CLIMATE RISK COUNTRY PROFILE

ECUADOR

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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).

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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 and guidance on use of climate related datasets.

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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

Ecuador is an Andean country in the northwest corner of South America, with a total land area of 256,370 kilometers square (km^2). It is bordered by Colombia to the north, Peru to the east, with the Pacific Ocean along its western coastline. Ecuador is a topographically diverse country traversed by the Andes Mountains, and is comprised of a double mountain chain, which divides the continental territory into three different regions: Coast, Sierra and Amazon, each with its own distinct characteristics of climate, soils, landscapes and biodiversity (**Figure 1**). Ecuador is recognized as a megadiverse country due to its wide variety of climates, microclimates and terrestrial and marine biodiversity.[1]

With its wide range of climate zones, Ecuador has an extraordinary array of geographical systems, which range from high altitude glaciers to tropical rain forests in the Amazon upper tributaries to dry tropical forest on the Pacific Coast, as well as an insular outpost in the Pacific with the Galapagos Islands. Many of Ecuador's systems are highly vulnerable and already have shown great sensitivity to climate variability and long-term change. Ecuador's ecosystems provide a range of environmental services that are critical to rural livelihoods and urban welfare. As these systems come under pressure from altered climate patters as well as other direct and indirect factors (i.e., deforestation, agricultural and livestock practices), it is likely they will deteriorate due and the quality of environmental goods and services will also decrease.[2]

FIGURE 1. Topography of Ecuador[3]

[1] Ecuador (2017). Third National Communication to the UNFCCC. URL: https://unfccc.int/documents/77568
[2] UNDP (2020). Climate Change Adaptation – Ecuador. URL: https://www.adaptation-undp.org/explore/south-america/ecuador#:~:text=Ecuador%20faces%20a%20variety%20of,possible%20alterations%20to%20ocean%20currents.&text=Periodic%20El%20Ni%C3%B1o%20events%2C%20particularly,climate%20variability%20in%20the%20country.
[3] World Bank Group (2019). Internal Climate Migration Profile – Ecuador.

Ecuador is a small but populous country, with an estimated 17.6 million people in 2020[4] with projections suggesting the country's population could reach over 23 million people by 2050[5]. Approximately 64% of Ecuadorians live in urban areas (2019) and this is expected to reach 67% and 75% by the 2030s and 2050s, respectively. The country has a Gross Domestic Product (GDP) of approximately $108.1 billion in 2019, with an annual growth rate of 0.1% (2019) (**Table 1**). Ecuador is considered a middle-income country, however, approximately a fifth of the population lives below the national poverty line. While Ecuador has made significant strides in expanding its middle class, endemic poverty in rural and indigenous communities persists, resulting in many Ecuadorans dependent upon informal businesses as their sole means of support. In rural areas, access to land is unequal, with smallholder farmers owning a small percentage of the arable land.[6]

TABLE 1. Data Snapshot: Key Development Indicators[7]

Indicator	
Life Expectancy at Birth, Total (Years) (2019)	77.0
Population Density (People per sq. km Land Area) (2018)	76.8
% of Population with Access to Electricity (2019)	100%
GDP per Capita (Current US$) (2020)	$5,600.4

The ND-GAIN Index[8] ranks 182 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, Ecuador is recognized as vulnerable to climate change impacts, ranked 108th out of 182 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 Ecuador's progress

[4] World Bank (2021). DataBank – World Development Indicators. URL: https://databank.worldbank.org/source/world-development-indicators

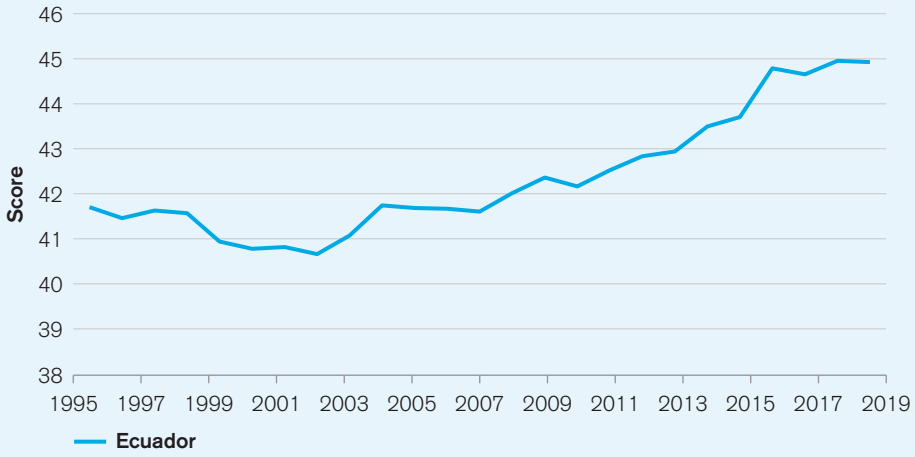
[5] World Bank Open Data, Data Retrieved August 2021. Data Bank: Population Estimates and Projections, Ecuador. URL: https://databank.worldbank.org/data/reports.aspx?source=health-nutrition-and-population-statistics:-population-estimates-and-projections

[6] FINCA International (2021). Fighting Poverty in Ecuador. URL: https://finca.org/where-we-work/latin-america/ecuador/

[7] World Bank (2021). DataBank – World Development Indicators. URL: https://databank.worldbank.org/source/world-development-indicators

[8] University of Notre Dame (2020). Notre Dame Global Adaptation Initiative. URL: https://gain.nd.edu/our-work/country-index/

FIGURE 2. ND-GAIN Index for Ecuador



Ecuador submitted its Nationally-Determined Contributions to the UNFCCC in 2019 and its Third National Communication the UNFCCC in 2017, in support of the country's efforts to achieve its development goals and increase its adaptation and mitigation efforts in response to climate variability and change by enhancing mitigation and adaptation implementation efforts. The Ecuadorian territory is highly vulnerable to extreme events, particularly flooding due to increased rainfall in El Niño phenomenon and increased aridity during La Niña phases.[9]

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.

[9] Ecuador (2017). Third National Communication to the UNFCCC. URL: https://unfccc.int/documents/77568

Climate Baseline

Overview

There is great variety in the Ecuadorian climate, largely determined by altitude and terrain. The mountain valleys have a year-round temperate climate and a humid subtropical climate exists in coastal areas and rainforest in lowlands. The country has two primary seasons that are differentiated by the distribution of rainfall: the rainy season and the summer or dry season. The four regions that form the country have very distinct climates. The coast has a tropical climate and a rainy season that extends from the end of December to May; the thermal regime is characterized by a 2°C to 3°C variation between the hottest and coldest months. The inter-Andean valleys have a temperate climate and rainy season from October to May and a dry season from June to September; average monthly temperatures are about 14.5°C in the rainy season and 15°C in the dry season. The Amazon Region in the eastern part of the country experiences rainfall throughout the year; the average temperature is around 21°C during most months of the year. The Island region comprising the Galapagos Islands has a climate similar to that of the Coastal region. Average temperature is about 25°C to 26°C during the rainy season (December to May) and 21°C to 22°C during the dry season (June to November), mainly owing to the influence of the cold Humboldt current. The climate of the country is strongly marked by the influence of oceanographic factors, of atmospheric circulation and marine currents because they are in the Convergence Zone Intertropical.[10]

Climate variability in Ecuador is closely related with the El Niño Southern Oscillation (ENSO) with increased rainfall and floods in the coast and Western Andes, and droughts in the Northern and Eastern areas. In the medium- to long-term, climate change trends in Ecuador are expected to result in major impacts for the country. These include the intensification of extreme climatic events (e.g. ENSO); sea level rise; increased retreat of glaciers; decrease in annual runoff and increased vulnerability of water resources; increased vulnerability to floods and prolonged droughts; increased transmission of dengue and other tropical diseases; the expansion of invasive species populations in the Galapagos and other sensitive ecosystems of continental Ecuador; and the extinction of certain species.[11]

[10] Ecuador (2015). National Climate Change Plan 2015–2018. URL: https://info.undp.org/docs/pdc/Documents/ECU/PLAN%20NACIONAL%20DE%20CAMBIO%20CLIMÁTICO.pdf

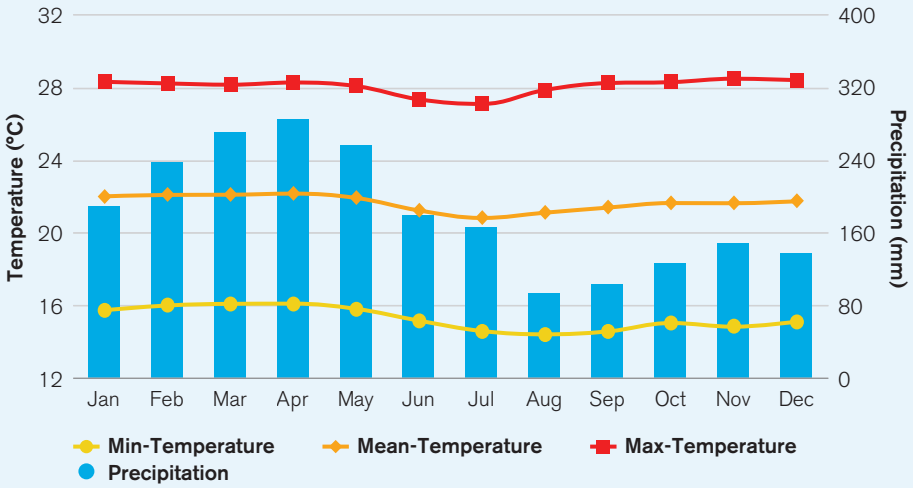
[11] UNDP (2018). National Adaptation Plans in Focus: Lessons from Ecuador. URL: https://www.adaptation-undp.org/sites/default/files/resources/nap_in_focus_lessons_from_ecuador_english.pdf

Analysis of data from the World Bank Group's Climate Change Knowledge Portal (CCKP) (**Table 2**) shows historical climate information for the period between 1991–2020. Mean annual temperature for Ecuador is 21.7°C, with average monthly temperatures ranging between 21°C (July) and 22°C (April). Mean annual precipitation is 2,201 millimeters (mm), with year-round rainfall and highest rainfall occurring February to May (**Figure 3**).[12] **Figure 4** presents the spatial variation of observed average annual precipitation and temperature for 1991–2020.

TABLE 2. Data Snapshot: Country-Level Summary Statistics

Climate Variables	1991–2020
Mean Annual Temperature (°C)	21.7°C
Mean Annual Precipitation (mm)	2,201 mm
Mean Maximum Annual Temperature (°C)	28.1°C
Mean Minimum Annual Temperature (°C)	15.3°C

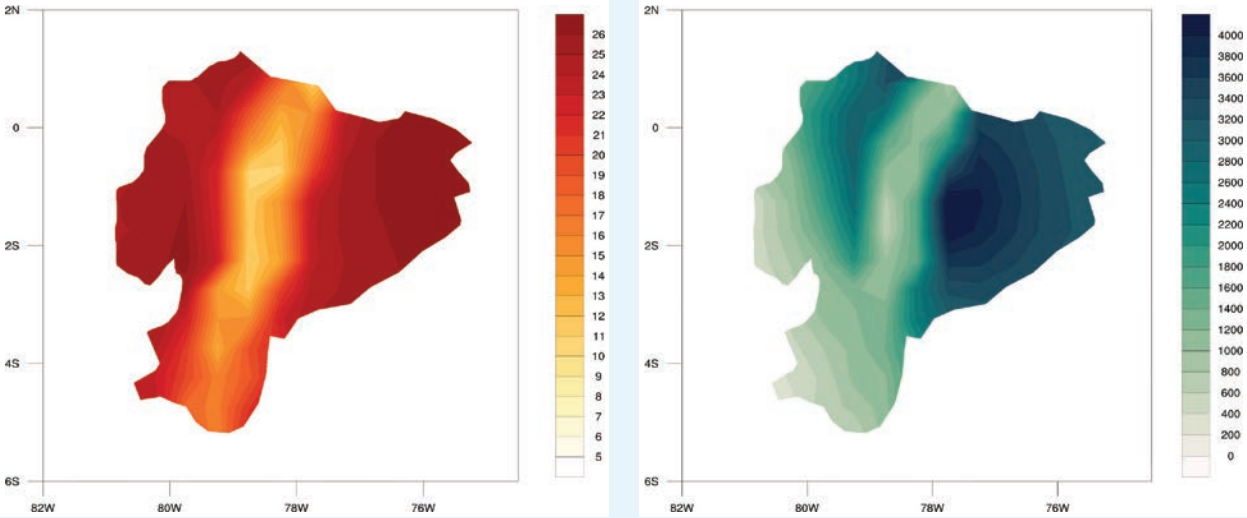
FIGURE 3. Average Monthly Mean, Max, Min Temperature and Rainfall of Ecuador for 1991–2020[13]



[12] WBG Climate Change Knowledge Portal (CCKP, 2021). Ecuador Historical Data. URL: https://climateknowledgeportal.worldbank.org/country/ecuador/climate-data-historical

[13] WBG Climate Change Knowledge Portal (CCKP, 2021). Ecuador Historical Data. URL: https://climateknowledgeportal.worldbank.org/country/ecuador/climate-data-historical

FIGURE 4. Average Annual Temperature (°C) (left); Annual Precipitation (mm) (right) for Ecuador, 1991–2020[14]

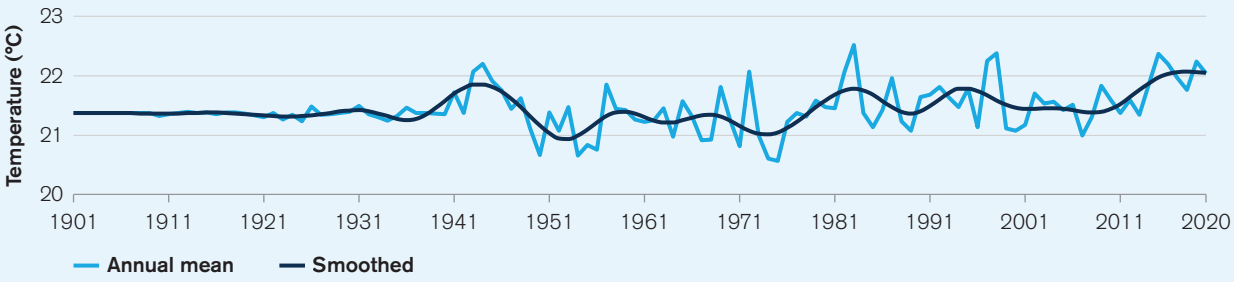


Key Trends

Temperature

Ecuador experienced increases in average as well as minimum and maximum temperatures between 1960 and 2010. Observed average temperature increase was 1.4°C (**Figure 5**), with maximum temperatures increasing by 1.0°C and minimum increasing by 1.1°C.[15] Maximum temperatures have risen between 1°C per decade in the high mountains, and 0.6°C per decade in the sub-paramo regions. The number of warm nights[16] have increased, while the number of cold nights[17] have decreased.[18]

FIGURE 5. Observed Annual Mean Temperature for Ecuador, 1901–2020[19]



[14] WBG Climate Change Knowledge Portal (CCKP, 2021). Ecuador Historical Data. URL: https://climateknowledgeportal.worldbank.org/country/ecuador/climate-data-historical

[15] Ecuador (2019). Nationally Determined Contribution. URL: https://www4.unfccc.int/sites/ndcstaging/PublishedDocuments/Ecuador%20First/Primera%20NDC%20Ecuador.pdf

[16] "Warm: night is defined by the temperature exceeded on 10% of days or nights in current climate of region or season.

[17] "Cold" night is defined by the temperature below which 10% of days or nights are recorded in current climate of that region or season

[18] Ecuador (2015). National Climate Change Plan 2015–2018. URL: https://info.undp.org/docs/pdc/Documents/ECU/PLAN%20NACIONAL%20DE%20CAMBIO%20CLIMÁTICO.pdf

[19] WB Climate Change Knowledge Portal (CCKP, 2021). Ecuador URL:https://climateknowledgeportal.worldbank.org/country/ecuador/climate-data-historical

Precipitation

Ecuador has a high degree of variability in its precipitation trends.[20] The annual amount of precipitation has varied across its regions, but between 1960 and 2006, increasing rainfall occurred in the eastern areas over Ecuador's Amazon rainforest, in the Sierra and along the northern coast, especially in the coastal areas of the provinces of El Oro, Guayas, Santa Elena and Manabí. Annual precipitation increased by 33% in the Coastal Region and by 8% in the Inter-Andean Region. On the other hand, the retreat of glaciers in the Andean region is significant is about 20 to 30% in the last 30 years.[21]

Climate Future

Overview

The main data source for the World Bank Group's Climate Change Knowledge Portal (CCKP) is the CMIP5 (Coupled Model Inter-comparison Project Phase 5) 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.

TABLE 3. Data Snapshot: CMIP5 Ensemble Projection

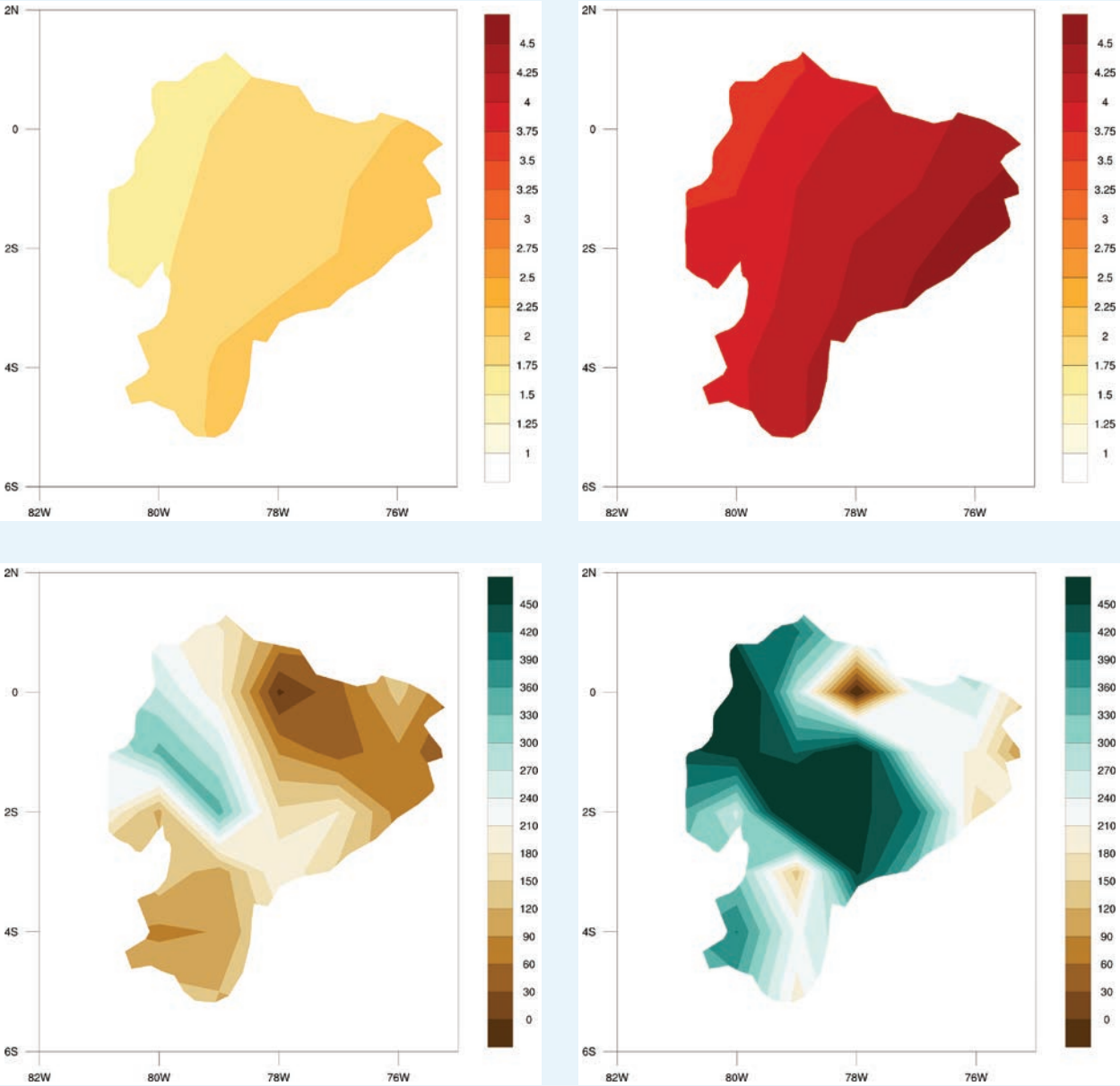
Cmip5 Ensemble Projection	2020–2039	2040–2059	2060–2079	2080–2099
Annual Temperature Anomaly (°C)	**+0.7 to +1.6** (1.0°C)	**+1.3 to +2.7** (1.7°C)	**+2.0 to +4.2** (+2.6°C)	**+2.7 to +5.6** (+3.4°C)
Annual Precipitation Anomaly (mm)	**–23.6 to +43.4** (+5.47 mm)	**–26.0 to +53.9** (+7.52)	**–27.3 to +76.4** (+15.25 mm)	**–31.9 to +93.8** (+22.88 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).

[20] Ecuador (2019). Nationally Determined Contribution. URL: https://www4.unfccc.int/sites/ndcstaging/PublishedDocuments/Ecuador%20First/Primera%20NDC%20Ecuador.pdf

[21] Ecuador (2015). National Climate Change Plan 2015–2018. URL: https://info.undp.org/docs/pdc/Documents/ECU/PLAN%20NACIONAL%20DE%20CAMBIO%20CLIMÁTICO.pdf

FIGURE 6. Multi-model (CMIP5) Ensemble Projected Change (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[22]



[22] WBG Climate Change Knowledge Portal (CCKP, 2021). Ecuador Projected Future Climate. URL: https://climateknowledgeportal.worldbank.org/country/ecuador/climate-data-projections

Key Trends

Temperature

Continued temperature increases will continue in Ecuador, with near-term warming expected along the eastern border, increases by as much as 1.0°C in the inter-Andean valley in the 2030s. The Amazon and Sierra Regions are expected to experience the highest temperatures, with significant increases, by as much as 5°C and 4°C, respectively, by the end of the century under RCP8.5. Coastal regions will also increase, but at a slower pace, reaching temperature increases by as much as 3.3°C in the 2090s.[23]

Across all emissions scenarios, temperatures are projected to continue to rise in Ecuador, through the end of the century. As seen in **Figure 7**, under a high-emissions scenario (RCP8.5), average temperatures are projected to rise rapidly after the 2040s. Hot temperatures, analyzed in terms of the number of days above 25 degrees, are expected to also rise significantly across the seasonal cycle, with the most pronounced changes occurring during June to October by the 2050s (**Figure 8**). Rising temperatures and extreme heat conditions will result in significant implications for human and animal health, agriculture, water resources, and ecosystems.

FIGURE 7. Projected Average Temperature for Ecuador (Reference Period, 1986 to 2005)[24]

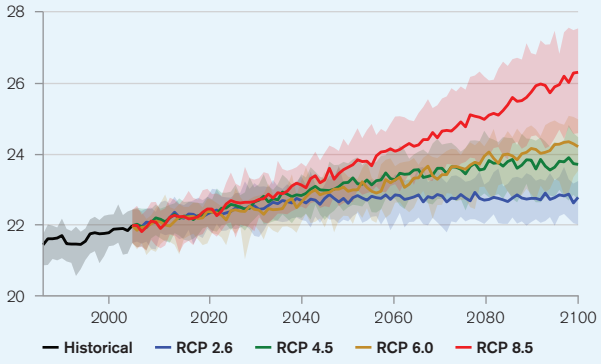
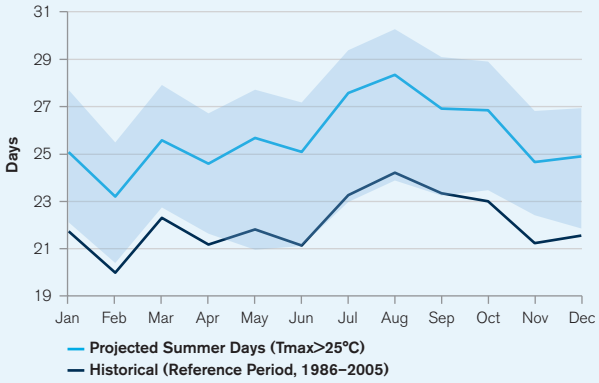


FIGURE 8. Projected Summer Days, 2040–2059 (Tmax >25°C) (RCP8.5, Reference Period, 1986–2005)[25]



[23] Ecuador (2015). National Climate Change Plan 2015–2018. URL: https://info.undp.org/docs/pdc/Documents/ECU/PLAN%20NACIONAL%20DE%20CAMBIO%20CLIMÁTICO.pdf

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

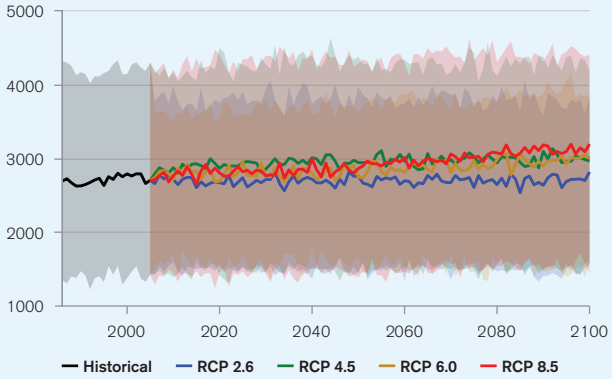
[25] WBG Climate Change Knowledge Portal (CCKP, 2021). Interactive Climate Indicator Dashboard – Agriculture. Ecuador. URL https://climatedata.worldbank.org/CRMePortal/web/agriculture/crops-and-land-management?country=ECU&period=2080-2099

Precipitation

Ecuador experiences a high degree of variability in rainfall patterns and intensity across its climate zones. While the country experiences the most rainfall in its eastern zone of the Amazon Forest, it is expected that to experience heightened dry conditions, with reduced rainfall through mid-century, with an increase in rainfall expected for the second half of the century. Precipitation intensity is expected to increase in the Sierra and Amazon regions, but is likely to decrease, by up to 50%, for the coastal areas of Esmeraldas, Manabi and Santa Elena by mid-century.[26]

As shown in **Figure 9** below, there is significant uncertainty on the future of rainfall patterns for Ecuador,[27] however presented as a nationally aggregated scale, projected show a slight increase in precipitation under a high emission scenario (RCP8.5).

FIGURE 9. Projected Annual Average Precipitation in Ecuador (Reference Period, 1986 to 2005)[28]



CLIMATE RELATED NATURAL HAZARDS

Overview

Ecuador's diverse landscape is subject to the impacts of extreme events. Due to its geographical, morphological, geological, oceanographic, climatic and human conditions, Ecuador is a territory, which is highly vulnerable to the effects of climate variability and change. Past events such as the El Niño phenomenon of 1997 and 1998 caused losses estimated at $2,869.3 million, equivalent to 15% of the country's GDP in 1997. Of these, 783 million (27%) were direct damage and million (73%) were indirect damages. The threats facing the country as a whole, as a result of climate change, are and its effects have historically entailed significant economic and social costs social. Between 1900 and 2009, 65 major disasters were recorded 60% caused by hydrometeorological phenomena (droughts, floods, landslides) and 40% by geophysical events.[29] The highland areas, where most of the country's population is concentrated, are subject to landslides and significant flooding due to increased surface run off from snow melt and extreme rainfall on degraded high elevation forest ecosystems which, in addition, increases sediment loads.[30]

[26] Ecuador (2015). National Climate Change Plan 2015–2018. URL: https://info.undp.org/docs/pdc/Documents/ECU/PLAN%20NACIONAL%20DE%20CAMBIO%20CLIMÁTICO.pdf

[27] WBG Climate Change Knowledge Portal (CCKP, 2021). Ecuador Water Dashboard. Data Description. URL: https://climateknowledgeportal.worldbank.org/country/ecuador/climate-sector-water

[28] WBG Climate Change Knowledge Portal (CCKP, 2021). Climate Data-Projections. Ecuador. URL: https://climatedata.worldbank.org/CRMePortal/web/agriculture/crops-and-land-management?country=ECU&period=2080-2099

[29] GFDRR (2010). Country Note: Ecuador. Disaster Risk Management in Latin America and the Caribbean. URL: https://www.gfdrr.org/en/publication/country-note-ecuador

In addition, volcanic eruptions affect the central zone of Ecuador and drought has been recorded in some provinces in the northern coastal and central regions.[31]

In Ecuador, as temperatures continue to rise, critical glaciers are likely to disappear, further contributing to water shortages in the highlands. In the coastal areas, rising seas, coupled with increased storm surges can lead to localized flooding. Floods are most common especially during abnormal climatic conditions associated brought by the El Nino events. Floods can damage agricultural output and threatening operations at the hydroelectric power projects which generate most domestic energy supplies. Landslides are also common, particularly in the mountainous interior. The hydrometeorological events that have marked the country in recent decades are the phenomenon of El Niño of 1983, 1987, 1992, 1993, 1997, 1998, the warm event of 1997 was catalogued extreme event in terms of climate. These are concentrated in the regions of the Ecuadorian coast and highlands, and in lesser stopover in the Amazon. In year 2012 the rainfall was the highest in the last 10 years and was affected around 195,147 hectares which generated costs of at least 237.9 million dollars.[32]

Data from the Emergency Event Database: EM-Dat database,[33] presented in **Table 4**, shows the country has endured various natural hazards, including floods, landslides, epidemic diseases, storms, earthquakes and droughts, costing lives, and economic damage.

TABLE 4. Natural Disasters in Ecuador, 1900–2020

Natural Hazard 1900–2020	Subtype	Events Count	Total Deaths	Total Affected	Total Damage ('000 USD)
Drought	Drought	2	0	11,000,000	
Epidemic	Bacterial Disease	2	412	17,137	0
	Viral Disease	4	260	104,057	
Flood	Riverine Flood	46	2212	10,198,629	3,452,500
	Flash Flood	2	132	166,283	
	Coastal Flood	2	14	11,050	
Earthquake	Ground Movement	28	3497	1,460,619	2,318,666
	Tsunami	1	111	46	
Landslide (Dry)	Avalanche	2	87	2,411	
	Landslide	1	160		
Landslide (wet)	Avalanche	1	10	117	
	Landslide	37	2880	27,826	2,400
	Mudslide	4	538	48,139	100,000
Storm	Tropical Cyclone	4	28	103,074	50,500
	Convective Storm	3	17	8,258	
Volcanic Activity	Ash Fall	11	22826	56,964	1,000,000

[30] Ecuador (2015). National Climate Change Plan 2015–2018. URL: https://info.undp.org/docs/pdc/Documents/ECU/PLAN%20NACIONAL%20DE%20CAMBIO%20CLIMÁTICO.pdf

[31] GFDRR (2014). Country Program Update May 2014. URL: https://www.gfdrr.org/sites/default/files/publication/country-program-update-2014-ecuador.pdf

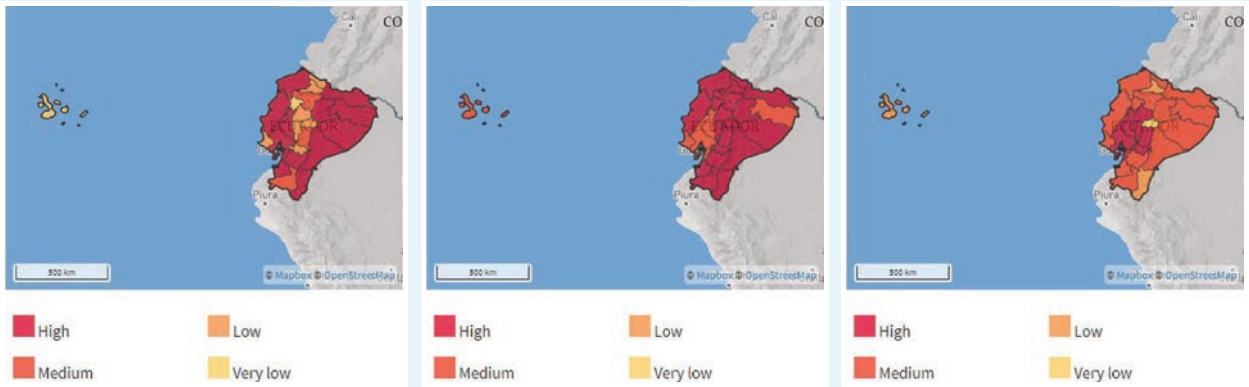
[32] GFDRR (2010). Country Note: Ecuador. Disaster Risk Management in Latin America and the Caribbean. URL: https://www.gfdrr.org/en/publication/country-note-ecuador

[33] EM-DAT: The Emergency Events Database – Universite catholique de Louvain (UCL) – CRED, D. Guha-Sapir, Brussels, Belgium. https://public.emdat.be

Key Trends

As the climate changes, weather related disasters are likely to continue, exacerbating existing vulnerabilities in Ecuador, such as infrastructure conducted on unstable mountains, which could increase the damage and loss from landslides and avalanches. High migration flows are also increasing the vulnerability and poverty of urban areas (**Figure 10**). Vulnerability to phenomena like ENSO and related disasters such as floods and landslides are further exacerbated as 96% of the urban population the live in the coastal and mountainous region. Insufficient policies and land use planning instruments, environmental deterioration of the river basis, the largely-unchecked expansion of farmland, and poorly constructed infrastructure are factors that contribute to the high vulnerability of the country to natural hazards.[34] An estimated, 48% of the country is affected by soil erosion at different degrees, according to the Ministry of Agriculture, Livestock, Aquaculture and Fisheries and the most affected area is the Andean region (70%). About a quarter of the country is also affected by drought. Historically, political instability has also been a major component of the country's vulnerability to disasters. During the 1997/1998 El Nino event, for instance, political instability reduced the capacity of the country to respond to the immediate and long-term needs of the population, increasing its vulnerability. Compared to other Latin American and Caribbean countries, Ecuador can enhance its economic resilience; risk preparedness, and socio-economic fragility.[35]

FIGURE 10. Risk of Riverine Flood (left), Landslides (center), Risks of Extreme Heat (right)[36]



Implications for DRM

The Ecuadorian government has been focused on shifting its Disaster Risk Management (DRM) efforts from emergency response towards understanding and reducing the country's vulnerability to disaster. This trend is due in part to the leadership and example set by the municipality of Quito, Ecuador's capital city, in developing a comprehensive vision and plan for DRM that has prioritized: (i) strengthening compliance with codes and building standards in order to reduce vulnerability of the built environment; (ii) reducing the social and economic vulnerability

[34] GFDRR (2014). Ecuador. Country Program Update. May 2014. URL: https://www.gfdrr.org/en/publication/country-program-update-ecuador
[35] GFDRR (2010). Disaster Risk Management in Latin America and the Caribbean Region: Ecuador. GFDRR Country Notes. URL: https://www.gfdrr.org/en/publication/country-note-ecuador
[36] ThinkHazard! (2020). Ecuador. URL: https://thinkhazard.org/en/report/73-ecuador

of people living in high risk zones; and (iii) strengthening the institutional capacity for DRM both in the public and private sectors, including raising awareness and preparedness of leaders and the community in general. Efforts continue to be ongoing in order to increase preparedness efforts through local municipalities as well as design and implement a national system for the country's DRM approach.[37]

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.[38]

CLIMATE CHANGE IMPACTS TO KEY SECTORS

Agriculture

Overview

Agriculture plays a crucial role in a country's economy and is the backbone of Ecuador's economic system; providing food and raw materials, as well as employment opportunities throughout the country. It is the main source of employment in the country, representing 25% of the economically active population, that is and is the main source of employment for more than 1.6 million people. In 2017, the sector contributed an average of 8.5% of GDP. The country is continuing to expand its land used for farm and agricultural purposes with an annual growth rate of 5.7%. The main agricultural products (in terms of total production) are banana, cacao, flowers, cereals and coffee.[39] Ecuador's agricultural sector is its third largest greenhouse gas (GHG) emitter at 18.17%. The country's livestock sector is dominated by cattle, followed by pigs. Ecuador's largest agricultural production zone is located primarily in the Costa region; the Manabí, Guayas and Esmeraldas provinces represent over 42% of total national land area used for agriculture.[40]

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[37] GFDRR (2014). Ecuador. Country Program Update. May 2014. URL: https://www.gfdrr.org/en/publication/country-program-update-ecuador

[38] 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

[39] FAO (2020). Ecuador – Production data. URL: http://faostat.fao.org/site/339/default.aspx [accessed 17 August 2020]

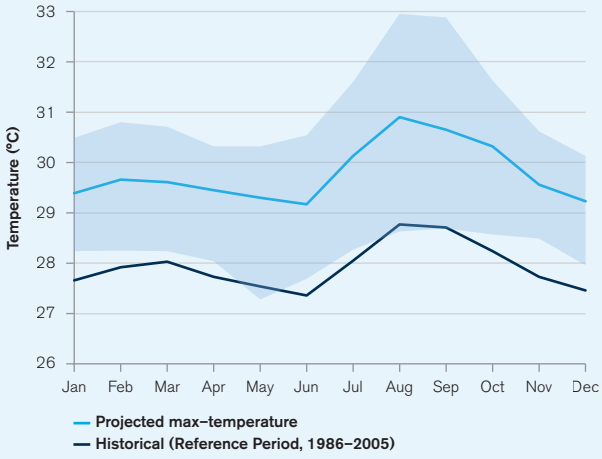
[40] Ecuador (2017). Third National Communication to the UNFCCC. URL: https://unfccc.int/documents/77568

Climate Change Impacts

Agricultural activity in Ecuador is vulnerable to the wide range of extreme events that the country regularly experiences, including floods and droughts, as well as rising temperatures and desertification driven by poor land use practices. The projected impacts from an increased climate variability and change on food production, agricultural livelihoods. Impacts to the country's overall food security in Ecuador are significant national policy concerns. Impacts are crucially linked to future projected water supply constraints. The floods brought about through the La Niña phenomenon in 2010–2011 brought a sum of losses of over 89 million pesos, lowering crop yields and damaging rice, vegetables, and corn.[41] The livestock sector also suffered flooding of 1,165,413 hectares, equivalent to 3% of the livestock area. Small scale agriculture is especially vulnerable in areas over-exploited by livestock. Much of the country's agroecosystems are vulnerable to the effects of drought, soil erosion, desertification and changes in the rainfall and hydrological regimes. The increase of droughts in inland areas pose a risk to crops and livestock. Projections suggest that by 2050, climate change in Ecuador will impact 14% of the GDP corresponding to agriculture, and that without adaptation, 80% of the country's crops could be impacted in more than 60% of their current areas of cultivation, especially high value perennial and export crops. Further, highly specialized niche crops such as coffee, cocoa, and other fruits will likely see critical changes in the prevalence of pests and diseases.[42] Climate change is expected to impact Ecuador's agriculture sector in different ways depending on specific scenarios and crops. By mid-century, it is likely that there will be a deficit in rice production of anywhere from 3% to 60%, if no adaptation measures are pursued. For potatoes, one scenario predicts a shortage of 34%, while a more optimistic scenario projects a surplus in production. Soybeans would also be adversely impacted by climate change, while hard corn would benefit from it.[43]

Rising temperatures, particularly daily maximum temperatures, pose an increased risk of heat stress for livestock and could significantly reduce critical crop yields for rural populations. Under present climate conditions, heat stress already poses challenges for livestock populations, rendering them vulnerable to heat stress during certain periods of the year. Heat stress can reduce milk production and reproduction, particularly for cattle. As heat increases, so is the likelihood of altered growing seasons. **Figure 11** shows the projected change in average daily maximum temperatures for Ecuador across the seasonal cycle, with higher temperatures expected throughout the year by the 2050s, under a high emissions scenario.

FIGURE 11. Projected Average Max Temperature for Ecuador, 2040–2059 (RCP8.5, Reference Period 1986–2005)[44]



[41] FAO (2019). Subregional Strategy to prevent the introduction of Foot-and-Mouth Disease, and Plan of Action to improve the Management and Attention of Health Emergencies. Family Farming Knowledge Platform. URL: http://www.fao.org/3/ca5163es/CA5163ES.pdf

[42] FAO (2018). Agronoticias: Agriculture News from Latin America and the Caribbean. Andean Region. [4 April, 2018]. URL: http://www.fao.org/in-action/agronoticias/detail/en/c/1113859/

[43] Ecuador (2017). Third National Communication to the UNFCCC. URL: https://unfccc.int/documents/77568

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

Adaptation Options

In response to the expected risks posed to the country by increased climate variability, Ecuador launched a National Adaptation Program specifically for agriculture (under current development). The Government has prioritized several, new adaptation measures. Agro-ecological zoning and suitable seasons for sowing and harvesting have been defined and are being promoted to assist farmers maximize seasonal opportunities. The introduction of higher-yield varieties is starting to be used across the country to reduce the need for expansion of the agricultural frontier and the deforestation rate, and to increase growing efficiency. Implementation of irrigation systems are staring to become more widespread as is the expanded use of fertilizers and pest and disease control systems.[45] Ecuador has also committed to the development of research, systems, techniques for improved production regarding crops and livestock in relation to needed climate change adaptation. Additionally, technical assistance programs, capacity building, and financing of adaptation measures have been introduced in the agricultural sector, through intra-sectoral, multi-sectoral coordination and public, private, and community cooperation.[46]

Water

Overview

Much of Ecuador is endowed with abundant natural water resources, but this is not equally accessible throughout the country. However, over 88% of the population lives in the Pacific basin, an area with relatively limited water availability with just 31% of available water resources located in the area. At a national scale, 80% of the population has access to water and 65% have access to sanitation. Accessibility decreases to coverage of less than 40% in rural areas.[47]

Climate Change Impacts

For Ecuador's water sector, climate change is expected to further exacerbate these conditions, aggravating access to water, especially in the most vulnerable areas. Impacts related to excess precipitation and extreme rainfall are expected to be most impactful in the coastal and Andean region, mainly in the central and southern areas, while those related to the period of shortage of precipitation would accentuate in the central zone of the coast and in the central zones and south of the Sierra region. Another impact associated with water resources is the decline in glaciers, which have lost more than 50% of their surface area in the last 50 years. This will continue to result in significant impacts for water users, both for household consumption and agricultural needs. In Andean communities, loss of glacial area and increased melt is especially likely to result in increased risk of landslide.[48]

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[45] FAO (2018). Agronoticias: Agriculture News from Latin America and the Caribbean. Andean Region. [4 April, 2018]. URL: http://www.fao.org/in-action/agronoticias/detail/en/c/1113859/

[46] Ecuador (2019). Nationally Determined Contribution. URL: https://www4.unfccc.int/sites/ndcstaging/PublishedDocuments/Ecuador%20First/Primera%20NDC%20Ecuador.pdf

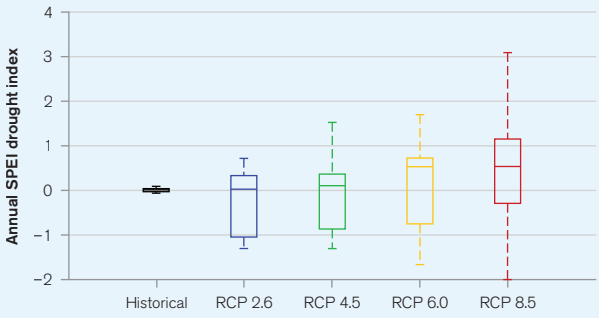
[47] Nolivos, I et al. (2015). Challenges for a sustainable management of Ecuadorian water resources. *Sustainability of Water Quality and Ecology*. 6(September 2015), 201-2016. DOI: https://doi.org/10.1016/j.swaqe.2015.02.002

[48] Ecuador (2015). National Climate Change Plan 2015–2018. URL: https://info.undp.org/docs/pdc/Documents/ECU/PLAN%20NACIONAL%20DE%20CAMBIO%20CLIMÁTICO.pdf

In the short-term, river basins could experience an increase in frequency, intensity and occurrence of intense rainfall, resulting in flood events. In between these heavy rainfall events, a reduction in precipitation is expected, increasing aridity and may lead to drought conditions. The glaciers and snow-capped peaks of the Andean region already show effects from warming trends. It is estimated that glacier retreat and thawing processes will accelerate even more in the coming decades, which has important implications for the country's hydrographic basins associated with the country's most important glaciers. While these trends may cause an initial increase in water availability due to the greater thawing, it will be followed by heightened water stress that will increase as the glaciers disappear, and reduce/eliminate this contribution volume.[49] When understanding Ecuador's water conditions, it is essential to consider the role of the moors, since the characteristics of the comprising soils and vegetation enable these areas to provide essential environmental services such as the regulation of water balances in basins and water storage, thus contributing to the sustainability of flows. The changing variability of precipitation regimes and the occurrence of extreme events will affect the water balance and this process, and exacerbated by climate change, this will cause greater water stress in the regions of Ecuador that depend for their supply on stored and regulated water by the páramos. Changes in melt, storage and runoff patterns could also affect river systems in valleys. As a consequence, repercussions could be expected on agricultural, forestry and livestock production, the availability of water for consumption by society and industry, hydroelectric generation, and the integrity of ecosystems and their services.[50]

Figure 12 shows the projected annual Standardized Precipitation Evapotranspiration Index (SPEI), 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 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 regard 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. At national scale, Ecuador is expected to experience slightly increased SPEI through the end of the century, representing slightly wetter conditions, however water deficits will vary across the country.

FIGURE 12. Projected Annual SPEI Drought Index in Ecuador (Reference Period, 1986 to 2005)[51]



[49] Moreno, L., et al. (2020). Integrating water-quality analysis in national household surveys: water and sanitation sector learnings of Ecuador. *Nature*. 3(23). URL: https://www.nature.com/articles/s41545-020-0070-x

[50] Ecuador (2017). Third National Communication to the UNFCCC. URL: https://unfccc.int/documents/77568

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

Adaptation Options

Ecuador is committed to strengthening its water management and has introduced its National Water Plan, which supports the democratic and sustainable governance of the country's water and sanitation sectors. Key efforts are ongoing to strengthen local and national capacities to enhance and enforce institutional regulations for he sectors. Prioritized efforts remain on actions to preserve the country's existing aquifers as well as the quality of water and water sources. Investment has been made to improve the technical, social, environmental, institutional and financial sustainability indicators of water service providers in the four primary provinces, Esmeraldas, Bolívar, Los Ríos and Manabí. Civil society organizations have also been included in the formulation of regulatory frameworks, quality monitoring and the sustainable management of water services to improve local capacities and appropriateness of interventions.[52]

Energy

Overview

Ecuador's energy sector includes both electricity generation activities, as well as those energy consuming sectors, specifically: transport, the residential sector, the public, the commercial sector and the industry.[53] The country has productive petroleum reserves, which account for approximately 76% of the country's export earnings. The country also relies on natural gas, hydropower and biofuels to meet the country's energy demands. Ecuador is an oil-producing country, which is exported mainly in the form of crude oil, while refined products are imported for national consumption. Production in the Amazon has continued to grow steadily in average daily production volumes.[54]

Climate Change Impacts

Hydropower in Ecuador maintains a critical role in the country's energy policies and broader mitigation commitments and reducing the country's greenhouse gas emissions. Changes to precipitation patterns, glacial melt and river flow are all expected to negatively impact generation capacity as well as the overall sector to meet its commitments and client demand. Extreme events are expected to have an impact on Ecuador's energy sector. For Ecuador, large-scale hydropower is currently considered as the main means for attaining energy security, reducing electricity prices and mitigating GHG emissions in the long-term. However, uncertainty around the impacts of climate change, investment cost overruns and restrictions to untapped resources may challenge the future deployment of hydropower and consequently impact decarbonization efforts for Ecuador's power sector.[55]

It is estimated that 590 megawatts (MW) of electricity generation, mainly thermoelectric and hydropower that is located in the coastal region, could be affected by floods.[56] Additionally, the expectation for decreased rainfall in

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[52] Sustainable Development Goals Fund (2017). Case Study: Water Governance in Ecuador. URL: https://www.sdgfund.org/sites/default/files/Case%20Study%20-%20Ecuador%20Agua%20-%20EN.pdf

[53] Peláez-Samaniego, M.R. et al. (2007). Energy sector in Ecuador: Current status. *Energy Policy*. 35(8), 4177–4189. DOI: https://doi.org/10.1016/j.enpol.2007.02.025

[54] Ecuador (2017). Third National Communication to the UNFCCC. URL: https://unfccc.int/documents/77568

[55] Carvajal, P. and Li, F. (2019). Challenges for hydropower-based nationally determined contributions: a case study for Ecuador. *Climate Policy*. 19(8). DOI: https://doi.org/10.1080/14693062.2019.1617667

[56] Carvajal, P. et al. (2019). Large hydropower, decarbonization and climate change uncertainty: Modelling power sector pathways for Ecuador. *Energy Strategy Reviews*. 23 (January 2019), 86–99. DOI: https://doi.org/10.1016/j.esr.2018.12.008

the area would also affect generation capacities. The torrential rains would generate landslides, which would cause damage to the power lines, with cuts also likely in the power supply. Additionally, the strong erosive processes, linked to torrential rains, contributes to large amount of sediment and suspended materials, clogging the dams with the possibility of preventing the turbination. Glacial retreat also affects negatively the amount of snow falling in winter, thereby reducing potential runoff.[57] Increased temperatures will create greater demand for air conditioning, which in the immediate future, is not expected that these peak periods will always be able to cover demand through existing hydroelectric generation. Increases in temperatures can also have an impact on the performance and useful life of the equipment (generation and transmission), as well as on the increase in losses due to the transmission and distribution of electrical energy.[58]

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) will increase. As seen in **Figure 13**, seasonal increases for cooling demands are expected to increase throughout the year. The Warm Spell Duration Index 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 in **Figure 14**, warm spells are projected to sharply increase in the second half of the century.

FIGURE 13. Projected Change in Cooling Degree Days in Ecuador for 2050s (Reference Period, 1986–2005)[59]

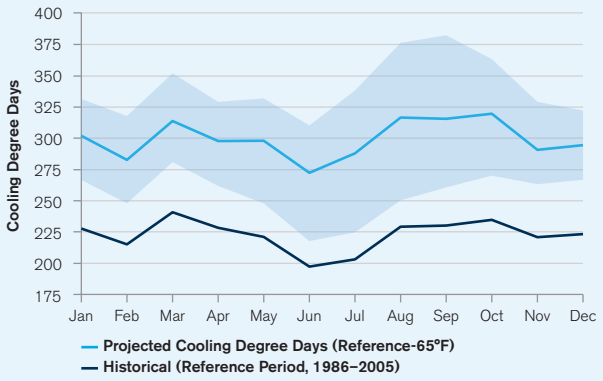
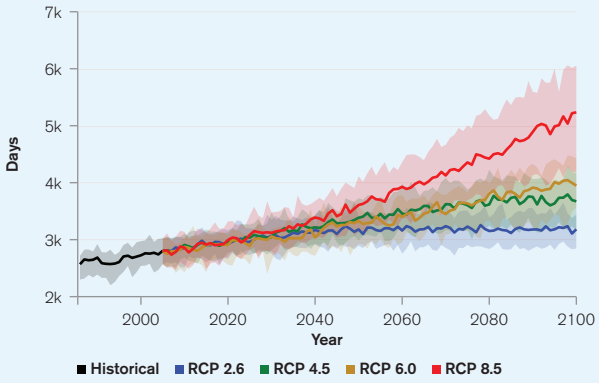


FIGURE 14. Projected Change in Warm Spell Duration Index in Ecuador (Reference Period, 1986–2005)[60]



[57] Ecuador (2015). National Climate Change Plan 2015–2018. URL: https://info.undp.org/docs/pdc/Documents/ECU/PLAN%20NACIONAL%20DE%20CAMBIO%20CLIMÁTICO.pdf

[58] Ecuador (2015). National Climate Change Plan 2015–2018. URL: https://info.undp.org/docs/pdc/Documents/ECU/PLAN%20NACIONAL%20DE%20CAMBIO%20CLIMÁTICO.pdf

[59] WBG Climate Change Knowledge Portal (CCKP, 2021). Ecuador URL: https://climateknowledgeportal.worldbank.org/country/Ecuador/climate-data-projections

[60] WBG Climate Change Knowledge Portal (CCKP, 2021). Ecuador – Energy. URL: https://climateknowledgeportal.worldbank.org/country/ecuador/climate-data-projections

Adaptation Options

Challenges faced by the energy sector are associated with the promotion and diversification of the energy supply through renewable sources, the expansion of this portfolio contribute to the mitigation of climate change. The Ecuadorian Government is working to optimize its energy matrix as well as address the need for increasing renewable energy generation and meeting the challenges posed from promoting energy efficiency and responsible consumption in transport, industry and the residential and commercial sectors. Adaptation focus should be set for the energy sector to promoting the production of renewable energy and the progressive abandonment of hydrocarbons. Adaptation options for the hydropower sector should focus on improved water resource management under changing conditions. Additional investments can be made in the building of more storage capacity, improving turbine efficiencies and to increase the more efficient use of available resources. Integrated water use management will be required as competing demands for water are further exacerbated from increased demand for water for other uses such as irrigation and urban demands. Ecuador's National Policy for Climate Change aims to incorporate climate change management into public and private decisions to advance in a climate-resilient and low-carbon development path that reduces the risks of climate change and allows opportunities to be seized. The long-term objective is for the country to be carbon neutral, as such, adaptation options for the energy sector include the promotion of energy efficiency and integrated water resources management, including educating the public on the impacts of climate change on energy supplies and implementing behavioral techniques to increase energy use efficiency in tandem with water conservation.[61]

Ecuador is committed to ensuring its energy system optimization and expansion goals. Estimates indicate that the share of total electricity supplied by hydropower in Ecuador might vary significantly between 53% to 81% by 2050.[62] Restricting large hydropower due to social-environmental constraints can cause a fourfold increase in cumulative emissions compared to NDC implied levels, while a 25% reduction of hydropower availability due to climate change would cause cumulative emissions to double. In comparison, a more diversified power system (while more expensive), which limits the share of large hydropower and natural gas in favor of other renewables could achieve the expected NDC emission levels.[63]

Health

Overview

Ecuador's health system consists of two subsystems: public and private. The Ministry of Health spearheads the processes defined in the government's health policies, which follows the strategies set forth by the National Secretariat of Planning and Development and implements the system's Integrated Health Care Model.[64] Ecuador

[61] Ecuador (2015). National Climate Change Plan 2015–2018. URL: https://info.undp.org/docs/pdc/Documents/ECU/PLAN%20NACIONAL%20DE%20CAMBIO%20CLIMÁTICO.pdf

[62] Ecuador (2019). Nationally Determined Contribution. URL: https://www4.unfccc.int/sites/ndcstaging/PublishedDocuments/Ecuador%20First/Primera%20NDC%20Ecuador.pdf

[63] Carvajal, P. and Li, F. (2019). Challenges for hydropower-based nationally determined contributions: a case study for Ecuador. *Climate Policy*. 19(8). DOI: https://doi.org/10.1080/14693062.2019.1617667

[64] Torres, I. and López-Cevallos, D. (2018). Institutional challenges to achieving health equity in Ecuador. The Lancet Global Health. 6(8). URL: https://www.thelancet.com/journals/langlo/article/PIIS2214-109X(18)30245-6/fulltext

already deals with a prevalence of communicable diseases such as dengue, zika, malaria, chagas and tuberculosis, as well as many non-communicable diseases such as diabetes and hypertension; HIV/AIDS is relatively prevalent for a Latin American country. Mal-and under-nutrition remain problematic, specifically for rural areas and for school-aged children.[65]

Climate Change Impacts

Climate change projections indicate continued rising temperatures, more variable rainfall, rising seas and more frequent extreme weather events. These impacts are expected in food and water security, human settlements, infrastructure and ecosystems, as well as health, the latter particularly through increasing heat stress, the altered range, seasonality and distribution of vector-borne diseases including malaria, zika, chikungunya, as well as air pollution and associated respiratory illnesses, as well as water-borne illnesses such as cholera and diarrheal disease.[66]

Changing weather patterns and projected climate trends are expected to impact dynamics of some diseases. Impacts related to climate change, especially increased temperature and prolonged periods of extreme precipitation are expected in the near future. These effects on Public health conditions are likely to include the reduction in food production and resulting access to food, especially for poorer households, an increase in favorable conditions for respiratory diseases (waves of intense cold and changes abrupt temperatures during the day), the proliferation of mosquito-borne tropical diseases, as well as changes in the quality of water for human consumption.[67] 70% of Ecuadorian territory is located in tropical and subtropical areas with current favorable habitats for the development and propagation of transmission vectors diseases such as dengue, malaria and leishmaniasis (the presence of Aedes aegypti has been detected up to 1,650 meters above sea level in the eastern mountain range). The populations that live in the Ecuadorian Coast and Amazon are especially vulnerable to these kinds of changes in the climate, as well as the areas located in the piedmont area in the Ecuadorian Andes, which cross the country from north to south.[68]

Increases in year-round temperatures will bring a more pronounced heat season with more frequent and intense heatwaves. Increased heavy rainfall periods, with increased temperatures will increase moisture and humidity, also increasing favourable breeding grounds for vector-borne and mosquito-borne diseases. **Figure 15** shows the expected Number of Very Hot Days (Tmax >35°C) which will increase throughout the year, with spikes especially pronounced between July and November, under a high-emission scenario (RCP8.5) through the end of the century. Heat discomfort and heat stress increases mortality and morbidity for the most vulnerable, especially the elderly, children and pregnant women. Additionally, children's learning ability significantly decreases with increased heat exposure. **Figure 16** shows that tropical nights, minimum temperatures (>20°C), will increase sharply through the end of the century, rising rapidly under a high-emission scenario (RCP8.5).

[65] PAHO (2017). Health in the Americas: Ecuador. URL: https://www.paho.org/salud-en-las-americas-2017/?p=4272
[66] Ecuador (2017). Third National Communication to the UNFCCC. URL: https://unfccc.int/documents/77568
[67] Aldulaimi, S. and Mora, F. (2019). A Primary Care System to Improve Health Care Efficiency: Lessons from Ecuador. *J. of the American Board of Family Medicine.* 30(30). URL: https://www.jabfm.org/content/jabfp/30/3/380.full.pdf
[68] Ecuador (2019). Nationally Determined Contribution. URL: https://www4.unfccc.int/sites/ndcstaging/PublishedDocuments/Ecuador%20First/Primera%20NDC%20Ecuador.pdf

FIGURE 15. Projected Number of Very Hot Days >35°C (RCP8.5, Reference Period, 1986–2005)[69]

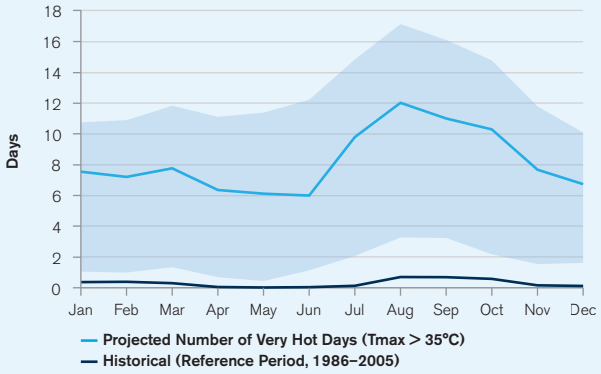
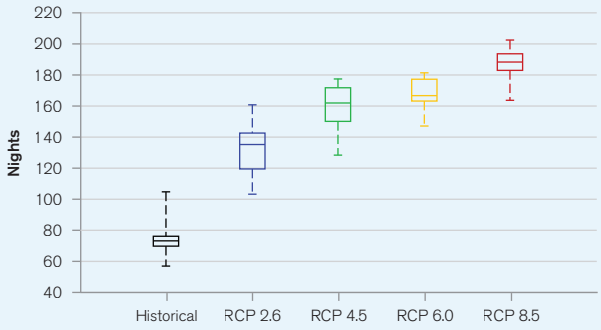


FIGURE 16. Projected Number of Tropical Nights (Tmin >20°C) (Reference Period, 1986–2005)[70]



Adaptation Options

Additional research is required to determine more direct linkages between. Ecuador is currently supporting research into impacts of climate change trends and vector-borne diseases, such as dengue, zika and chikungunya. The Government, led by the Ministry of Health, is working to establish National System of Surveillance and Early Warning for Vector Control, with specific focuses on dengue and yellow fever. The National System of Surveillance and Early Warning for the Control of Malaria and Leishmaniasis Vectors has also been established, which has national scope and is prioritizing the epidemiological importance of the diseases, in urban and rural areas. Information gathered to date is supplemented with data environmental and socioeconomic, which has supported the initial development of mathematical models of risk for dengue, malaria and leishmaniasis.[71] These data will enable the country to have a baseline of scientific information on the populations of the vectors studied, which will serve to make comparisons temporal and spatial changes in the behavior of these populations. Further, facilitates correlations with indicators of climate change in dispersion and distribution of insect species as well as well as its impact on the transmission dynamics of emerging diseases.[72] Ecuador is also committed to adaptation for the sector, which include analyzing climate risks to health infrastructure, generating public policies and instruments to manage the impacts of climate change on health, implementing surveillance and early warning systems for health outcomes sensitive to climate, such as dengue, and to enhance institutional capacities to generate information of the impacts of climate change on public health and the implementation of adaptation responses.[73]

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

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

[71] Torres, I. and López-Cevallos, D. (2018). Institutional challenges to achieving health equity in Ecuador. The Lancet Global Health. 6(8). URL: https://www.thelancet.com/journals/langlo/article/PIIS2214-109X(18)30245-6/fulltext

[72] Ecuador (2017). Third National Communication to the UNFCCC. URL: https://unfccc.int/documents/77568

[73] Ecuador (2019). Nationally Determined Contribution. URL: https://www4.unfccc.int/sites/ndcstaging/PublishedDocuments/Ecuador%20First/Primera%20NDC%20Ecuador.pdf

Institutional Framework for Adaptation

Ecuador is committed to the fight against climate change and to ensure that as a country, Ecuador has in place effective adaptation and mitigation mechanisms. Climate change related efforts have been integrated into National Development Plans and established through the National Strategy for Climate Change (2015) and Ecuador's Agenda 2030. Ecuador continues to develop and implement policies, actions and efforts that promote the reduction of greenhouse gases and the increased resilience and decreased vulnerability to the adverse effects of climate change in priority sectors.[74] By 2030, the country aims to develop a mechanism to track regional climate change trends and their effects on key elements of territorial management, such as water balances, levels of risk, productivity, among others.[75] This is aimed to provide the basis for a national program on mitigation and adaptation for Ecuador.

The Ministry of Environment, supported by the Under-Secretariat of State for Climate Change, leads these efforts and has made important progress in creating a policy framework for managing climate change, in particular: the inclusion of specific references on the subject in the current Constitution of the Republic and in the National Development Plans (2009–2013, 2013–2017 and 2017–2021). The Constitution of the Republic of Ecuador is recognized as a global pioneer in its acknowledgment of the rights of nature, and refers to the adoption of appropriate and transversal measures for mitigating climate change, and protecting the population at risk.[76] The National Climate Change Strategy, adopted in 2012, provides a vision until 2025, and seeks to establish a long-term objective for the management of climate change in the country. It has strategic work areas proposed for both adaptation and mitigation to climate change. For adaptation, the strategy defined key priority sectors or areas of work, taking into account the priority development objectives defined in the National Development Plan.[77]

Policy Framework for Adaptation

Ecuador submitted its Third National Communication to the UNFCCC in 2017, its Nationally-Determined Contribution (NDC) to the UNFCCC in 2019. Ecuador is currently developing its National Adaptation Plan (NAP), with will identify the country's technical capacity needs, at the national and sub-national level as well as at the sectoral level. In support of its adaptation efforts, ongoing adaptation projects and planning frameworks have included local level vulnerability assessments; capacity building; adaptation measures in areas such as: water and watershed management, glacier management, protected areas, Ecosystem-based Adaptation, agriculture, livestock and food sovereignty. The Third National Communication focuses adaptation efforts on key sectors impacted by climate change as health, water resources, protected areas and agriculture.

[74] Ecuador (2017). Third National Communication to the UNFCCC. URL: https://unfccc.int/documents/77568
[75] Ecuador (2013). National Development Plan/National Plan for Good Living, 2013–2017. Summarized Version. URL: https://www.planificacion.gob.ec/wp-content/uploads/downloads/2013/12/Buen-Vivir-ingles-web-final.pdf
[76] UNDP (2018). National Adaptation Plans in Focus: Lessons from Ecuador. URL: https://www.adaptation-undp.org/sites/default/files/resources/nap_in_focus_lessons_from_ecuador_english.pdf
[77] Ecuador (2019). Nationally Determined Contribution. URL: https://www4.unfccc.int/sites/ndcstaging/PublishedDocuments/Ecuador%20First/Primera%20NDC%20Ecuador.pdf

National Frameworks and Plans

- Third National Communication (2017) Spanish
- Second National Communication (2012) Spanish
- First Biennial Update Report (2016) Spanish
- First National Communication (2000) Spanish
- Nationally Determined Contributions (2019) Spanish
- National Climate Change Strategy 2012–2025 (2012) Spanish
- National Climate Change Plan 2015–2018 (2015) Spanish
- Plan for Good Living 2013–2017 (2013) Spanish

Recommendations

Research Gaps

- Improve the coverage and the spatial and temporal resolution of climate projections, risks, and vulnerability analyses
- Support development of climate-smart agricultural techniques for improved productivity as well as mitigation efforts for reducing the sector's GHG emissions
- Increase the amount of vulnerability studies with national focus for key sectors and both rural and urban areas[78]

Data and Information Gaps

- Design measurement, reporting and verification (MRV) mechanisms for the National Adaption Process and related adaptation actions
- Improve understanding and quantification of costs for key sectors related to climate change impacts
- Broaden and strengthen the coverage of oceanographic hydrometeorological station networks through the country and its marine area
- Increase the involvement of scientific institutions, academic institutions and civil society in the decision-making processes relating to climate change adaptation and mitigation

Institutional Gaps

- Strengthen institutional capacities to facilitate the management of climate risks
- Develop technical and regulatory tools that facilitate the integration of adaptation into development planning and budgeting processes at sectoral, territorial and local levels
- Formulate strategies to ensure the financing and sustainability of implemented adaptation actions, and strengthen the engagement of the private sector in these actions[79]
- Improve comprehensive management strategies and institutional mandates for sustainable water resource management
- Improve coordination capacities across sections to improve climate change preparation, adaptation and mitigation efforts

[78] Ecuador (2015). National Climate Change Plan 2015–2018. URL: https://info.undp.org/docs/pdc/Documents/ECU/PLAN%20NACIONAL%20DE%20CAMBIO%20CLIMÁTICO.pdf

[79] UNDP (2018). National Adaptation Plans in Focus: Lessons from Ecuador. URL: https://www.adaptation-undp.org/sites/default/files/resources/nap_in_focus_lessons_from_ecuador_english.pdf

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