Climate Centre

Country-level | Climate fact sheet

Colombia

1. Country overview

Colombia is the fourth largest country of South America with a continental landmass of 1,14.748 square kilometres (km^2), and the only one with both Caribbean and Pacific coasts (República de Colombia 2010). It is estimated that 81 per cent of its 49 million inhabitants live in urban areas (Central Intelligence Agency (CIA) 2018), with the majority of its population concentrated in the Andean highlands (60 per cent) (World Population Review 2020) and along the Caribbean coast. Colombia is a middle-income country, where 68 per cent of the labour force works in the service industry.

Nonetheless, 27 per cent of the population lives below the national poverty line, making Colombia the second most unequal country in South America with a Gini index of 50.4 (CIA 2018; World Bank n.d.). The Gini index is a measure of the distribution of income across a population, developed by the Italian statistician and sociologist Corrado Gini in 1912.

Colombia is also faced with an acute internal displacement situation with 139,000 new Internally Displaced People (IDP) in 2019, making an overall total of 5,576,000 people (Internal Displacement Monitoring Centre (IDMC) n.d.). At the same time, the country is the second-largest host for asylum-seekers, with 1.8 million displaced Venezuelans living in Colombia (United Nations High Commissioner for Refugees (UNHCR) n.d.).

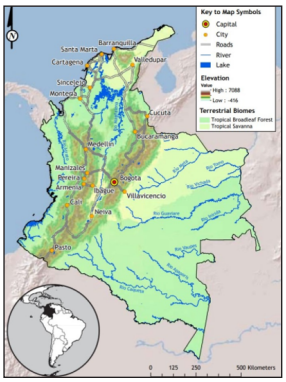

Figure 1: Map of Colombia. Source: World Bank,2011

Figure 2: Colombia's ND-GAIN Ranking (ND-GAIN 2021).

1.1 Climate

Colombia's climate is typically tropical, showing limited temperature variability across seasons. There are great geographical variations across the country (from the Andes Mountains to the Amazon rainforest) creating four main climatic zones.

2021

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The lower-lying tropical zone (tierra caliente: below 900 metres (m)) spreads over 86 per cent of the country, with alternating dry and wet seasons corresponding to summer and winter. The temperate zone (tierra templada: at 900–1,980m) is the most productive land and is home to the majority of the population. It displays two wet seasons between January and March, and July and September. The cold zone (tierra fría: at 1,980–3,500m) supports 25 per cent of the population, including the capital Bogotá. Here, two wet seasons occur between April and May, and September to December. The Paramós zone (at 3,500–4500m) is a treeless zone going up to the permanent snowline (Magrin *et al.* 2007; República de Colombia 2010; United States Agency for International Development (USAID) 2017).

The main regional climate process driving annual rainfall distribution in Colombia is the position of the Intertropical Convergence Zone (ITCZ); while spatial variability is determined by the interaction of the ITCZ with the topography of the Andes Mountains, western Atlantic oceans, eastern Pacific oceans and the Amazon basin. In addition, El Niño Southern Oscillation (ENSO) creates irregular periodic variation in the temperature of the wind as well as sea surface temperature, thus influencing year-to-year variability and extreme weather events such as heatwaves, droughts and floods. El Niño creates warmer and drier conditions than average, whereas La Niña is associated with wetter conditions. The wettest zone is the West Pacific coast (with annual average rainfall of up to 7,000 millimetres (mm)) and precipitation generally decreases moving eastwards across the country, with the exception of the eastern slope of the Andes Mountains (5,000mm per year) and arid deserts (below 500mm per year). Northern areas receive less rain (1,070mm per year) but remain vulnerable to hurricanes and seasonal floods due to poor drainage (USAID 2017; World Bank n.d.; World Bank 2011).

1.2 Climate change

Historical climate	Projected climate
Temperature	
Temperature has increased by 1°C in the last 20 years, with increasing trends of daily mean and minimum temperatures for the past 30–40 years (Magrin *et al.* 2007).	Temperature increases of between 1°C (Representative Concentration Pathway (RCP) 2.6) to 2.5°C (RCP 6.0) by 2100 are projected across the country, with a more significant increase at higher altitude (World Bank n.d.).
The frequency of hot days and hot nights has increased significantly every season since 1960 (+20 per cent in 1960– 2006) (República de Colombia 2010).	Numbers of hot days and hot nights will double by 2100 (RCP 6.0) (World Bank n.d.).

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Precipitation

There has been an annual precipitation variation of -4–6 per cent (during the period 1961–1990) (Magrin *et al.* 2007).

The frequency and magnitude of extreme rainfall events has increased, while the frequency of tropical cyclones has doubled (during the period 1851–2005) (USAID 2017).

Sea level has risen by 1–3mm per year (during the period of 1961–1990) (World Bank 2011).

Glacier coverage is shrinking by 3–5 per cent a year and main catchment rivers are experiencing decreasing runoff trends. (World Bank 2011).

By 2100, 34 per cent of Colombia will be at risk of facing significant annual rainfall variation (-30 per cent to -10 per cent or 10–30 per cent) (República de Colombia 2010).

The frequency of extreme rainfall days could increase by 26–37 per cent by 2050 (USAID 2017).

Sea level rise could increase by 40–60 centimetres (cm) by 2050, making 55 per cent of the Caribbean coast population and 41 per cent of the Pacific coast population vulnerable to flooding (Magrin *et al.* 2007).

Total glacier and snow cover collapse is projected by 2050 (RCP 8.5) (Rabatel *et al.* 2017).

1.3 Climate vulnerability

Colombia faces high and increasing vulnerability to climate change. Population concentration in the Andes – which faces increased precipitation variability, glacial collapse and reduced water availability – will increase stressors on large swathes of the population. In addition, coastal populations face increased flooding and erosion. Both circumstances will continue to drive increases in displacement (United Nations Development Programme (UNDP) 2010).

However, according to Colombia's Notre Dame Global Adaptation Initiative (ND-GAIN) score of 48.4, climate vulnerability could be manageable if adequate improvements are implemented to address current low readiness. The highest vulnerability components identified by the ND-GAIN index are health, projected change in cereal yield, and insufficient dam capacity to ensure adequate water management (ND-GAIN n.d.). Other significant climate-driven vulnerabilities include:

1. reduced water supplies and water quality, along with increasing extreme rainfall events (USAID 2017)
2. increases in vector-borne and waterborne diseases (Tran *et al.* 2015)
3. population and national assets facing significant economic risk due to natural hazards (World Bank n.d.)
4. sea level rise could affect more than one million people (República de Colombia 2010)
5. 3.7 million IDP facing constrained resilience to climate vulnerability (World Bank n.d.).

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2.Humanitarian sectors and climate change

2.1 Water and habitat

Though Colombia is a water-rich country, mismanagement, inadequate dam capacity, unequal distribution and climate-driven impacts, such as rainfall variations and glacial collapse, are projected to produce or exacerbate severe water shortages that increase conflict and displacement (República de Colombia 2010).

Climate projections estimate that one-third of the territory will face significant annual variation in rainfall by 2100, with some areas becoming up to 30 per cent dryer and others 30 per cent wetter, therefore requiring major adaptation measures (República de Colombia 2010). In addition, the projected increase in extreme rainfall events by 26–37 per cent by 2050 will affect the temporal availability of water resources, as well as a tendency to trigger natural hazards such as landslides and flooding (USAID 2017). Flooding is projected to account for 66 per cent of future natural disasters, and to become the main environmental threat to already vulnerable people in coastal communities (threatening 87 and 46 per cent of the populations of the Pacific coast and Caribbean coast respectively) (Prevention Web n.d.; World Bank 2011). Across the country, 14 million people are already at permanent risk of being impacted by floods (Wong 2018).

The ND-GAIN assessment identifies "projected change of annual runoff" and insufficient "dam capacity" to be the two main components of Colombia's water vulnerability (ND-GAIN n.d.). Reduction of annual runoff of up to 30 per cent can already be observed in major river basins where the majority of the population is established, such as the Magdalena River basin (Magrin *et al.* 2007; República de Colombia 2010). Half of municipal headwaters are already showing signs of water shortage, and climate change projections show shortages will be greater in the Andes where 80 per cent of the population is located (República de Colombia 2010). Increased pressure on water resources is likely to lead to more informal and illegal use of water, giving rise to additional conflict during water scarce periods (Organization for Economic Co-operation and Development (OECD) 2015). In addition, dam capacities are insufficient to meet altered water influx from decreasing glaciers and increasing extreme rainfall events (very high vulnerability according to the ND-GAIN index of 0.945) (ND-GAIN n.d.). A drastic reduction in hydropower production capacity will affect 43 per cent of existing dams, leaving the energy sector highly vulnerable as the climate changes (República de Colombia 2010).

In addition to these climate-driven water shortages, extreme rainfall events are likely to cause increasing damage to water distribution infrastructure, while increasing contamination from human waste. Only 40 per cent of rural water systems are currently being managed safely (OECD 2015). 4.9 million people continue to lack access to improved sanitation, creating significant risk of water-borne disease and decreased access to potable water for vulnerable populations (WaterAid Global n.d.). One of the main needs of a conflict-affected population remains access to safe water; therefore, climate change will likely exacerbate existing water challenges (European Civil Protection and Humanitarian Aid Operations (ECHO) 2019).

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2.2 Economic security

Colombia faces various climate-driven socioeconomic stressors including crop, livestock and infrastructure damage. It has high economic risk (ranking 10th in the world) linked to three or more natural hazards. More than 80 per cent of its population and assets are exposed to the impacts of earthquakes as well as from climate-driven flooding and landslides (República de Colombia 2010). During the 2010–2011 extreme rainfall events, damage to crops and infrastructure caused 6 billion US dollars in damages (USAID 2017). Although agriculture and livestock livelihoods only represent 17 per cent of the labour force, these sectors are highly vulnerable to climate change-induced stressors.

In addition, the livestock sector (which represents 19 per cent of agricultural employment) is highly impacted by climate change and has suffered a 1.8 billion US dollars loss over the last decade due to ENSO (Federacíon Colombiana de Ganaderos (FEDEGAN) 2018). With decreased precipitation and higher temperatures, it is projected that pasture and animal growth will reduce and negatively impact annual meat and milk production by 25 per cent by 2100 (Tapasco *et al.* 2019). In addition, heat stress and the expansion of livestock pathogens' geographic range is likely to increase livestock mortality (Tapasco *et al.* 2019).

By 2050, it is projected that 14 per cent of national gross domestic product (GDP) will be affected by climate change stressors, impacting 3.5 million people's livelihoods in the sector of agro-industries as well as food and nutrition security, and related supply chains (Ramirez-Villegas *et al.* 2012). By then, 80 per cent of all crops will face some impacts of climate change (Ramirez-Villegas *et al.* 2012). High value perennial and exportable crops like bananas, tropical fruit and coffee are more vulnerable to these severe impacts (Ramirez-Villegas *et al.* 2012), thereby hindering crop substitution programmes from promoting diversification from the illicit agriculture of coca (Schiffman 2019). Some rural communities are reverting to coca production because of its higher crop resiliency (Schiffman 2019), to the detriment of personal safety from violent conflicts. Illicit methods of coca production involve the deforestation of large areas, rendering small-scale farmers more at risk of large-scale landslides (López-Rodríguez *et al.* 2008). These effects are likely to be generalized across the country, adding land use stress to more than 60 per cent of agricultural areas (Ramirez-Villegas *et al.* 2012). Projected climate change impacts will reinforce existing land deterioration and conflict over land use. It estimated that 50 per cent of the most fertile remaining land is under the control of armed groups and that 5 million IDP have fled from rural areas since 1985 (USAID n.d.).

Climate-driven rainfall reduction will have high to very high impacts on 47 per cent of farmers' livelihoods (Magrin *et al.* 2007) as farmers in more than half of large-scale irrigation schemes have already been impacted by lack of water and soil deterioration. Smallholders' livelihoods and urban food supplies provided in local markets face significant threat (Eitzinger *et al.* 2012). A food security and livelihood assessment in Bogotá demonstrated that a 2°C temperature increase would make all regional commonly used crops climatically unsuitable for the area by 2050 (Eitzinger *et al.* 2012).

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2.3 Health

Climate change is projected to significantly impact the health of Colombians by continuing to drive an increase in communicable disease along with an increase in morbidity and mortality from heatwaves, an increase in exposure to air pollutants, and a decrease in medical capacity, coupled with increased demands on already burdened healthcare infrastructure (World Health Organization (WHO) 2015).

Climate change will continue to contribute to an increase in communicable diseases, especially vector- and waterborne ones such as malaria and dengue fever. Malaria transmission is highly susceptible to temperature and precipitation increases – even a 2°C temperature increase doubles the number of infectious mosquitos (World Bank 2011). Climate variability and severe weather shocks have been shown to have an impact on waterborne disease transmission, often (but not always) driving up infection rates (De la Mata *et al.* 2014).

Currently, 13 million Colombians live in areas with endemic malaria risk (Tran *et al.*, 2015); under a high emissions scenario this number is projected to increase to 64 million people by 2070 (WHO 2015). It is projected that Andean areas will be disproportionately impacted due to inadequate water, sanitation and hygiene (WASH) infrastructure and increases in temperature and precipitation (UNDP 2010). It is further important to highlight that most cases are expected to be borne by those living in poverty (World Bank 2011).

Heatwaves will continue to grow in frequency and severity, and will impact vulnerable populations in urban areas the most. This includes children, the elderly, street workers, those with chronic illnesses and other marginalized groups (USAID 2017). Under a high emissions scenario, morbidity and mortality are projected to increase significantly; by 2080 heat-related deaths within elderly populations could be 87 times as high as the 1990 baseline (WHO 2015). Urban populations will also face deteriorating air quality as rising temperatures increase ozone and pollutants that can cause cardiovascular and respiratory ailments (USAID 2017).

WHO has indicated that climate change is projected to contribute to an increase in mental health issues (WHO 2015). While climate anxiety exists among the population writ large, it poses an even bigger challenge to IDP. These people largely settle in marginalized urban settings and face high levels of physical and emotional stressors in addition to those triggered by displacement. Half of IDP are challenged by mental health problems, such as major depression disorders and post-traumatic stress disorder, and their needs are rarely met by interventions (Shultz *et al.* 2014). Therefore, climate-driven increases in IDP are projected to have an associated increase in demand for mental health care (Shultz *et al.*, 2014).

Finally, WHO has also flagged that climate change carries the potential to overload and damage hospital infrastructure (WHO 2015). This is particularly significant given that one of the highest vulnerability components identified is health; therefore, increased demands on healthcare infrastructure will occur at the same time as decreasing numbers of medical staff, which in turn threatens to undermine quality of care and health outcomes in the country (Rodríguez Moreno *et al.* 2017).

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2.4 Protection

Colombia faces the second-highest rate of internal displacement linked to violence and conflict in the world. It is estimated that 5.6 million people have been displaced over the last 50 years of a conflict opposing the government and the Revolutionary Armed Forces of Colombia (IDMC n.d.). Since the Peace Agreement of 2016, fighting between armed groups has led to 139,000 new IDP in 2019 alone (IDMC n.d.). Conflict-based IDP are frequently the more vulnerable IDP to climate change as they are often dispossessed from their land and are not able to return to home communities. They are more likely to settle for a long period of time in precarious informal urban settlements exposed to climate-driven disasters (Shultz *et al.* 2014). Violent conflicts on the Pacific coast created more than 23,000 IDP in a region where half of the urban population will be under threat of flooding by 2060 (World Bank 2017). It is estimated that 3.7 million of the current 5.6 million IDP are especially vulnerable to climate change (World bank n.d.), amongst which indigenous peoples and women are overrepresented (Shultz *et al.* 2014).

The Internal Displacement Monitoring Centre expects pressure on local resources to continue to increase, as 155,000 new IDP per year result from environmental disasters (IDMC n.d.).

National security and military resources may be used more frequently in the future to provide humanitarian basic needs and support immediate relief following climate-driven disasters (Catarious *et al.* 2009; Warn *et al.* 2014). In addition, multiple national security missions and infrastructure are likely to be impacted by floods and other extreme weather events (Catarious *et al.* 2009).

2.5 Policy

Colombia has a robust climate policy in place. It has ratified the Paris Agreement and committed to a 20 per cent reduction in emissions by 2030 (Climate and Development Knowledge Network (CDKN) 2019).

Over the past decade, the policy landscape has shown a shift from mitigation to a focus on adaptation strategies (Tran *et al.* 2015). Colombia has mainstreamed climate change adaptation by launching the national plan for climate change adaptation (PNAAC) in 2012, with a commitment to increasing climate resilience by 2030 (Departamento Nacional de Planeación 2012). In 2015 the country submitted its Intended Nationally Determined Contributions (INDC) to the United Nations Framework Convention on Climate Change (UNFCCC) (UNFCCC/Gobierno de Colombia 2016). A national climate change policy was then built off the PNAAC and features: an emphasis on reducing socioeconomic and ecosystem harm; a commitment to iteration; and a pledge to develop and implement both sectoral and regional adaptation strategies (Departamento Nacional de Planeación 2012).

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Key sectors for mitigation and adaptation are agriculture, forestry and other land use (representing 46 per cent of Colombia's emissions) along with energy (42 per cent of total emissions) (NDC Partnership 2017). 14 Nationally Appropriate Mitigation Actions (NAMAs) are in different phases of implementation, while existing climate change plans cover 65 per cent of the national territory (with an objective of full implementation across all regions of Colombia by 2100) (NDC Partnership 2017; Gobierno de Colombia, 2016). 2016 was also the year that Colombia established an Intersectional Commission on Climate Change to facilitate intersectoral implementation.

Targeted policy frameworks are also in place to increase micro-level adaptation strategies. For example, the Integrating Agriculture in National Adaptation Plan of 2017 spells out an adaptation plan for farming families to be able to transition to more resilient crops (Food and Agriculture Organization of the United Nations (FAO) n.d.).

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