies by region, but maize and cassava are major staples, and most areas support livestock. The principal staple crops are cassava, plantains, beans, and bananas. The main agricultural exports include palm oil, green coffee, sugar, and natural dry rubber. The primary crops grown in the USAID regions of interest are shown in Table 3.

Table 3: Primary crops grown in DRC USAID regions of interest and their climate sensitivities.

Crop *Province*	Climate Sensitivities
Maize *Tanganyika, Kasai Regions*	• Optimal growing temperature from 17–33°C • Sensitive to temperatures above 35°C • Risk of crop failure (i.e., death) at 45°C • Requires at least 500 mm of water
Cassava *Tanganyika, Kasai Regions*	• Optimal growing temperature from 25–29°C, but can withstand higher temperatures • Fairly abundant rainfall is best for optimal growth, but can withstand prolonged periods of drought • Periods of drought combined with very high temperatures can inhibit yield and quality
Beans *Kasai Regions*	• Sensitive to heat stress, drought and flooding • Susceptible to pests and disease (fungal and root rot), including Mosaic virus (BCMV) and leaf rust; requires dry conditions at harvest
Soybean *Kasai Regions*	• Sensitive to temperatures above 35°C • Increased ozone concentrations have been linked to yield losses of 8.5–14 percent globally as ozone affects the reproductive process, leading to reduced fruit and seed development • Sensitive to soil moisture conditions throughout the growing cycle • Sensitive to waterlogging and excessive humidity, particularly at harvest and during storage • Soybean yields could experience benefits from the CO_2 fertilization effect

°C = degrees Celsius; mm = millimeters; BCMV = Bean common mosaic virus; CO_2 = carbon dioxide

Promoting agricultural development is the cornerstone of the country's national economic development plan, which aims to improve productivity, access, and technical and organizational capacities of producers and private institutions to support production. Climate variability and change, through more irregular precipitation patterns and rising temperatures, amplifies challenges in the face of these goals. Climate changes have the potential to reduce yield potential, modify production costs, damage crops post-harvest, and reduce labor productivity. Increased temperatures alone can reduce yield potential, modify production costs, and require alterations to farming practices. Furthermore, climate change impacts to agriculture could limit women's socioeconomic development, as women have high labor force participation in agriculture but earn lower incomes, own fewer assets, and have less decision-making power. Women in the DRC carry out an equal or higher amount of work on farms but only make about 10 percent of decisions compared to men, reducing their ability to respond to climate change impacts.

Pests and Pesticides

Changing climate conditions could also lead to changing prevalence of pests and diseases, potentially affecting agricultural yields. For example, cassava mosaic virus disease is spread by the whitefly insect (*Bemisia tabaci*), which is growing in abundance within Central Africa. The pest benefits from higher temperatures, which are associated with high fecundity, rapid development, and greater longevity. In contrast, the fruit tree mealybug (*Rastrococcus invadens*), an invasive pest known to persist within USAID's DRC regions of interest, may be negatively affected by warming temperatures. The mealybug's ability to reproduce is stifled at temperatures above 30°C and is unable to reproduce at 35°C and higher. Although chemical pesticide use is historically low throughout most of Sub-Saharan Africa

compared to other parts of the world, some increase in pesticide use is occurring as income levels rise. Because women have high labor force participation in agriculture, increases in pesticide use induced by climate change may result in disproportionately more pesticide-related health impacts to women. While there are no data for pesticide use in the DRC for specific crops, donor-funded programs sometimes support pesticide use. Therefore, it is important to be aware of climate risks that may have implications for pesticide use in the agriculture sector.

Agricultural production systems are associated with a series of interconnected natural resource management challenges. A climate lens offers the opportunity not only to safeguard the sustainability of investments, but also to add flexibility, allowing for adjustments to interventions as improved information and experience are gained in the field. Central to this task is building farmers' awareness of climate impacts and of the larger community on crop production and potential adaptation measures that can be used to address these impacts. Testing, learning, and building adaptive capacity for climate change is about adding a new layer to existing best practices in agricultural development or sustainable natural resource management. (8, 9, 10, 11, 12, 13, 14, 15, 16, 17, 18, 19, 20)

Livestock and Fisheries

Livestock is an important sector supporting the DRC's overall food security, namely through small-scale household livestock production (e.g., pigs, chickens, goats). The southern savannahs and the mountainous regions of the southeast and east (Kasai and Tanganyika Provinces) provide meat, milk, and wool and have a growing processing sector. While livestock rearing is practiced throughout the DRC, overall, the sector is under-exploited and has significant potential to expand. With more than 87 million hectares of grassy plains and wooded grasslands, the DRC is estimated to produce only about 2.3 percent of its national potential in beef; however, few families have the means to buy or manage a herd. And, raising cattle can contribute to degradation of forest and other landscapes. However, the potential impacts of climate variability and change on this sector create further challenges, hindering both the tolerance of the animals (Table 4) and the potential productivity of the system. (9, 21, 22)

Table 4: Climate risks to livestock.

Climate Stressors	Risks
Increased temperature	• Reduced productivity • Reduced ability to obtain feed sources and increased price of feed sources • Increased speed at which meat and milk spoil
Increased frequency and severity of intense precipitation	• Livestock infrastructure and equipment damage • Increased difficulty of maintaining a sanitary environment for animals due to changing water systems

Fisheries is also a sector with significant room for expansion in the DRC. Currently the country is using only an estimated 30 percent of total fisheries potential, primarily harvesting through artisanal practices. Even still, fisheries provide a critical source of protein for communities living along the country's water bodies. Within USAID's regions of interest, the main bodies of water that fisherfolk rely on include Lake Tanganyika, Lake Kivu, and a series of rivers including the Congo, Kasai, and Lubilash Rivers. Similar to the livestock sector, climate change poses a series of risks to expansion of sustainable fisheries across the DRC (Table 5). According to the Intergovernmental Panel on Climate Change (IPCC), regions where inland fishery production is derived primarily from lakes (Tanganyika) are at less risk of reduced

catch than regions more reliant on rivers and floodplains (Kasai provinces), since hydrological dynamics are more likely to be altered by climate change in rivers, relative to lakes. However, water temperatures are reportedly increasing in various lakes in Africa's Great Lakes region, including Lake Kivu and Lake Tanganyika at the DRC's eastern border. Variations in climate can cause wide fluctuations in freshwater thermal dynamics, which can lead to increased algal growth and reduced dissolved oxygen, while increasing deep-water temperatures and, thus, reducing the upwelling of nutrient-rich deep water that supports fish populations. (5, 23, 24, 25)

Table 5: Climate risks to fisheries.

Climate Stressors	Risks
Increased temperature	• Difficulty securing cold storage • Altered water stratification patterns in lakes, resulting in reduced catch • Increased fish mortality due to warmer water temperatures • Increased algal blooms, leading to depletion of dissolved oxygen and consequent production losses • Increased speed at which fish spoil
More variable precipitation patterns	• Reduced catch due to changing hydrological dynamics • Increased dryness may lower production of fish stocks, particularly at smaller ponds • Increased difficulty across the supply chain, especially if transportation sites are damaged or inaccessible

Food Processing, Storage, Imports, and Access to Markets

Many crops from smallholder farms are minimally processed; constraints include lack of materials, credit, and market access to sell processed goods for an adequate return. In terms of storage, a survey in the eastern DRC found that 68 percent of households are affected by post-harvest losses, including rodent infestations, poor storage conditions, theft, and straying livestock. Less than 10 percent of farmers used improved storage methods such as containers, improved household granaries, and community storage facilities. Climate change may exacerbate some of these issues as extreme heat or increased flooding could damage improperly stored crops (Table 6). (26)

The most apparent constraint to value chain development at the national level is the lack of transport infrastructure and corresponding high transportation costs. In some areas, like the Kasai provinces, the combination of limited storage availability and poor transport conditions leads to weak and poorly integrated markets, while other provinces like Tanganyika face long distances to markets. Climate change can worsen transport conditions as heavy rainfall and floods can damage road networks and result in significant delays, negatively affecting farmer household livelihoods. Heavy flooding or periods of elongated dryness can also affect river transport and make waterways less navigable. These impacts can isolate rural communities, and both decrease their access to markets, as well as make it more difficult for food imports to reach them. (26)

Table 6: Climate risks to food processing, storage, imports, and access to markets.

Climate Stressors	Risks
Increased temperature	• Damage to improperly stored crops and increased spoilage of crops
Increased extreme precipitation events	• Damage to improperly stored crops • Damaged transportation networks, hindering transport of imports and access to markets

Water Resources Availability

The DRC contains 62 percent of the Congo Basin and has one of the highest volumes of freshwater in Africa. Surface water and groundwater sources are critical elements in the food security equation throughout the country. While there is uncertainty surrounding how climate change will affect total annual precipitation in the country, the DRC is likely to experience increased intensity of wet and dry precipitation extremes, affecting the quantity and quality of local water supplies at different times of the year.

The rivers and lakes of the DRC are a vast source of freshwater covering 12,000 kilometers (km) of navigable networks. Despite this hydrological wealth, access to water remains a critical issue for rural populations due in large part to lack of investment in the water resources management sector; only 31 percent of rural households have access to improved water facilities. Even in areas where water supplies are readily available, concerns arise about quality, particularly in and around major urban areas, as increased rainfall intensity, flooding, and increasing temperatures can affect storage, infiltration, and the transport of potential contaminants—all of which affect water quality. Climate projections anticipate increased intense rainfall events that will exacerbate these issues. These climate risks are illustrated in Table 7. (27)

Because many rivers, streams, and lakes do not provide potable water, most DRC residents rely on groundwater sources, such as shallow wells and springs. In rural areas, most people collect water from these sources and carry it back to their homes. These shallow groundwater sources, which generally are open at the extraction point, could be vulnerable to increased evaporation and decreased recharge due to rising temperatures. This could increase the burden of work for water collectors, particularly women and girls who are primarily responsible for this role, and who may face additional hazards like increased gender-based violence and reduced ability to receive an education. The eastern and southern parts of the country (including Tanganyika) are projected to see a decrease in dry-season rainfall, further exacerbating drinking water availability. (1)

Table 7: Climate risks to water resources availability.

Climate Stressors	Risks
Increased temperatures	• Reduced water quality • Increased evaporation and thus reduced water quantity and quality in shallow wells
Increased frequency of intense precipitation	• Increased sedimentation and erosion in surface water • Increased contamination due to damaged infrastructure affecting stored or infiltrated drinking water

Climate Stressors	Risks
	• Increased damage to water infrastructure
Decreased dry season precipitation	• Reduced water quantity and quality, requiring improvements in water infrastructure

Conflict Management

The DRC has experienced decades-long conflict and violence driven by ethnic and geopolitical unrest, particularly along its eastern front (including Tanganyika province). Access to land resources is already a driver of conflict within the DRC and increased stress to resources as a result of climate change could intensify conflict and complicate circumstances for those fleeing violence. Dwindling resources across the country due to climate and environmental shocks could increase competition and conflict in forest spaces, threatening land tenure of groups that have been marginalized, particularly Indigenous Peoples. Furthermore, according to the most recent IPCC report, there have been observed links between water stress and individual attitudes for participating in violence within the DRC, potentially affecting those in more arid regions where water stress is a concern.

Communities afflicted by violence are less likely to be able to address climate impacts due to the vulnerabilities associated with and magnified by violence. The degrading of institutions that manage and safeguard natural resources and provide essential services, as well as the absence of reliable law enforcement in areas experiencing violence, could stifle efforts to adapt to climate change. For example, lack of investment in the DRC's forestry sector has been tied to security concerns. (5, 27, 28)

Human Health: WASH, Nutrition, and Health Services

Climate change is expected have impacts on water, sanitation, and hygiene (WASH) infrastructure and services. Basic water supply and sanitation needs are immense: only 52 percent of the population has access to improved water facilities and less than 29 percent has access to improved sanitation. Poor and rural populations have significantly less access to improved water facilities compared to urban and wealthier populations. While this is largely due to damages to infrastructure during the prolonged conflicts in the DRC during the 1990s and 2000s, climate risks could exacerbate the situation by reducing water quality and increasing the incidence of flooding, which damages sanitation infrastructure, increasing the incidence of waterborne and diarrheal diseases such as cholera. For example, after intense rains and flooding events in January 2018, the number of weekly cholera cases in Kinshasa increased from less than 5 to more than 100. Increased flooding can also damage WASH facilities, allowing fewer people to use them. (1, 3, 27)

Climate change is expected to worsen malnutrition in the DRC. The nutritional situation in the DRC is critical, especially for vulnerable groups such as children and pregnant and lactating women. In 2021, an estimated 3.3 million children in the country experienced acute malnutrition, and about 1 million of those experienced severe acute malnutrition. Stunting is also a significant health risk and is associated with 53 percent of infectious disease-related deaths in developing countries. The impacts to agriculture described above—including increased temperatures, drought, and flooding—will reduce agricultural production, further exacerbating food insecurity and worsening nutrition problems throughout the DRC. (27, 29)

Projections anticipate climate change will result in impacts to other health issues in the DRC (Table 8). Malaria is a leading cause of mortality in the country, and climate change hazards such as higher

temperatures and humidity are likely to expand the habitat of mosquitoes, potentially extending seasonality and geography of malaria incidence. By mid-century, cases may triple in existing malaria-prone areas, while an additional 65,000–80,000 people may face endemic malaria risk in areas previously unsuitable for the disease. These areas include the southwest (Kwango province) and east (Kivu provinces). Other climate-related health issues include increased incidence of heat-related illnesses, increased suitability for zoonotic diseases and viruses that transmit between wildlife and humans, such as the Monkeypox virus, and increased flooding that could block roads and damage health facilities, disrupting access for people to attend health services. Climate change can also worsen the health of people with existing health issues and illnesses. Women and children, particularly those living in conflict-affected settings, may have increased trouble accessing health services. Barriers to accessing health services include availability and retention of skilled personnel, lack of equipment, and insufficient financial resources to ensure operations and payment for workers. Women may also face gender-based violence when visiting hospitals and health centers, potentially discouraging women and girls from accessing health care. (1, 30, 31)

Table 8: Climate risks to human health.

Climate Stressors	Risks
Increased temperature	• Increased food insecurity and hunger due to impacts to agricultural production • Extended range of disease vectors such as mosquitos to new geographies and times of year • Increased incidence of heat-related illnesses • Increased suitability for human-wildlife viruses
Increased frequency of intense precipitation	• Increased damage to sanitation infrastructure, resulting in contamination of drinking water and, thus, an increase in waterborne and diarrheal diseases • Reduced access to health services due to transportation breaks and infrastructure damage

Natural Resources Management (including forestry & national parks)

The DRC has the world's second-largest area of tropical rainforest, which makes up 59 percent of its territory. The country's forests store about 8 percent of global forest carbon and are part of the greater Congo Basin, which makes up 18 percent of the world's tropical forests. These forests contain an abundance of ecosystem services (such as carbon sinks, erosion control, water filtering, and flow regulation) and natural resources that provide products (such as timber, charcoal, palm oil, and tourism spots). Forests in the DRC face deforestation, which has increased significantly in the DRC since 2010 and is driven by subsistence agriculture, fuelwood production, logging, and expansion of road and urban infrastructure. Climate change may worsen deforestation in the Congo Basin as changes in precipitation lead to increased drying (due to increased evapotranspiration resulting in desiccation) over the Sahel, Ethiopian highlands, and Guinean coast (Table 9). (1, 32)

Climate change could also affect forests by causing vegetation and species shifts. Climate models suggest that tropical evergreen forests may expand north- and southward, seasonal forest may shift east, and grassland may decline in the northeast. Furthermore, while the Congo Basin region may experience a slight increase in vegetative production and soil organic matter in the first half of the 21st century, increasing temperatures after mid-century are expected to result in declined vegetative production and soil organic matter. This could eventually lead to a decline in resource availability and overcrowding, threatening local species such as bonobos, chimpanzees, mountain gorillas, and forest elephants. (32, 33)

Climate change impacts to natural resources management will have implications for food security and vice versa. Impacts that decrease agricultural production may incentivize more households to rely on forest products and wildlife or expand land cultivation through deforestation, which could increase forest and biodiversity loss. Climate change could also shrink existing protected habitats or shift distribution of endangered species outside zones of protection, putting both humans and wildlife at risk from disease transmission and affecting livelihoods that depend on tourism revenue. (32)

Table 9: Climate risks to natural resources management.

Climate Stressors	Risks
Increased temperature	• Increased intensity and spread of fires, resulting in changes to species composition and distribution and wildlife corridor movement • Increased spread of invasive species in protected areas, resulting in less fodder available for wildlife and habitat degradation • Species range shifts that result in loss of native species, such as degradation of fish breeding areas • Decrease in vegetative production and soil organic matter
Prolonged dry spells	• Loss of climate-sensitive plant species, resulting in decreased biodiversity • Worsening of deforestation

Ecological Sensitivity and Endangered Species

The DRC is the most biologically diverse country in Africa and is one of the most important centers of biodiversity globally. Food security and biodiversity are inextricably linked; biodiversity helps regulate the water and nutrient cycle and underpins nutritious diets, thereby enhancing the resilience of rural communities in the DRC. Climate change threatens biodiversity at several scales including directly leading to species population decline or even extinction through ecosystem changes resulting from climate stressors including increasing temperatures, changing precipitation patterns, increased wildfires, etc. Climate change also can drive land use changes that results in reduced habitat for species, further depleting biodiversity and affecting food security. (34, 35)

Gender, Youth, and Equitable Access to Services

Climate change will have disproportionate impacts on women and youth. Women in the DRC tend to have lower adaptive capacity, or ability to respond and adapt to to climate shocks and stressors, due to less access to resources such as credit. Women also have decreased ability to control their living situations, as men often control household, financial, and medical decisions in households and hold more institutional power. Girls and youth face obstacles that prevent them from improving their circumstances. About 35 percent of the youth population in DRC is unemployed, preventing them from accessing resources that could help them respond to climate change. Girls are especially vulnerable to gender-based violence that could affect their performance and retention in school, further decreasing their ability for later economic mobility. (29, 36)

Climate change can worsen equality and food insecurity issues faced by women and youth (Table 10). Increased drought may force women and girls to walk further distances to fetch water or wood for cooking. This could put them at increased risk of violence along their route and overburden them with heavier manual labor. Households that lose part of their income due to climate change, such as through

negatively affected agricultural livelihoods, may also be more likely to pull their female children out of school as the education of girls is not prioritized. (36, 37)

Climate change risks in other sectors will have a disproportionately higher impact on communities that are marginalized in general. Climate impacts to livelihood and health will affect poor populations the most, as they may rely more on those livelihoods for income and may lack a financial safety net. Rural populations may have a harder time accessing services during severe weather events. People displaced by conflicts are also especially vulnerable as they may lack a support system and local knowledge.

Table 10: Climate risks to gender, youth, and equitable access.

Climate Stressors	Risks
Increased temperatures, flooding, and drought	• Increased distances for women and girls to walk to fetch water and wood • Decreased household incomes due to affected livelihoods, reducing funds available to put girls in school

EXISTING AND POTENTIAL INTERVENTION MEASURES

Designing and implementing resilience and food security activities in the context of our changing climate requires informed decision-making that takes into account the climate risks identified here, as well as contextualized experience from existing and past activities in the DRC. Failure to account for climate risk in program or activity design and implementation can result in underperforming outcomes or even an inadvertent increase in vulnerability or risks, known as maladaptation.

Table 11 provides a snapshot of potential climate risk management measures that can be considered by teams working in the DRC when addressing the risks identified above. In addition, Table 12 outlines examples of concurrent or active projects in the DRC that have a climate adaptation or food security focus and could present potential lessons learned or opportunities for collaboration. USAID's Climate Risk Management (CRM) tools provide further examples and resources for systematically addressing climate risks throughout the programming cycle, including via the Initial Environmental Examination (IEE).

All activities to strengthen climate resilience and food security should integrate diverse voices and perspectives to result in better and more sustained project outcomes. The impacts of climate change are not felt equally—they disproportionately affect the communities that have been marginalized the most that BHA resilience and food security efforts support every day. Therefore, robust stakeholder engagement with beneficiary communities and those that know the local context (such as civil society organizations) should be a part of designing and implementing climate risk management measures.

Table 11: Potential climate risk management measures.

Climate Risk Area	Potential Climate Risk Management Measures
Crop Production	• Improve access to and promote climate-smart technologies, such as drought, heat, and pest-tolerant seeds, as well as varieties with higher yield potential • Implement nature-based adaptation measures to protect crops from flooding • Partner with Indigenous and local communities to identify and implement climate-resilient agricultural practices

Climate Risk Area	Potential Climate Risk Management Measures
	• Increase accessibility and usability of early warning systems and climate information for farmers • Install more efficient irrigation infrastructure to provide farmers more control over water resources • Incorporate climate risk into agricultural planning to avoid planning cropland in flood prone areas • Train farmers on integrated pest management (IPM) • Increase monitoring and incorporate climate projections into surveillance to catch new pests or diseases before an outbreak occurs • Conduct research on impacts from climate change, such as increased heat and drought, to effects on specific pests and diseases • Implement inclusive and accessible agriculture early warning systems to protect livelihoods of diverse populations
Livestock and Fisheries	• Install boreholes, which can provide water to livestock during drought • Increase herding of goats and sheep, which are less sensitive to drought than cattle • Conduct fish stock assessments to ensure the resource is not overexploited • Avoid introducing non-native or invasive, fast-growing fish species
Food Processing, Storage, Imports, Access to Markets	• Increase accessibility and usability of early warning systems and climate information for supply chain managers • Diversify markets to allow for continued livelihoods during drought
Water Resources Availability	• Coordinate with the government on a national drought contingency plan
Conflict Management	• Improve and protect livelihoods and natural resource management, including improving land tenure rights and natural resource claims, including customary rights, of local and Indigenous Peoples • Develop youth training programs to support unemployed youth and reduce their potential recruitment into armed groups • Use climate change as an organizing principle to build trust between communities and reduce the potential for conflict
Human Health, WASH and Nutrition	• Work with other development objectives, such as implementation of integrated watershed management, to protect WASH infrastructure vulnerable to flooding and drought • Expand mobile health services, particularly in rural areas • Incorporate climate risk into agricultural planning to avoid planning WASH infrastructure in flood-prone areas • Increase malaria surveillance and monitoring to new areas where malaria cases may expand • Monitor seasonal forecasts to determine how rainfall may change and, thus, affect seasonal malaria prevalence • Increase use of gardens to increase availability of nutritious foods • Increase willingness to eat nutritious foods during climate shocks by increasing awareness of benefits • Train communities to conduct surveillance of infectious diseases and provide an effective system for reporting that information

Climate Risk Area	Potential Climate Risk Management Measures
	• Use and promote accessible early warning systems to proactively access areas affected by disease before flooding makes access an issue
Natural Resources Management	• Improve policies around land tenure rights and natural resource claims, including customary rights, of local and Indigenous Peoples to address potential natural resource conflicts • Partner with local communities and Indigenous Peoples to improve land and water management strategies
Ecological Sensitivity and Endangered Species	• Develop an action plan that identifies key endangered and culturally valuable species, assesses their potential vulnerability to climate change, and takes steps to mitigate climate risks and avoid adverse impacts that might compound climate impacts
Gender, Youth, and Equitable Access	• Meaningfully integrate diverse voices and perspectives into activity design to ensure benefits and adverse impacts of climate activities are distributed equitably and avoid maladaptation • When developing new infrastructure, implement hiring guidelines to provide jobs for women and youth, and expand services to rural communities • Work with WASH and water resource providers to increase access to clean and safe drinking water, particularly during drought, to reduce the distances women need to travel to find water • Improve livelihoods of households to reduce the incentive to pull children from school during extreme weather events • Incorporate climate hazard preparation into school curriculums

Source: DRC CDCS Climate Risk Management Annex

Selected Ongoing Experiences

Diverse bilateral, multilateral, philanthropic and religious organizations work across the sectors mentioned above. Table 12 represents ongoing projects in natural resource management, agriculture production and value chains, food security, and climate adaptation.

Table 12: Ongoing projects related to food security and climate resilience.

Program	Amount	Donor	Year	Implementer
Activities under the Central Africa Regional Program for the Environment, including: - Forest resource management and understanding of drivers of forest loss - Environmental monitoring and policy support - Maiko-Tayna-Kahuzi-Biega landscape Areas Project		USAID	Ongoing	- African Wildlife Foundation - Wildlife Conservation Society - World Wildlife Fund - African Parks - NASA - University of Maryland - Central Africa Forest Satellite Observatory

Program	Amount	Donor	Year	Implementer
Forests for the Future: For sustainable and scalable Community Forests in the Democratic Republic of Congo		USAID	2020–2025	Rainforest Foundation, UK
Esi Ni Nishati Kwa Kila Mtu (Gas Is Affordable Alternatives To Charcoal Activity)		USAID		BBOXX Ltd.
Tanganyika Conflict Mitigation and Reconciliation	$9.975 million	USAID	2018–2024	Pact, Inc.
USAID's End Malaria Project	$39.9 million	USAID	2021–-- 2026	Chemonics International
Accelerating Peri-Urban Water And Sanitation Services In Kasai Oriental And Lomami Provinces Activity (DRC Peri-Urban WASH)	$21.7 million	USAID	2020–-- 2025	Chemonics International
Strengthening capacities in the Agriculture, Forestry and other Land Use sector of the DRC to enhance transparency and tracking of the Nationally Determined Contribution	$1.95 million	GEF Trust Fund	2022–2025	FAO
Reducing vulnerability and increasing resilience to climate change through promoting innovation, transfer and large-scale deployment of adaptation-oriented technologies in priority agriculture value-chains and creating jobs	$44 million	LDCF	2022–- 2027	UNIDO
Climate Resilient Growth and Adaptation in Democratic Republic of Congo	$28 million	LDCF	Concept approved	UNDP
Improvement of the nutrition situation in sub-Saharan Africa		German Federal Ministry for Economic Cooperation and Development	2016–-- 2019	GIZ, DRC Ministry of Agriculture and Rural Development
Healthy School and Village (promoting WASH services in schools, villages, and health centers)		UNICEF	Ongoing	UNICEF

Program	Amount	Donor	Year	Implementer
National Agriculture Development Program	$500 million	World Bank	2021–2026	DRC Ministry of Agriculture and Rural Development
DRC Multisectoral Nutrition and Health Project	$50 million	World Bank	2022 approval. End date TBC.	DRC PRONANUT

USAID = United States Agency for International Development; NASA = National Aeronautics and Space Administration; GEF = Global Environment Facility; LDCF = Least Developed Countries Fund; FAO = Food and Agriculture Organization; UNIDO = United Nations Industrial Development Organization; UNDP = United Nations Development Programme; GIZ = Deutsche Gesellschaft für Internationale Zusammenarbeit; UNICEF = United Nations Children's Fund; DRC PRONAUT = National Nutrition Program

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