CLIMATE RISK COUNTRY PROFILE

TIMOR-LESTE

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ADB ASIAN DEVELOPMENT BANK

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

This profile was written by Alex Chapman (Consultant, ADB), William Davies (Consultant, ADB) and Ciaran Downey (Consultant). Technical review of the profiles was undertaken by Robert L. Wilby (Loughborough University). Additional support was provided by MacKenzie Dove (Senior Climate Change Consultant, WBG), Jason Johnston (Operations Analyst, WBG), Yunziyi Lang (Climate Change Analyst, WBG), Adele Casorla-Castillo (Consultant, ADB), and Charles Rodgers (Consultant, ADB). This profile also benefitted from inputs of WBG and ADB regional staff and country teams.

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 (WBG) and the Asian Development Bank (ADB) are 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.

Both institutions are investing in incorporating and systematically managing climate risks in development operations through their individual corporate commitments.

For the World Bank Group: 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 International Development Association and International Bank for Reconstruction and Development operations, climate and disaster risk screening is one of the mandatory corporate climate commitments. This is supported by the World 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.

For the Asian Development Bank (ADB): its Strategy 2030 identified "tackling climate change, building climate and disaster resilience, and enhancing environmental sustainability" as one of its seven operational priorities. Its Climate Change Operational Framework 2017–2030 identified mainstreaming climate considerations into corporate strategies and policies, sector and thematic operational plans, country programming, and project design, implementation, monitoring, and evaluation of climate change considerations as the foremost institutional measure to deliver its commitments under Strategy 2030. ADB's climate risk management framework requires all projects to undergo climate risk screening at the concept stage and full climate risk and adaptation assessments for projects with medium to high risk.

Recognizing the value of consistent, easy-to-use technical resources for our common client countries as well as to support respective internal climate risk assessment and adaptation planning processes, the World Bank Group's Climate Change Group and ADB's Sustainable Development and Climate Change Department have worked together to develop this content. Standardizing and pooling expertise facilitates each institution 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 common client countries, these 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.

We hope that this combined effort from our institutions will spur deepening of long-term risk management in our client countries and support further cooperation at the operational level.

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KEY MESSAGES

- Timor-Leste's tropical climate is heavily influenced by the West Pacific Monsoon and its mountainous climate.
- Timor-Leste's climate is strongly impacted by the El Niño Southern Oscillation (ENSO) which can vary the inter-annual quantity of rainfall by up to 50% and affect the timing of peak annual rainfall.
- Annual mean surface air temperatures in Timor-Leste are projected to increase by approximately 2.9°C by the 2090s under the RCP8.5 emissions pathway, and by 0.9°C under the RCP2.6 emissions pathway.
- There is great uncertainty around projected precipitation changes but high confidence in an increase in extreme rainfall events.
- Future drought frequency is uncertain but could increase and as such disaster risk reduction efforts are needed.
- Under all emissions pathways Timor-Leste is projected to experience an increase in the frequency of extreme high temperatures. These represent a major threat to human health and demand significant attention from all stakeholders.
- The population is heavily dependent on agriculture, with 70% of families relying on some form of farming activity for their livelihoods. Climate change is set to alter rainfall patterns, with Timor-Leste's food production likely to be one of the most affected by changes in rainfall in Southeast Asia. In combination with increased growing season temperatures, agricultural production may see reduced yields.
- While Timor-Leste has made considerable progress in development, it still suffers from high levels of poverty. Climate change threatens to exacerbate vulnerability and inequality, particularly in food security. The rural poor and other marginalized groups are most vulnerable.
- Without systemic action climate change threatens to increase inequality and drive significant damage and loss.

COUNTRY OVERVIEW

Timor-Leste is a small country with a population of approximately 1.3 million in 2020 and a land area of 14,874 km^2 comprises of the eastern half of Timor Island and the small enclave of Oecussi located within West Timor, situated between 8′15S – 10′30S latitude and 125′50E – 127′30E longitude. A particularly mountainous country, its central mountains rise to 3,000 m, with just under half of the country reported to have a slope of >40%,[1] contributing to soil erosion during heavy rainfall. Coastal plains are found in the less mountainous south,[2] The country is vulnerable to natural hazards, at high risk of cyclones, earthquakes, tsunamis and heavy rainfall, all exacerbated by limited and inadequate infrastructure and social welfare.[3]

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1 Barnett, Jon & Dessai, Suraje & Jones, Roger. (2007). Vulnerability to Climate Variability and Change in East Timor. Ambio. 36. 372–8. 10.1579/0044-7447(2007)36[372:VTCVAC]2.0.CO;2. URL: https://pubmed.ncbi.nlm.nih.gov/17847801/

2 Molyneux, Nicholas & Rangel da Cruz, Gil & Williams, Rob & Andersen, Rebecca & Turner, Neil. (2012). Climate Change and Population Growth in Timor Leste: Implications for Food Security. Ambio. 41.URL: https://www.ncbi.nlm.nih.gov/pmc/articles/PMC3492559/

3 USAID (2017). Timor-Leste Climate Change Risk Profile. URL: https://www.climatelinks.org/resources/climate-change-risk-profile-timor-leste

Timor-Leste has undergone significant development in recent decades due to political stability and oil revenues. It is one of the world's most oil-dependent countries, with production beginning in 2004 and predicted to finish in 2021.[4] However, recent explorations show that production can be extended until 2024/2025.[5] Approximately 42% of its population were considered as living below the national poverty line as of 2014 (**Table 1**), a product of low productivity and limited employment opportunities. The country and its economy are primarily agrarian, with approximately 66% of the population reliant on this sector.[6] Commodities exported include coffee, sandalwood and marble.[3,4]

Timor-Leste is highly vulnerable to natural hazards which are associated with droughts, floods, landslides and soil erosion. Increasing temperatures, changing precipitation patterns and increased heavy rainfall events increase impacts of climate change for the country. Timor-Leste submitted its Nationally Determined Contributions (NDC) in 2016. The country's Second National Communication to the UNFCCC in 2020, which identified the agriculture, water resources, forestry and public health to be the most vulnerable sectors to climate change.[7]

TABLE 1. Key Indicators

Indicator	Value	Source
Population Undernourished[8]	30.9% (2017–2019)	FAO, 2020
National Poverty Rate[9]	41.8% (2014)	ADB, 2020
Share of Income Held by Bottom 20%[10]	9.4% (2014)	World Bank, 2019
Net Annual Migration Rate[11]	–0.43% (2015–2020)	UNDESA, 2019
Infant Mortality Rate (Between Age 0 and 1)[12]	3.7% (2015–2020)	UNDESA, 2019
Average Annual Change in Urban Population[13]	3.4% (2015–2020)	UNDESA, 2018
Dependents per 100 Independent Adults[14]	70 (2020)	UNDESA, 2019
Urban Population as % of Total Population[15]	31.3% (2020)	CIA, 2020
External Debt Ratio to GNI[16]	N/A	ADB, 2020b
Government Expenditure Ratio to GDP[17]	80.8% (2018)	ADB, 2020b

4 ADB (2016). Country Partnership Strategy Timor-Leste 2016–2020. URL: https://www.adb.org/documents/timor-leste-country-partnership-strategy-2016-2020
5 D. Evans (2021). East Timor's Bayu-Undan production boost exceeds expectations. *Energy Voice*. 28 July. URL: https://www.energyvoice.com/oilandgas/asia/339865/east-timors-bayu-undan-production-boost-exceeds-expectations/
6 FAO (2020). Results of the first Timor-Leste Agricultural Census 2019. URL: http://www.fao.org/3/ca7875en/ca7875en.pdf
7 Timor Leste (2014). Initial National Communication to the UNFCCC. URL: https://unfccc.int/sites/default/files/resource/Timor-Leste-INC_English.pdf
8 FAO, IFAD, UNICEF, WFP, WHO (2020) The state of food security and nutrition in the world. Transforming food systems for affordable healthy diets. FAO. Rome. URL: http://www.fao.org/documents/card/en/c/ca9692en/
9 ADB (2020). Basic Statistics 2020. URL: https://www.adb.org/publications/basic-statistics-2020 [accessed 27/01/21]
10 World Bank (2019). Income share held by lowest 20%. URL: https://data.worldbank.org/ [accessed 17/12/20]
11 UNDESA (2019). World Population Prospects 2019: MIGR/1. URL: https://population.un.org/wpp/Download/Standard/Population/ [accessed 17/12/20]
12 UNDESA (2019). World Population Prospects 2019: MORT/1-1. URL: https://population.un.org/wpp/Download/Standard/Population/ [accessed 17/12/20]
13 UNDESA (2019). World Urbanization Prospects 2018: File 6. URL: https://population.un.org/wup/Download/ [accessed 17/12/20]
14 UNDESA (2019). World Population Prospects 2019: POP/11-A. URL: https://population.un.org/wpp/Download/Standard/Population/ [accessed 17/12/20]
15 CIA (2020). The World Factbook. Central Intelligence Agency. Washington DC. URL: https://www.cia.gov/the-world-factbook/
16 ADB (2020b). Key Indicators for Asia and the Pacific 2020. Asian Development Bank. URL: https://www.adb.org/publications/key-indicators-asia-and-pacific-2020
17 ADB (2020b). Key Indicators for Asia and the Pacific 2020. Asian Development Bank. URL: https://www.adb.org/publications/key-indicators-asia-and-pacific-2020

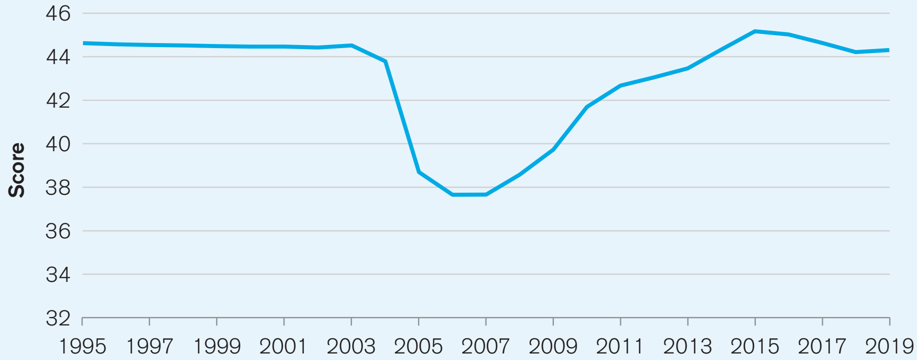
Green, Inclusive and Resilient Recovery

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.

This document aims to succinctly summarize the climate risks faced by Timor-Leste. This includes rapid onset and long-term changes in key climate parameters, as well as impacts of these changes on communities, livelihoods and economies, many of which are already underway. This is a high-level synthesis of existing research and analyses, focusing on the geographic domain of Timor-Leste, therefore potentially excluding some international influences and localized impacts. The core data presented is sourced from the database sitting behind the World Bank Group's Climate Change Knowledge Portal (CCKP), incorporating climate projections from the Coupled Model Inter-comparison Project Phase 5 (CMIP5). This document is primarily meant for WBG and ADB staff to inform their climate actions. The document also aims to direct the reader to many useful sources of secondary data and research.

Due to a combination of political, geographic, and social factors, Timor-Leste is recognized as highly vulnerable to climate change impacts, ranked 113th out of 182 countries in the 2020 ND-GAIN Index.[18] The ND-GAIN Index ranks 181 countries using a score which calculates a country's vulnerability to climate change and other global challenges as well as their readiness to improve resilience. 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 1** is a time-series plot of the ND-GAIN Index showing Timor-Leste progress

FIGURE 1. The ND-GAIN Index Summarizes a Country's Vulnerability to Climate Change and Other Global Challenges in Combination with Its Readiness to Improve Resilience. It Aims to Help Businesses and the Public Sector Better Prioritize Investments for a More Efficient Response to the Immediate Global Challenges Ahead.



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

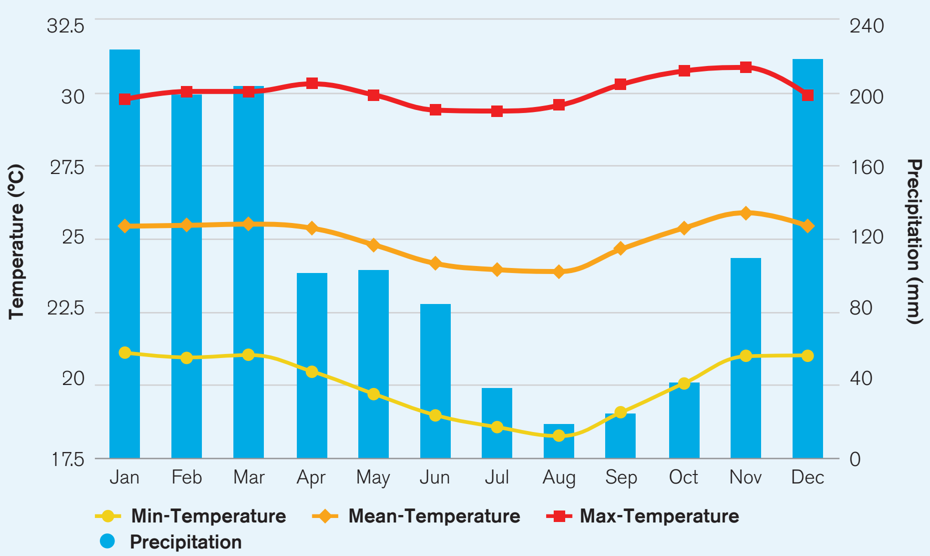
Climate Baseline

Overview

Timor-Leste's tropical climate is heavily influenced by West Pacific Monsoon and its mountainous climate. Its wet season takes place between December and May and dry season between June and November, with the southern parts of the country experiencing a longer wet season of seven to nine months. Rainfall is variable across the country, with the northern areas receiving less rainfall than the south. Like many other countries with a tropical climate, there is little seasonal variation in temperature. Timor-Leste's climate is strongly impacted by the El Niño Southern Oscillation (ENSO) and can vary the inter-annual extent and timing of rainfall by up to 50%.[1,3] As **Figure 2** demonstrates, there is relatively little seasonal variability in average monthly temperature, ranging 1.3°C between a minimum of 24.1°C in July and maximum of 25.4°C in November. June, July and August are the coldest months of the year. Average monthly precipitation varies throughout the year, ranging between approximately 12–18 millimeter (mm) during the driest months of August and September and between 222–252 mm in wettest months of December to March. **Figure 3** shows the spatial differences of observed historical temperature and rainfall in Timor-Leste for the latest climatology, 1991 to 2020.

Annual Cycle

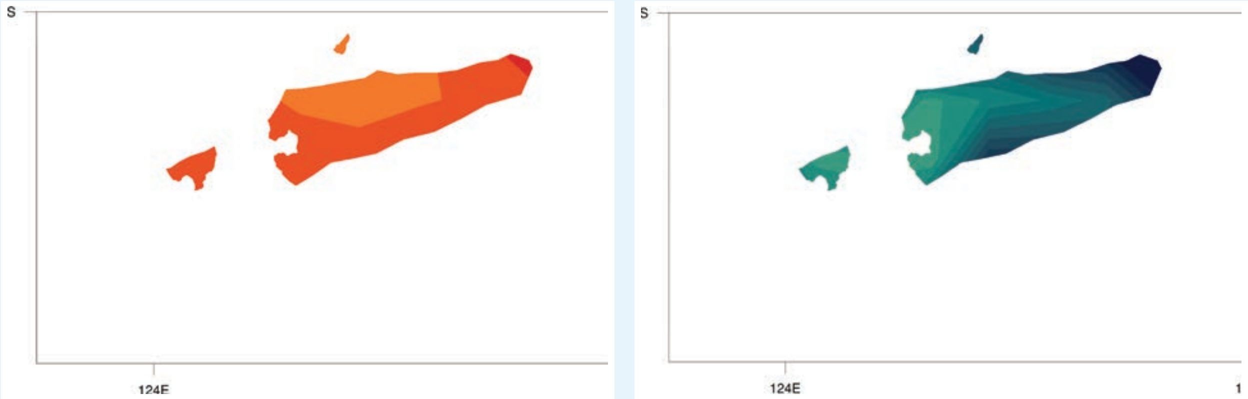
FIGURE 2. Average Monthly Mean, Minimum, and Maximum Temperatures and Rainfall in Timor-Leste (1991–2020)[19]



[19] WBG Climate Change Knowledge Portal (CCKP, 2021). Timor-Leste Climate Data: Historical. URL: https://climateknowledgeportal.worldbank.org/country/timor-leste/climate-data-historical

Spatial Variation

FIGURE 3. Annual Mean Temperature (°C) (left), and Annual Mean Rainfall (mm) (right) in Timor-Leste Over the Period 1991–2020[20]



Key Trends

Temperature

Limited meteorological data is available (**Figure 3**) to sufficiently estimate historical temperature changes, although data availability is likely to improve in future years as more historical data are recovered and digitized from colonial archives. Despite limited data, the Pacific-Australia Climate Change Science Adaptation Planning (PACCSAP) estimate that temperatures in Timor-Leste have likely increased in line with regional and global trends, based on warming ocean trends recorded around the country.[21] USAID, estimate a rise in temperature of 0.16°C per decade since 1950, but emphasize that accurate trends are difficult given data limitations.[3,21] Comparatively, the Berkeley Earth dataset,[22] which provides historical temperature change estimates for 1° × 1° grid cells, estimates warming around the capital Dili between 1851 and 2017 (average) has been 0.8°C (see **Figure 2**). It should be noted that while this dataset can be used to estimate warming over the 20th century, estimates of warming over grid cells containing larger amounts of ocean cover are less reliable, but also generally show less warming. Warming appears to have accelerated since approximately 1980.

Precipitation

Interannual variability associated with ENSO is present in observed precipitation records, driving significant variation. However, annual rainfall trends have shown little climate change-driven change since 1952. USAID estimate a negligible 6.4mm increase in annual rainfall from 1901–2009. There is insufficient data available to observe trends in daily rainfall.[3]

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[20] WBG Climate Change Knowledge Portal (CCKP, 2021). Timor-Leste Climate Data: Projections. URL: https://climateknowledgeportal.worldbank.org/country/timor-leste/climate-data-projections

[21] Australian Bureau of Meteorology and CSIRO (2014). Climate Variability, Extremes and Change in the Western Tropical Pacific: New Science and Updated Country Reports. Pacific-Australia Climate Change Science and Adaptation Planning Program Technical Report, Australian Bureau of Meteorology and Commonwealth Scientific and Industrial Research Organization, Melbourne, Australia. URL: https://www.pacificclimatechangescience.org/wp-content/uploads/2014/07/PACCSAP_CountryReports2014_WEB_140710.pdf

[22] Carbon Brief (2018). Mapped: How every part of the world has warmed – and could continue to. Infographics, Berkeley Dataset. [26 September 2018]. URL: https://www.carbonbrief.org/mapped-how-every-part-of-the-world-has-warmed-and-could-continue-to-warm

Climate Futures

Overview

The main data source for the World Bank Group's Climate Change Knowledge Portal (CCKP) is the Coupled Model Inter-comparison Project Phase 5 (CMIP5) models, which are utilized within the Fifth Assessment Report (AR5) of the Intergovernmental Panel on Climate Change (IPCC), providing estimates of future temperature and precipitation. 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. In this analysis, RCP2.6 and RCP8.5, the low and high emissions pathways, are the primary focus where RCP2.6 represents a very strong mitigation scenario and RCP8.5 assumes a high-emissions scenario. For more information, please refer to the RCP Database.

A Precautionary Approach

Studies published since the last iteration of the IPCC's report (AR5), such as Gasser et al. (2018), have presented evidence which suggests a greater probability that earth will experience medium and high-end warming scenarios than previously estimated.[1] Climate change projections associated with the highest emissions pathway (RCP8.5) are presented here to facilitate decision making which is robust to these risks.

The majority of the models from which outputs are presented in this report are from the CMIP5 round of standardization and quality assurance. Unfortunately, models of this generation operate at large spatial scales and are not well equipped to simulate the future climate of small islands. Typically, the changes projected will relate more to the expected changes over nearby ocean than the island itself. Caution should therefore be applied in interpreting results. This highlights a major area for future development, a research opportunity, and an urgent need from the perspective of policy makers planning for climate change. Projections indicate increasing temperature rise and while precipitation patterns are highly variable, an increase in heavy precipitation events are likely. **Table 2** provides information on temperature projections and anomalies for the four RCPs over two distinct time horizons; presented against the reference period of 1986–2005.

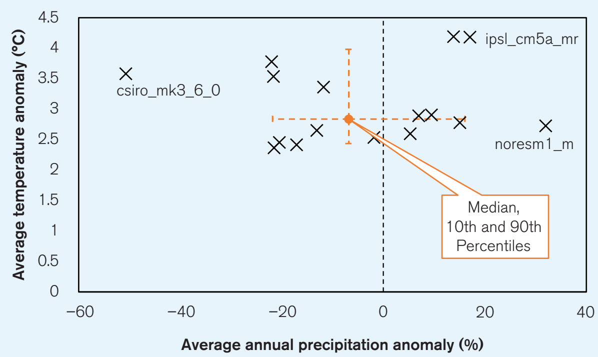
TABLE 2. Projected Anomaly (Changes °C) for Maximum, Minimum, and Average Daily Temperatures in Timor-Leste for 2040–2059 and 2080–2099, from the Reference Period of 1986–2005 for All RCPs. The Table is Showing the Median of the CCKP Model Ensemble and the 10–90th Percentiles in Brackets.[21]

	Average Daily Maximum Temperature		Average Daily Temperatures		Average Daily Minimum Temperatures	
Scenario	**2040–2090**	**2080–2090**	**2040–2090**	**2080–2090**	**2040–2090**	**2080–2090**
RCP2.6	0.8 (0.2, 1.6)	0.8 (0.2, 1.7)	0.8 (0.2, 1.5)	0.8 (0.2, 1.5)	0.8 (0.2, 1.5)	0.7 (0.1, 1.5)
RCP4.5	1.1 (0.4, 1.9)	1.5 (0.8, 2.5)	1.1 (0.5, 1.7)	1.5 (0.9, 2.3)	1.1 (0.5, 1.7)	1.5 (0.9, 2.3)
RCP6.0	0.9 (0.3, 1.8)	1.8 (1.2, 2.9)	0.9 (0.4, 1.7)	1.9 (1.2, 2.8)	0.9 (0.4, 1.7)	1.9 (1.2, 2.8)
RCP8.5	1.4 (0.3, 2.4)	3.2 (2.3, 4.4)	1.4 (0.8, 2.2)	3.1 (2.3, 4.2)	1.4 (0.8, 2.2)	3.0 (2.3, 4.2)

Model Ensemble

Climate projections presented in this document are derived from datasets made available through the CCKP, unless otherwise stated. These datasets areprocessed outputs of simulations performed by multiple General Circulation Models (GCM) developed by climate research centers around the world and evaluated by the IPCC for quality assurance in the CMIP5 iteration of models (for further information see Flato et al., 2013).[23] Collectively, these different GCM simulations are referred to as the 'model ensemble'. Due to the differences in the way GCMs represent the key physical processes and interactions within the climate system, projections of future climate conditions can vary widely between different GCMs, this is particularly the case for rainfall related variables and at national and local scales. Exploring the spread of climate model outputs can assist in understanding uncertainties associated with climate models. The range of projections from 16 GCMs on the indicators of average temperature anomaly and annual precipitation anomaly for Timor-Leste under RCP8.5 is shown in **Figure 4.** Spatial variation of future projections of annual temperature and precipitation for mid and late century under RCP8.5 are presented in **Figure 5**.

FIGURE 4. 'Projected Average Temperature Anomaly' and 'Projected Annual Rainfall Anomaly' in Timor-Leste. Outputs of 16 Models Within the Ensemble Simulating RCP8.5 Over the Period 2080–2099. Models Shown Represent the Subset of Models Within the Ensemble which Provide Projections Across All RCPs and Therefore are Most Robust for Comparison.[24] Models at the Extremities are Labelled.



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[23] Flato, G., Marotzke, J., Abiodun, B., Braconnot, P., Chou, S. C., Collins, W., . . . Rummukainen, M. (2013). Evaluation of Climate Models. Climate Change 2013: The Physical Science Basis. Contribution of Working Group I to the Fifth Assessment Report of the Intergovernmental Panel on Climate Change, 741–866. URL: http://www.climatechange2013.org/images/report/WG1AR5_ALL_FINAL.pdf

[24] WBG Climate Change Knowledge Portal (CCKP, 2021). Timor-Leste Climate Data: Projections. URL: https://climateknowledgeportal.worldbank.org/country/timor-leste/climate-data-projections

Spatial Variation

FIGURE 5. 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.[25]

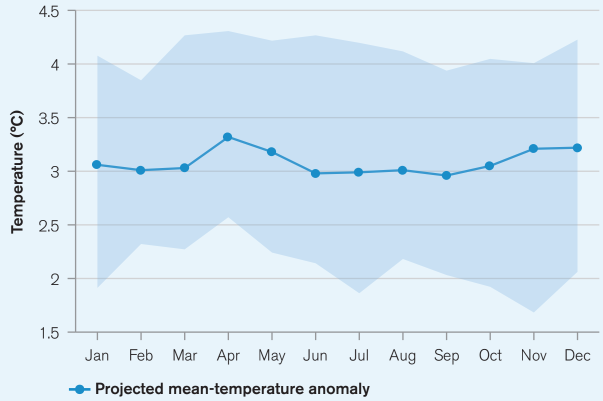
Temperature

Projections of future temperature change are presented in three primary formats. Shown in **Table 2** are the changes (anomalies) in daily maximum and daily minimum temperatures over the given time period, as well as changes in the average temperature. **Figure 6** displays the monthly average temperature projections. While similar, these three indicators can provide slightly different information. Monthly and annual average temperatures are most commonly used for general estimation of climate change, but the daily maximum and minimum can explain more about how daily life might change in a region, affecting key variables such as the viability of ecosystems, health impacts, productivity of labor, and the yield of crops, which are often disproportionately influenced by temperature extremes.

[25] WBG Climate Change Knowledge Portal (CCKP 2021). Timor-Leste. Climate Data. Projections. URL: https://climateknowledgeportal.worldbank.org/country/timor-leste/climate-data-projections

Annual mean surface air temperatures in Timor-Leste are projected to increase by approximately 3.1°C by the 2090s, under the RCP8.5 emissions pathway, and by 0.8°C under the RCP2.6 emissions pathway. **Figure 6** demonstrates how projected temperature changes are uniform across the seasonal cycle, as well as the high uncertainty surrounding these projections.

FIGURE 6. Projected Change (Anomaly) in Monthly Temperature, Shown by Month, for Timor-Leste for the Period 2080–2099 Under RCP8.5 Pathway. The Value Shown Represents the Median of the Model Ensemble with the Shaded Areas Showing the 10th–90th Percentiles.[24]



Precipitation

Considerable uncertainty characterizes projections of local long-term future precipitation trends in Timor-Leste, this uncertainty is compounded by a poor understanding of the relationship (teleconnections) between El Niño Southern Oscillation and the monsoon, and the impact climate change may have on this relationship. Some projected changes to the global precipitation regime are expected to affect Timor-Leste. The intensity of sub-daily extreme rainfall events appears to be increasing with temperature, a finding supported by evidence from different regions of Asia.[26] However, as this phenomenon is highly dependent on local geographical contexts further research is required to constrain its impact in the different regions of Timor-Leste.

CMIP5 models present a range f projected rainfall change from an increase to a decrease for Timor-Leste, as shown in **Figure 4**, with the model average near zero. While there is low confidence in average rainfall change projections, there is a high confidence in an increase in extreme rainfall events.[21]

CLIMATE RELATED NATURAL HAZARDS

Timor-Leste faces high disaster risk levels, ranked 66 out of 191 countries by the 2019 Inform Risk Index[27] (**Table 3**). Tropical cyclones represent the climate-related natural hazard risk Timor-Leste is most exposed to, ranked 43rd at-risk, while for flooding and droughts Timor-Leste is ranked at a relatively low risk, (152nd and 130th, respectively). Timor-Leste's ranking in the top-third of at-risk countries is largely down to its lack of coping capacity and the levels of social vulnerability in its population, both of which are scored lower that most countries in the region. The section which follows analyses climate change influences on the exposure component of risk

[26] Westra, S., Fowler, H. J., Evans, J. P., Alexander, L. V., Berg, P., Johnson, F., Kendon, E. J., Lenderink, G., Roberts, N. (2014). Future changes to the intensity and frequency of short-duration extreme rainfall. Reviews of Geophysics, 52, 522–555. URL: https://agupubs.onlinelibrary.wiley.com/doi/full/10.1002/2014RG000464

[27] European Commission (2019). INFORM Index for Risk Management. Timor-Leste Country Profile. URL: https://drmkc.jrc.ec.europa.eu/inform-index/INFORM-Risk

TABLE 3. Selected Indicators from the INFORM 2019 Index for Risk Management for Timor-Leste. For the Sub-Categories of Risk (e.g. "Flood") Higher Scores Represent Greater Risks. Conversely the Most at-Risk Country is Ranked 1st. Global Average Scores are Shown in Brackets.

Flood (0–10)	Tropical Cyclone (0–10)	Drought (0–10)	Vulnerability (0–10)	Lack of Coping Capacity (0–10)	Overall Inform Risk Level (0–10)	Rank (1–191)
1.7 [4.5]	3.6 [1.7]	1.5 [3.2]	4.2 [3.6]	6.2 [4.5]	4.5 [3.8]	66

in Timor-Leste. As seen in **Figure 1**, the ND-GAIN Index presents an overall picture of a country's vulnerability and capacity to improve its resilience. In contrast, the Inform Risk Index identifies specific risks across a country to support decisions on prevention, preparedness, response and a country's overall risk management.

Heatwaves

Over the baseline period 1986–2005 maximum temperatures regularly surpassed 30°C in Timor-Leste. Under the lowest emissions pathway, the projected change in annual probability of heat wave in Timor-Leste changes little throughout the century, ranging between 10%–12% between 2020–2039 and 2080–2099. However, this rises significantly under RCP8.5 pathway (see **Figure 7**). This steep rise primarily reflects the use of a static historical baseline period, and the impact of constantly rising temperatures which generate historically unprecedented temperatures on a regular basis.

Perhaps a better measure of the future risks of extreme heat is the count of annual days in which conditions surpass Heat Index 35°C. Heat Index measures the combined impact of temperature and humidity and hence represents a more accurate measure of the thermal comfort of the human body. In Timor-Leste, as shown in **Figure 8** for the highest emission pathway, the number of days in which the 35°C Heat Index threshold is passed increases very significantly. Indeed, even under lower emissions pathways (e.g. RCP4.5), the count of days above the threshold increases by over 100. This flags cause for significant concern for population health and highlights the importance of disaster risk reduction efforts.

FIGURE 7. Projected Change in Daily Probability of Heat Wave in Timor-Leste for the Period 2080–2099, Under RCP8.5 Pathway

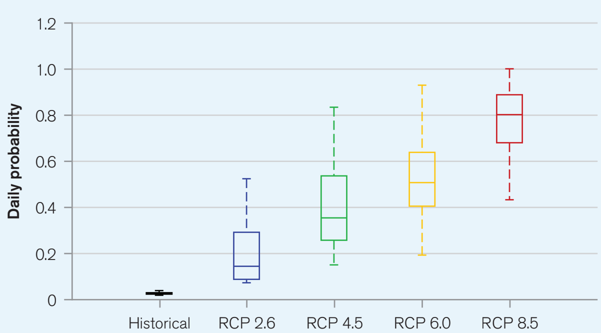
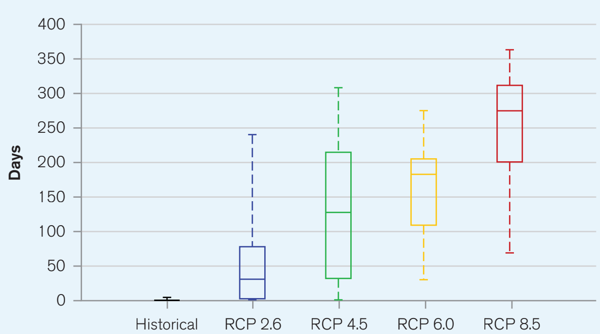


FIGURE 8. Projected Change in Annual Count of Heat Index >35 in Timor-Leste for the Period 2080–2099, Under RCP8.5 Pathway



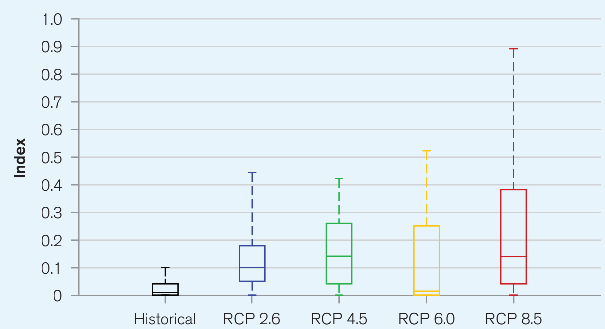
The Global Facility for Disaster Reduction and Recovery's (GFFDRR) categorizes Timor-Leste's extreme heat hazard as 'medium', which means there is greater than 25% change the country will experience in the next five years at least one period of prolonged exposure to extreme heat, resulting in heat stress.[28] Timor-Leste's National Adaptation Program of Action on Climate Change and USAID's climate risk profile for Timor-Leste's describe how the country is forecast to experience an increase in both intensity and duration of heatwaves by 2050.[3,29]

Drought

Two primary types of drought may affect Timor-Leste, meteorological (usually associated with a precipitation deficit) and hydrological (usually associated with a deficit in surface and subsurface water flow, potentially originating in the region's wider river basins). There are few documented drought events taken before Timor-Leste's independence, but anecdotally it is seen as a frequent occurrence.[30]

Naumann et al. (2018) provide a global overview of changes in drought conditions under different warming scenarios. In comparison to West and Central Asia, Southeast Asia is less likely to experience extreme increases in drought intensity. However, as shown in **Figure 9**, the likelihood of severe drought (as defined by a standardized precipitation evaporation index (SPEI) of less than –2) under the RCP8.5 pathway is projected to approximately double from 5% to 12% annual probability from the 2040s to the 2090s, respectively. However, much uncertainty is associated with this projection and indeed some model projections much larger increases in the future probability of drought. Droughts could increase in frequency and intensity given the association of accentuated drought with El Niño events, which are expected to increase in frequency and intensity through warmer global temperatures. PACCSAP projections show a lesser degree of change, with drought frequency projected to remain roughly similar to that found in the current climate.[21]

FIGURE 9. Projected Change in Annual Severe Drought Likelihood for Timor-Leste for the Period 2080–2099, Under RCP8.5 Pathway[19]



Flood and Landslide

Timor-Leste is exposed to river, coastal, and flash (surface) flooding, but in all cases the available data is lacking and the risk to vulnerable populations often understated. In regard to river flooding, the World Resources Institute's AQUEDUCT Global Flood Analyzer[31] can be used to establish a baseline level of river flood exposure. As of 2010

[28] Global Facility for Disaster Reduction and Recovery (2017). Think Hazard: Timor-Leste. URL: http://thinkhazard.org/en/report/242-timor-leste/EH

[29] Ministry for Economy and Development (2010). Timor-Leste National Adaptation Program of Action to Climate Change. URL: https://unfccc.int/resource/docs/napa/tls01.pdf

[30] World Bank (2018). Timor-Leste Water Sector Assessment and Roadmap. World Bank, Washington, DC. URL: http://documents.worldbank.org/curated/en/433121521173685667/pdf/124329-WP-P163648-PUBLIC-Timor-Leste.pdf

[31] WRI (2018). AQUEDUCT Global Flood Analyzer. URL: https://floods.wri.org/# [Accessed: 22/11/2018]

(WRI, 2018), assuming protection for up to a 1 in 25-year event, the population annually affected by flooding in Timor-Leste is estimated at 259 people and expected annual urban damage is estimated at $1.4 million. Development and climate change are both likely to increase these figures. The climate change component can be isolated and by 2030 is expected to increase the annually affected population by 111 people, and urban damage by $3.9 million under the RCP8.5 emissions pathway (AQUEDUCT Scenario B).

Timor-Leste is vulnerable to flash flooding, the consequence of heavy rainfall. La Nina years bring greater volumes of precipitation and increased flooding, such as in 2010/2011.[1,21] In more recent years, Timor-Leste has experienced more severe flooding, particularly in March 2020 and April 2021. In the latter event, several days of heavy rainfall brought by tropical storm Seroja caused severe flooding and landslides adversely affecting more than 25,000 households.[32] With regional and global climate forecasts suggesting an increase in intensity of heavy short-term precipitation events, there is an increased risk of flooding events in Timor-Leste. Land and mudslide are strongly linked to incidents of intense rainfall, and as such the risks of both may increase under projected climate change. The GFDRR's ThinkHazard portal already classifies landslide risk in Timor-Leste as high.

In general, Timor-Leste's soils are shallow, rocky, alkaline, store little water and are easily eroded. However, better alluvial soils are located away from the mountainous regions in the flat lands near the coast and in the river valleys.[2] Upland farming practices and clearing of vegetation contribute to soil erosion. As aforementioned, climate change is likely to lead to heavy rainfall events of greater intensity interspersed with dry periods, putting Timor-Leste's soils at risk of greater erosion and more frequent landslides.[1]

Cyclone and Storm Surge

Climate change is expected to interact with cyclone hazard in complex ways that are currently poorly understood. Known risks include the action of sea-level rise to enhance the damage caused by cyclone-induced storm surges, and the possibility of increased windspeed and precipitation intensity. Modelling of climate change impacts on cyclone intensity and frequency conducted across the globe points to a general trend of reduced cyclone frequency and increased intensity and frequency of the most extreme events (Walsh et al., 2015). Further research is required to better understand potential changes in cyclone seasonality and routes, and the potential for cyclone hazards to be experienced in unprecedented locations.

Timor-Leste's proximity to the equator means it encounters relatively low intensity and few cyclones, experiencing seven between 1969 and 2011. PACCSAP forecast a decrease in the frequency of tropical cyclones by 2100, although they may increase in intensity (e.g wind speeds)[21]

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[32] United Nations Resident Coordinator's Office (2021). Timor Leste: Floods. Situation Report No. 4 (As of 12 April 2021). URL: https://timorleste.un.org/sites/default/files/2021-04/TL%20April%20Flood%20Response%20Situation%20Report%204%20%2812%20Apr%2021%29.pdf

Natural Resources

Water

Coastal areas in Timor-Leste are dependent on groundwater as an important natural resource, both rural and urban areas. Groundwater accounts for more than 60% of Dili's total annual water supply for agriculture, industrial and domestic purposes.[33] Water resources in Timor-Leste have potential for development but face several challenges, including steep topography of catchment areas, variable sediment runoff following flash-flood events and the wet-dry tropical monsoon climate[30]. A combination of high variability and poor management makes Timor-Leste's water resources highly vulnerable. As with other areas, there exists a lack of data and information.

Climate change is projected to have a negative impact on water management in Timor-Leste. Projected increases in intensity and variability of rainfall coupled with sea-level rise, will likely put pressure on ground- and surface-water resources, through increased risks of flooding and droughts. Timor-Leste is vulnerable to droughts, with parts of the north often experiencing water shortages in the dry season[1]. Access to clean water has been cited as a problem in some areas of the country, with changes in climate combined with large-scale deforestation contributing to loss and drying up of water sources.[34]

The Coastal Zone

Sea-level rise threatens significant physical changes to coastal zones around the world. Global mean sea-level rise was estimated in the range of 0.44 meter (m) –0.74 m by the end of the 21st century by the IPCC's Fifth Assessment Report[35] but some studies published more recently have highlighted the potential for more significant rises (**Table 4**). Localized sea-level rise can in fact be an extremely complex phenomenon to measure and model, notably due to the influence of large-scale climate phenomena such as ENSO. Some studies have suggested that the western Pacific has been experiencing above average rates of sea-level rise, but the extent to which this is attributable to human-driven climate change and/or likely to continue requires further research.[36]

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[33] Pinto, Domingos & Shrestha, Sangam & Babel, Mukand & Ninsawat, Sarawut (2015). Delineation of groundwater potential zones in the Comoro watershed, Timor Leste using GIS, remote sensing and analytic hierarchy process (AHP) technique. Applied Water Science. URL: https://link.springer.com/article/10.1007/s13201-015-0270-6

[34] Oxfam (2012). Weathering Change in Timor-Leste: Participatory Action Research in Timor-Leste identifying climate change and associated impacts experienced at the community level. URL: https://www.preventionweb.net/files/24686_24686climatechange reportexecutivesu.pdf

[35] Church, J. a., Clark, P. U., Cazenave, A., Gregory, J. M., Jevrejeva, S., Levermann, A., . . . Unnikrishnan, A. S. (2013). Sea level change. In Climate Change 2013: The Physical Science Basis. Contribution of Working Group I to the Fifth Assessment Report of the Intergovernmental Panel on Climate Change (pp. 1137–1216). Cambridge, United Kingdom and New York, NY, USA: Cambridge University Press. URL: https://www.ipcc.ch/site/assets/uploads/2018/02/WG1AR5_Chapter13_FINAL.pdf

[36] Peyser, C. E., Yin, J., Landerer, F. W., & Cole, J. E. (2016). Pacific sea level rise patterns and global surface temperature variability. Geophysical Research Letters, 43(16), 8662–8669. URL: https://agupubs.onlinelibrary.wiley.com/doi/full/10.1002/2016GL069401

TABLE 4. Estimates of Global Mean Sea-Level Rise by Rate and Total Rise Compared to 1986–2005 Including Likely Range Shown in Brackets, Data from Chapter 13 of the IPCC's Fifth Assessment Report with Upper-End Estimates Based on Higher Levels of Antarctic Ice-Sheet Loss from Le Bars et al. (2017)[37]

Scenario	Rate of Global Mean Sea-Level Rise in 2100	Global Mean Sea-Level Rise in 2100 Compared to 1986–2005
RCP2.6	4.4 mm/yr (2.0–6.8)	0.44 m (0.28–0.61)
RCP4.5	6.1 mm/yr (3.5–8.8)	0.53 m (0.36–0.71)
RCP6.0	7.4 mm/yr (4.7–10.3)	0.55 m (0.38–0.73)
RCP8.5	11.2 mm/yr (7.5–15.7)	0.74 m (0.52–0.98)
Estimate inclusive of high-end Antarctic ice-sheet loss		1.84 m (0.98–2.47)

Mean sea levels in Timor-Leste are projected to rise throughout the 21st century. By 2030, CMIP5 models project similar rises under all RCP emission pathways of around 80–180 mm. By 2090, under RCP8.5, sea-level rise is projected in the range of 430–880 mm.[21] When combined with other changes, this sea-level rise will increase the impact of storm surges and coastal flooding.[21] The capital, Dili, is particularly to coastal flooding, situated only a few meters above sea level.[38]

As shown in **Table 5**, under the RCP8.5 emissions pathway, by 2070–2100, up to 7,200 people in Timor-Leste are potentially exposed to flooding from sea-level rise (though it should be noted that this global modelling holds uncertainties at finer spatial scales). However, with investment in effective adaptation, including balancing of trade-offs between hard infrastructural approaches (e.g. dykes and sea-walls) and nature-based approaches (e.g. habitat restoration), this number may be very significantly reduced.

TABLE 5. The Average Number of People Experiencing Flooding Per Year in the Coastal Zone in the Period 2070–2100 Under Different Emissions Pathways (Assumed Medium Ice-Melt Scenario) and Adaptation Scenarios for Timor-Leste[39]

Scenario	Without Adaptation	With Adaptation
RCP2.6	6,500	100
RCP8.5	7,200	200

[37] Le Bars, D., Drijhout, S., de Vries, H. (2017) A high-end sea level rise probabilistic projection including rapid Antarctic ice sheet mass loss. Environmental Research Letters: 12:4. URL: https://iopscience.iop.org/article/10.1088/1748-9326/aa6512

[38] United Nations Development Programme. Timor-Leste. URL: https://www.adaptation-undp.org/explore/south-eastern-asia/timor-leste

[39] UK Met Office (2014). Human dynamics of climate change: Technical Report. Met Office, UK Government. URL: https://www.metoffice.gov.uk/binaries/content/assets/metofficegovuk/pdf/weather/learn-about/climate/human-dynamics-of-climate-change/hdcc_alternative_version.compressed.pdf

Trends show ocean acidification of Timor-Leste's waters have increased in recent decades. Climate modelling projects this to continue under all RCP emission pathways, impacting reef ecosystem health alongside other pressures including storm damage, coral bleaching and fishing pressure.[21]

Biodiversity

Timor-Leste harbors unique and abundant biodiversity. A key impact of climate change on wildlife is to shift the geographical range in which climate conditions are suited to species' survival. In general, shifts are expected to be either upslope to higher altitudes, or away from the equator. On islands, the pressure to range shift represents a threat to the survival of many species as suitable alternative habitats may not be either available or accessible to the species in question.[40] For some species thresholds may be present, where lower intensity climate changes can be tolerated, but more intense changes beyond a certain level result in loss or even extinction. For example, mangroves in Timor-Leste are believed to have some tolerance to small rises in sea-level (3–18 centimeter [cm]) but are significantly at risk from greater rises.[41] Research into the vulnerability of species in Timor-Leste is generally lacking. However, work on other islands in the region suggests that tree[42] and lizard species[40] could be at risk from range shifts.

Economic Sectors

Agriculture

Climate change will influence food production via direct and indirect effects on crop growth processes. Direct effects include alterations to carbon dioxide availability, precipitation and temperatures. Indirect effects include through impacts on water resource availability and seasonality, soil organic matter transformation, soil erosion, changes in pest and disease profiles, the arrival of invasive species, and decline in arable areas due to the submergence of coastal lands and desertification. On an international level, these impacts are expected to damage key staple crop yields, even on lower emissions pathways. Tebaldi and Lobell (2018) estimate 5% and 6% declines in global wheat and maize yields respectively even if the Paris Climate Agreement is met and warming is limited to 1.5°C. Shifts in the optimal and viable spatial ranges of certain crops are also inevitable, though the extent and speed of those shifts remains dependent on the emissions pathway.

The agricultural sector in Timor-Leste does not produce enough food to feed its population, the result of poor soils, poor yielding local varieties, high variability in rainfall, steep slopes and high weed burdens. The population is heavily dependent on agriculture, with 66% of families relying on some form of farming activity for their livelihoods.[6] As such Timor-Leste is highly vulnerable to the impact of climate change impacts on agriculture.[43,44]

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[40] Taylor, S., & Kumar, L. (2016). Global Climate Change Impacts on Pacific Islands Terrestrial Biodiversity: A Review. Tropical Conservation Science, 9(1), 203–223. URL: https://journals.sagepub.com/doi/full/10.1177/194008291600900111

[41] Alongi, D. M. (2014). Mangrove Forests of Timor-Leste: Ecology, Degradation and Vulnerability to Climate Change. In I. Faridah-Hanum, A. Latiff, K. R. Hakeem, & M. Ozturk (Eds.), Mangrove Ecosystems of Asia: Status, Challenges and Management Strategies (pp. 199–212). New York, NY: Springer New York.

[42] Pouteau, R., & Birnbaum, P. (2016). Island biodiversity hotspots are getting hotter: vulnerability of tree species to climate change in New Caledonia. Biological Conservation, 201, 111–119. URL: http://publications.cirad.fr/une_notice.php?dk=582327

[43] Mercer, Jessica & Kelman, Ilan & do Rosario, Francisco & de Deus de Jesus Lima, Abilio & da Silva, Augusto & Beloff, Anna-Maija & McClean, Alex. (2014). Nation-building policies in Timor-Leste: Disaster risk reduction, including climate change adaptation. Disasters. 38. 690–718.URL: https://www.ncbi.nlm.nih.gov/pmc/articles/PMC4415648/ .

[44] Asian Development Bank (2013). Timor-Leste Economy Predicted to Be Among Worst Hit by Climate Change – ADB. URL: https://www.adb.org/news/timor-leste-economy-predicted-be-among-worst-hit-climate-change-adb

Climate change is set to alter rainfall patterns, with Timor-Leste's food production one of the most affected by changes in rainfall in Southeast Asia.[30]

Acknowledging the interactions between CO_2, temperature and water status (e.g. increase in CO_2 concentrations might benefit crops such as rice, sweet potato and peanuts), without management changes, increased temperatures in tropical regions like Timor-Leste are expected to lead to decreased yields. Molyneux et al.'s analysis on climate change impacts on Timor-Leste's food security indicates that maize yields (the country's most abundant crop) will only be slightly affected whereas peanut yields will significantly decrease. Furthermore, increase temperatures are likely to affect coffee yields, an important cash crop. With a steep topography and climate varying with altitude, climate changes are likely to drive range shifts in the suitable growing area for different crops. In general, this will mean movement in an upslope direction of key crops such as maize.[45]

A further, and perhaps lesser appreciated influence of climate change on agricultural production is through its impact on the health and productivity of the labor force. Work by Dunne et al. (2013) suggests that global labor productivity during peak months has already dropped by 10% as a result of warming, and that a decline of up to 20% might be expected by 2050 under the highest emissions pathway (RCP8.5).[46] In combination, it is highly likely that the above processes will have a considerable impact on national food consumption patterns both through direct impacts on internal agricultural operations, and through impacts on the global supply chain.

Fisheries

The fisheries sector in Timor-Leste is small and less developed than in many neighboring nations, but has potential to develop into an important source of income and bolster food security.[47] The limited study into the future climate impact on local fisheries available has suggested that the outlook for near-coast fisheries is negative, and plans should be made for a potential yield declines of an order of 5%–10% by 2050.[48] To an extent these losses may be mitigated by better management techniques and adaptations. Economic modelling on the impact of adaptation scenarios on Timor-Leste fisheries estimates total fish production could be increased marginally by 2035 and 2050 but that by 2050, fish supplies from ocean and coastal ecosystems will see a net decrease as a result of climate change.[48] This has food security implications for the country given 94% of its domestic fish consumption comes from ocean and coastal ecosystems, as opposed to its freshwater ecosystems.

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[45] Bacon, S. A., Mau, R., Neto, F. M., Williams, R. L., & Turner, N. C. (2016). Effect of climate warming on maize production in Timor-Leste: interaction with nitrogen supply. Crop and Pasture Science, 67(2), 156–166. URL: https://doi.org/10.1071/CP15078

[46] Dunne, J. P., Stouffer, R. J., & John, J. G. (2013). Reductions in labor capacity from heat stress under climate warming. Nature Climate Change, 3(6), 563–566. URL: http://www.precaution.org/lib/noaa_reductions_in_labour_capacity_2013.pdf

[47] Alonso, E., Wilson, C., Rodrigues, P., Pereira, M. & Griffiths, D., (2012). Policy and Practice. Recommendations for Sustainable Fisheries Development in Timor-Leste. Bangkok: Regional Fisheries Livelihoods Programme for South and Southeast Asia Policy Paper TIM#2. URL: http://www.fao.org/3/a-ar483e.pdf

[48] Rosegrant, M. W., Dey, M. M., Valmonte-Santos, R., & Chen, O. L. (2016). Economic impacts of climate change and climate change adaptation strategies in Vanuatu and Timor-Leste. Marine Policy, 67, 179–188. URL:https://doi.org/https://doi.org/10.1016/j.marpol.2015.12.010

Communities

Poverty, Inequality and Vulnerability to Climate-Related Disaster

During the period of 2001–2011, 20,000 people were affected and 10,000 houses were damaged by natural hazards, with climate-related disasters the most impactful. As aforementioned, Timor-Leste is vulnerable to high variability of rainfall, accentuated by El Nino and La Nina events. This variability can contribute to landslides, with 234 house damaged and 222 people affected by landslides between 2003 and 2011.[30] Flooding is climate-related disaster Timor-Leste is most exposed to, accounting for 70% of its hazards, with storm and drought accounting for 14% each.[49] Research has shown how the integration of local and indigenous knowledge in Timor-Leste into climate adaptation plans can reduce the impacts of climate-related disasters.[50]

Recent examples of climate-related disasters include torrential rains in December 2003 that affected over 400 people and damaged 16 houses; a tropical cyclone in January 2006 destroying more than 500 houses and corn/rice crops; and severe rains in July 2007 causing landslides, severely affecting 947 people.[50] While Timor-Leste has made considerable progress in development in the last two decades, it still suffers from high levels of poverty, of which climate change threatens to accentuate[29]. In particular, climate change threatens food security, of which the rural poor are most vulnerable. The international development community is well-established in Timor-Leste in terms supporting the country with climate change adaptation. These efforts contribute towards reducing inequality and poverty in the country; however, some scholars argue that donor-led adaptation programs focus too much on the biophysical components of vulnerability and not on the systemic socio-economic and political that underpin Timor-Leste's vulnerability to climate change.[51]

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.[52]

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49 Center for Excellence in Disaster Management & Humanitarian Assistance (2016). Timor-Leste: Disaster Management Reference Handbook. URL: https://reliefweb.int/sites/reliefweb.int/files/resources/disaster-mgmt-ref-hdbk-TimorLeste.pdf

50 Hiwasaki, Lisa & Luna, Emmanuel & Syamsidik, Syamsidik & Shaw, Rajib. (2014). Process for integrating local and indigenous knowledge with science for hydro-meteorological disaster risk reduction and climate change adaptation in coastal and small island communities. International Journal of Disaster Risk Reduction. 10. URL: https://www.sciencedirect.com/science/article/pii/S2212420914000612

51 Barrowman, Hannah & Kumar, Mahendra. (2018). Conceptions of vulnerability in adaptation projects: a critical examination of the role of development aid agencies in Timor-Leste. Regional Environmental Change. URL: https://link.springer.com/article/10.1007%2Fs10113-018-1333-7

52 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

Human Health

Nutrition

The World Food Programme estimate that without adaptation the risk of hunger and child malnutrition on a global scale could increase by 20% respectively by 2050[53]. Work by Springmann et al. has assessed the potential for excess, climate-related deaths associated with malnutrition[54]. The authors identify two key risk factors that are expected to be the primary drivers: a lack of fruit and vegetables in diets, and health complications caused by increasing prevalence of people underweight. Climate change is projected to accentuate the significant problem of undernutrition in Timor-Leste[55].

Heat-related Mortality

Research has placed a threshold of 35°C (wet bulb ambient air temperature) on the human body's ability to regulate temperature, beyond which even a very short period of exposure can present risk of serious ill-health and death.[56] Temperatures significantly lower than the 35°C threshold of 'survivability' can still represent a major threat to human health. Climate change will push global temperatures closer to this temperature 'danger zone' both through slow-onset warming and intensified heat waves.

Work by Honda et al. (2014), which utilized the A1B emissions scenario from CMIP3 (most comparable to RCP6.0), estimates that without adaptation, annual heat-related deaths in the Southeast Asia region, will increase 295% by 2030 and 691% by 2050.[57] Under the RCP8.5 emissions pathway, heat-related deaths for 65+ year-olds in Timor-Leste are projected to increase considerably by 2080, from a baseline of zero per 100,000 in 1961–1990 to 39 per 100,000[56].

Disease

The World Health Organization projects an increase in people at risk of malaria and dengue fever under both low (RCP2.6) and high (RCP8.5) emissions scenarios. In January 2014, the capital Dili experienced and extreme outbreak of dengue fever, with 197 reported cases and two fatalities in the first week of the outbreak[50]. Timor-Leste's National Adaptation Program of Action on Climate Change describes how higher variability and greater rainfall intensity will lead to increased incidences of vector-borne diseases such as dengue fever and malaria[29].

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53 WFP (2015). Two minutes on climate change and hunger: A zero hunger world needs climate resilience. The World Food Programme. URL: https://docs.wfp.org/api/documents/WFP-0000009143/download/

54 Springmann, M., Mason-D'Croz, D., Robinson, S., Garnett, T., Godfray, H. C. J., Gollin, D., . . . Scarborough, P. (2016). Global and regional health effects of future food production under climate change: a modelling study. The Lancet: 387: 1937–1946. URL: https://pubmed.ncbi.nlm.nih.gov/26947322/

55 World Health Organisation (2015). Climate And Health Country Profile – 2015 Timor-Leste. URL: http://www.searo.who.int/entity/water_sanitation/tls_c_h_profile.pdf?ua=1

56 Im, E. S., Pal, J. S., & Eltahir, E. A. B. (2017). Deadly heat waves projected in the densely populated agricultural regions of South Asia. Science Advances, 3(8), 1–8. URL: https://advances.sciencemag.org/content/3/8/e1603322

57 Honda, Y., Kondo, M., McGregor, G., Kim, H., Guo, Y-L, Hijioka, Y., Yoshikawa, M., Oka, K., Takano, S., Hales, S., Sari Kovats, R. (2014) Heat-related mortality risk model for climate change impact projection. Environmental Health and Preventive Medicine 19: 56–63. URL: https://pubmed.ncbi.nlm.nih.gov/23928946/

POLICIES AND PROGRAMS

National Adaptation Policies and Strategies

TABLE 6. Key National Adaptation Policies, Strategies and Plans

Policy/Strategy/Plan	Status	Document Access
Nationally Determined Contribution (NDC) to Paris Climate Agreement	Submitted	November, 2016
National Disaster Risk Management Plan	Enacted	2008
National Communications to the UNFCCC	Two Submitted	Latest: November, 2020
National Action Plan on Climate Change (NAPCC)		
State Action Plans on Climate Change		
National Adaptation Programme of Action on Climate Change	Submitted	December, 2010
National Biodiversity Strategy and Action Plan	Enacted	2015

Climate Change Priorities of ADB and the WBG

ADB — Country Partnership Strategy

ADB has agreed a Country Partnership Strategy (CPS) with the Government of Timor-Leste which covers the period 2016–2020. Climate change issues feature under the 'environmental sustainability' driver of change which is designed to increase the effectiveness of the strategy. Specifically, ADB will support Timor-Leste to achieve environmental sustainability by strengthening the legal and regulatory frameworks for environmental protection and building government capacity for implementation. ADB-supported programs will ensure long-term environmental sustainability by making use of the latest technologies to climate proof new infrastructure and make services resilient to the possible impacts of natural hazards. ADB will also help Timor-Leste access additional resources for environmental management and climate change mitigation from global financing mechanisms.[58]

WBG — Country Partnership Framework

The WBG and Timor-Leste agreed to a Country Partnership Framework (CPF) for FY2020–FY2024. Climate change and the environment are key focuses in Timor-Leste's CPF. The country is highly vulnerable to climate variability, climate change trends and natural hazards, which will impact livelihoods dependent upon natural resource and the environment and further stress fragile environments, such a forests, mangroves and coral reefs. The CFP is supporting Timor-Leste to meet its climate change commitments, improve natural resource management, and build community resilience. The environmental risks reflect the Timor-Leste's vulnerability to climate change and natural hazards, also reflect the country's limited adaptive capacity. The effect of these risks can be very damaging and will likely divert attention from the implementation of the CPF program. The World Bank will partner with other development partners, through existing operations in agriculture and infrastructure, to improve community disaster risk preparedness and build resilience against natural hazards. In addition, adequate resources would be made available to support implementation of environmental and social safeguards policies and build government capacity to better manage environmental risks.[59]

[58] ADB (2016). Country Partnership Strategy – Timor-Leste 2016–2020. URL: https://www.adb.org/sites/default/files/institutional-document/183715/cps-tim-2016-2020.pdf

[59] WBG (2020). Country Partnership Framework for the Democratic Republic of Timor-Leste for the period FY2020–FY2024. URL: http://documents1.worldbank.org/curated/en/353111574777310081/pdf/Timor-Leste-Country-Partnership-Framework-for-the-Period-FY2020-FY2024.pdf

CLIMATE RISK COUNTRY PROFILE

TIMOR-LESTE

WORLD BANK GROUP

ADB ASIAN DEVELOPMENT BANK