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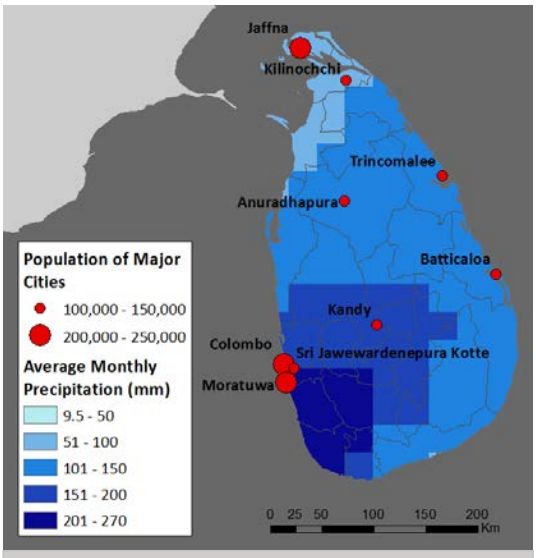
FACT SHEET

CLIMATE RISK PROFILE
SRI LANKA

COUNTRY OVERVIEW



MONTHLY PRECIPITATION IN SRI LANKA

Located in the Indian Ocean, off the Southwest Coast of India, Sri Lanka is a small island nation with a physically diverse geography and tropical climate. With a land area of 65,610 square kilometers (km^2) and 1,340 km of coastline, Sri Lanka is highly vulnerable to the impacts of climate change. As of July 2017, the estimated population of Sri Lanka is over 22 million, with roughly 50 percent of inhabitants living in coastal areas on the West, South-west, and Southern coasts of the island. The commercial Capitol of Colombo has the highest population density with 21,000 inhabitants per km^2. Sri Lanka has made great strides in the last 20 years to increase incomes and reduce poverty, now meeting most Millennium Development Goals. Much of this progress faces significant threat from the impacts of climate change. Primary economic drivers, including tourism, commercial agriculture, and manufacturing are extremely vulnerable to extreme weather events and sea level rise. In addition, deforestation, soil erosion, and loss of biodiversity also threaten to reduce the country's economic output. The Sri Lankan government has made great progress in improving quality of life for most of the population, with large development projects providing piped water, electricity, and access to health services. However, even as gross domestic product (GDP) per capita continues to climb, having reached USD 13,000 in 2017, Sri Lanka still suffers from substantial income inequality and rural poverty. The country has a low unemployment rate (4 percent) and much of its GDP is generated by the service industry, including tourism, which employs 45.9 percent of the population. (1,2,3,4,5,7,9,13)

CLIMATE PROJECTIONS

- 0.8 – 2°C increase in temperatures by 2060
- Changing precipitation patterns
- Increased frequency and severity of extreme weather events
- 20-58 cm rise in sea levels by 2060

KEY CLIMATE IMPACTS

Agriculture
Decreased crop yield and food security
Increased drought frequency/duration
Salinization of agricultural fields

Water Resources
Decreased drinking water availability
Reduced water availability for agriculture
Decreased hydropower generation

Health
Decreased water quality and availability
Decreased nutrition and food security
Shifts in infectious disease patterns

Coastal Zones
Loss of ocean biodiversity
Damage to coastal infrastructure
Groundwater salinization

Infrastructure and Industry
Increased energy costs
Damage to key infrastructure
Decreased economic output

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CLIMATE SUMMARY

The island nation of Sri Lanka possesses a hot and humid tropical climate, but with significant differences across variations in topography. Average annual rainfall is below 1,000 millimeters (mm) in the semi-arid Northwest, but above 5,000 mm in the central hills of the Southwest. Across the island, rainfall comes in four distinct seasons: the Southwest monsoon season from May to September, often exceeding 3,000 mm of precipitation in the wettest regions; a relatively dry inter-monsoon period from October to November; the Northeast monsoon season from December to February, contributing between 200 mm and 1,200 mm of precipitation, mostly in the wettest regions; and finally, another relatively dry inter-monsoon season from March to April. These seasonal variations, along with topography, divide Sri Lanka into three zones: the Wet Zone, the Intermediate Zone, and the Dry Zone. Precipitation patterns are influenced by El Niño and La Niña conditions and the Inter-Tropical Convergence Zone. These rains help support robust and extremely biodiverse forests, covering over 19,500 km^2 or 30% of the island, of which around 14,000 km^2 are dense forests. However, deforestation is rapidly reducing the forest cover of Sri Lanka and just one third of natural cover remains. This loss of forest cover can contribute to erosion and landslide risk. Temperatures fluctuate very little on an annual basis, with mean average temperatures ranging between 26°C and 28°C in coastal areas and between 15°C and 19°C at higher altitudes above 1500 meters (m). Historically, Sri Lanka experiences relatively moderate cyclone events, mostly in the Northern region. However, cyclone-related storm surges and coastal erosion are already a major threat to population centers. (1,2,3,4,5,6,11,13)

HISTORICAL CLIMATE

Climate trends include:

- Increase in mean annual temperature of 0.2°C per decade between 1961 and 1990.
- Increase in mean daytime maximum temperatures of 1°C between 1961 and 2001.
- Increase in mean nighttime minimum temperatures of 0.7°C between 1961 and 2001.
- Decrease in island-wide mean annual precipitation of 144 mm between 1961 and 1990.
- Increase in frequency and intensity of floods.
- Increase in frequency and intensity of droughts.
- Uncertain rates of sea level rise around Sri Lanka, specifically, but accelerated rates across Asia with increases of 3.1 mm per year from 1993 – 2003, compared to 1.7 mm to 2.4 mm per year for the 20th century. (2,3,5,7,9)

FUTURE CLIMATE

Projected changes include:

- Increase in mean annual temperature of between 0.8°C and 2°C by 2060.
- Increase in both daily maximum and minimum temperatures of between 0.7°C and 0.8°C by 2050.
- Projections of change in precipitation vary, with some predicting decreases and some increases, but generally indicate an increase in variability and extreme events.
- Increase in cyclone frequency and intensity.
- Increased frequency and severity of floods, drought incidence, and landslides.
- Total sea level rise of between 0.2 and 0.6 meters by mid-century, compared to 1971-2010 levels. (2,3,5,7,9)

SECTOR IMPACTS AND VULNERABILITIES

COASTAL ZONES AND ECOSYSTEMS

With 1,340 km of coastline and 25 percent of the population living in areas vulnerable to sea level rise (within 1 km of the coast), Sri Lanka's coastal zones face serious threat from sea-level rise caused by climate change, which could amplify existing hazards from tsunamis and cyclones. Being a small island nation with rich and numerous marine and coastal ecosystems, inhabitants of Sri Lankan coastlines rely heavily on fisheries, with nearly a quarter of a million families making their living on coastal and offshore fishing. Coastal ecosystems and livelihoods that depend on them are under direct threat from cyclones,

Climate Stressors and Climate Risks COASTAL ZONES & ECOSYSTEMS

Stressors	Risks
Sea level rise **Increased storm surge** **Increased sea-surface temperatures** **Ocean acidification**	Shoreline erosion
	Saltwater intrusion into aquifers and agricultural areas
	Loss of ocean and near inland biodiversity
	Coral bleaching
	Damage to coastal infrastructure
	Economic loss
	Population displacement

sea level rise, sea surface temperature rise, and ocean acidification. If climate conditions fulfill currently predicted trends, as listed in the stressors and risks table for this section, many coastal livelihood activities will become more difficult and place a larger proportion of the population under increased economic stress. Furthermore, these same changes in climate conditions will have an adverse effect on the tourism industry, which is closely related to, and largely dependent on, coastal and marine biodiversity and recreation. Rising sea levels and storm surges are expected to erode shorelines, degrade the health of coastal ecosystems, and potentially displace coastal populations. Mangroves and other forms of coastal vegetation offer protection and reduce vulnerability to tsunamis and cyclones, but less than one-third of the island is protected in this way and these areas are under pressure from development. By causing sea-level to rise, climate change could reduce the protection from coastal vegetation by 37 percent. Local authorities have recognized the benefits of coastal vegetation, though additional efforts to restore vegetation and harden unprotected coastlines may be needed. (15,16) Additionally, tourism activities are inherently vulnerable to adverse environmental conditions brought on by drought, floods, and cyclones. While tourism has traditionally been a healthy industry, these climate stressors will increasingly threaten the ability to provide visitors with a safe and attractive destination. Beyond the beach, near-coastal areas also include fertile strips of land that are critical for production of rice and coconuts, two major exports and nutritional staples. These areas are also under threat from saltwater intrusion and extreme weather events, particularly drought, as many coastal areas already receive the least precipitation on the island. Near-coastal areas are also vulnerable to flooding, as surplus water from the wet zone diverted to these plains for irrigation often exceeds what the landscape can handle. The manufacturing and agricultural sectors rely upon onshore and offshore infrastructure to export goods. Damage to these systems has the potential to reduce economic output across the Sri Lankan economy. (1,2,3,5,6,7,13)

WATER RESOURCES

Availability, distribution, and use of water for agriculture, human consumption, energy generation, and industry are all directly dependent on climate conditions. Water availability is a critical concern, particularly for drinking water. Climate change threatens both surface water and groundwater sources upon which Sri Lankans depend for domestic use. For example, more frequent and severe flooding can increase risk of water and vector-borne illness and make it more difficult to maintain sanitary living conditions. Increased and worsening droughts, along with salt water intrusion into coastal aquifers, are expected to seriously deplete freshwater availability. Increased economic activity is already leading to a high level of groundwater extraction and pollution of existing resources. High altitude regions in the central part of the island intercept moisture rich monsoonal winds, forming 103 distinct natural river basins across the island and 94 smaller coastal basins. The country's wet zone reliably receives plentiful rainfall, while the intermediate and dry zones receive little rainfall and rely on both natural and artificial distribution of water from the wet zone. Although the total amount of rainfall the island receives is enough to meet domestic and environmental requirements, this uneven distribution of water is problematic, with much of the dry zone experiencing months of drought, while the surface water that flows from the wet zone is artificially discharged into lowlands, often causing flooding and waterlogging. Sri Lanka generates 41% of its electricity via hydroelectric plants. Flood conditions have the potential to worsen, as hydroelectric systems are required to discharge increasing volumes of wet zone rainfall from overburdened reservoir structures. Hydroelectric infrastructure is also vulnerable to drought conditions, as they are designed to utilize historical levels of rainfall and could underproduce during prolonged dry periods. Rivers in the wet zone of the country feed

Climate Stressors and Climate Risks
WATER RESOURCES

Stressors	Risks
Increased evapotranspiration	Damage to drinking and storm water infrastructure
Sea level rise	Saltwater intrusion into aquifers and cropland
Increased drought frequency and duration	Reduced water availability for agriculture
	Decreased or unpredictable hydropower generation
Increased storm frequency and intensity	Difficulty maintaining sanitation systems and practices
	Increased adverse health effects

agricultural irrigation systems, which covers 13 percent of cropped land, some of which is double-cropped. Increased drought and flood frequency and severity from a changing climate can be expected to strain these systems, particularly in the dry zone where 70 percent of rice paddies are located. These areas, already prone to drought, may face more extreme fluctuations in growing conditions. Additionally, increasing temperatures will likely increase the rate of evapotranspiration for holding tanks and in rice paddies, further exacerbating water shortage issues. With high poverty rates, high exposure to drought, and large dependence on agriculture, the three most water vulnerable irrigation districts are Thanamalwila (Moneragala District), Anamaduwa (Puttalam District), and Horowpothana (Anuradhapura District). Conversely, increased rainfall in the wet zone will likely lead to greater flood and erosion risk. In recognition of the problems imposed by uneven distribution of precipitation, rainwater harvesting for both human consumption and for agricultural use is on the rise, as are shade tree management practices and more robust land suitability assessments. (2,4,5,8,9,13)

HEALTH

Having made great strides with its health system in recent years, Sri Lanka is a leader among developing countries and provides universal health care through its Ministry of Health. However, increased vulnerability in the face of climate change will likely prove challenging. This is especially true for vector-borne illnesses, particularly dengue fever. Spread by mosquitos, dengue outbreaks are occurring with higher frequency and severity as conditions improve for the insect populations. During 2017, Sri Lanka faced an exceptionally high number of dengue cases, 4.3 times the 2010-2016 average. There were 189 thousand cases of suspected dengue reported, with 302 deaths. The dengue virus that caused this outbreak was not the usual one circulating in Sri Lanka.(17) Urbanization, overcrowding, increased daytime and nighttime temperatures, and poor water management practices pose serious public health risks, as they are conducive to mosquito breeding and subsequent spreading of dengue. Leptospirosis, a rodent-borne disease, is also a serious concern in Sri Lanka, with outbreaks typically occurring following monsoon seasons, which are expected to intensify. Food insecurity and malnutrition are also critical concerns, with 29 percent of children under five underweight. The impacts of changing climate conditions on both agricultural and fishing yields may further exacerbate food insecurity. Food and waterborne illnesses, such as typhoid, dysentery, and viral hepatitis may be affected by increased flood and drought risks. Direct weather-related health risks are also expected to increase. This is particularly true for the 28 percent of the population working in agricultural fields, with thermal stress and heat-related illness being of greatest concern. Increased frequency and severity of cyclones, floods, and landslides may elevate the risk of acute injury and displacement, coupled with decreasing access to services. Awareness of the health risks associated with climate change is generally limited among the general public and also uneven within the Ministry of Health. (2,4,5,8,9,13)

Climate Stressors and Climate Risks HEALTH

Stressors	Risks
Increased temperatures	Shifts in vector- and waterborne diseases
	Decreased nutrition and food security
Increased drought frequency and duration	Reduced availability and increased disruption of health services
Increased storm frequency and intensity	Reduced water quality and availability
	Difficulty maintaining sanitation systems and practices

AGRICULTURE AND FOOD SECURITY

Sri Lanka's agricultural sector comprises 7.8 percent of GDP and occupies 28 percent of the labor force. Consequently, the adverse effects of a changing climate will create strain on Sri Lanka's domestic market, food security, and export potential. Stagnating sorghum and cowpea yields and declines in rice yields are markers of currently diminished agricultural productivity, leading to increases in food insecurity in agricultural regions, especially the most heavily drought-afflicted low country dry and intermediate zones. Additionally, poor infrastructure in rural areas severely constrains farmers in bringing goods-to-market. Rising temperatures, as well as increased frequency and severity of drought and flooding, will likely exacerbate

these existing challenges. The main crops in Sri Lanka, namely various types of rice, tea, and coconut, are particularly sensitive to variation in temperature and precipitation. Variability in distribution and amounts of precipitation are the primary concerns for Sri Lanka's agricultural sector, both currently and for predicted conditions. Changing rainfall patterns and unexpected periods of high rainfall are expected to strain the capacity of irrigation systems and increase the risk of landslide in some areas. Flooding may also increasingly become a limiting factor for yields, potentially causing crop failures. Despite recent positive economic growth in sectors outside of agriculture, income inequality in Sri Lanka remains an issue. As a result, various types of food insecurity and malnutrition are still prevalent and show high regional disparity. In the estate and plantation (rural) sectors of the country, levels of stunting are three times higher than in urban areas (24 percent vs. 8 percent). As yields and economic output of Sri Lanka's agricultural sector decrease or remain stagnant in the face of changing climate conditions, this disparity is likely to worsen. Furthermore, many of the fertile strips of land that support rice and coconut production are located in coastal areas. Groundwater salinization and coastal erosion resulting from sea level rise threaten crop production and the settlements of many farmers. (1,2,3,4,5,6,8,9,11,13)

Climate Stressors and Climate Risks AGRICULTURE & FOOD SECURITY

Stressors	Risks
Sea level rise	Soil erosion
Increased temperatures	Saltwater intrusion into aquifers and cropland
Variability in distribution and amount of precipitation	Reduced crop yields
	Crop failures
Increased drought frequency and duration	Increased malnutrition
	Overload of irrigation systems leading to flood

INFRASTRUCTURE AND INDUSTRY

Sri Lanka's economy has experienced rapid growth in recent years, growing at an average rate of 6.4 percent between 2010 and 2015. Accompanying this growth has been a transition away from a primarily rural agrarian economy to an urban, services-based economy with a corresponding increase in electricity demand. Sri Lanka has been able to meet much of this demand, providing electricity to 94 percent of the population using an energy mix of 54 percent imported petroleum-based fossil fuels, 41 percent hydroelectric, and 4 percent other renewables. The large portion of electricity generated by hydroelectric plants, however, faces challenges. Generation facilities and reservoir infrastructure have been designed for historical rainfall patterns and volumes. Changing rainfall patterns are likely to affect supply, and projected increases in heavy precipitation may overburden and potentially cause damage to these systems and reduce generating capacity. This is particularly problematic for the service and industrial sector, which rely heavily on the availability of energy to function. In addition to energy, many industrial processes themselves require substantial volumes of water to operate. More frequent and prolonged periods of drought could severely strain these activities. The impact on Sri Lanka's economic health could be significant, as industry and services account for 30 percent and 62 percent of GDP, respectively. In addition, landslides, sea level rise, and cyclones have the ability to damage infrastructure of all types, and particularly transportation infrastructure. Such climate stressors could affect exports, which tallied $10.9 billion in 2017. All aspects of the manufacturing and transportation of goods have the potential to be dramatically affected by changing climate conditions and worsening storms. Increased difficulty and uncertainly in generating energy could increase costs and economic risk. At the same time, the appeal of Sri Lanka as a tourist destination may also become reduced if energy becomes constrained and infrastructure is damaged or destroyed. (1,2,5,9,12,13).

Climate Stressors and Climate Risks INFRASTRUCTURE & INDUSTRY

Stressors	Risks
Increased storm frequency and intensity	Increased energy costs
	Damage to transportation and import/export infrastructure
Coastal erosion	Reduced tourism industry
Increased storm surge	Reduced commercial development
	Reduced economic output

POLICY CONTEXT

Being a developing island nation with rich biodiversity in both terrestrial and marine ecosystems, the impacts and risks of climate change are highly visible and weigh heavily on Sri Lankan policy makers. As a result, Sri Lanka has been relatively proactive in identifying and seeking to plan for the impacts of climate change, including through development of a national policy and multiple adaptation-focused reports for international agencies (e.g., two National Communications and a National Adaptation Plan).

INSTITUTIONAL FRAMEWORK

Sri Lanka has been actively developing planning documents related to climate change since the 1990s. Following the devastation of the 2004 tsunami, many of these documents and subsequent planning efforts have been built around resilience to natural disasters. Conflict in the country significantly reduced development investments until 2009. Since then, tangible progress in addressing climate change has been slow, particularly in the northern part of the country. Though national and regional documents have been produced to highlight the policy objectives related to climate change impacts and potential risk mitigation measures, implementation has generally been limited. However, the government of Sri Lanka has designed and implemented a number of plans that combat indirect risks associated with climate change, including a Water Sanitation and Hygiene (WASH) program through the Ministry of Education. Management of environmental practices and protection of natural resources in Sri Lanka is overseen by the Ministry of Mahaweli Development and Environment, under which serves the Climate Change Secretariat of Sri Lanka. (2,3,5,9,12,13)

NATIONAL STRATEGIES AND PLANS

- National Climate Change Policy of Sri Lanka (2015)
- National Adaptation Plan for Climate Change Impacts in Sri Lanka (2015)
- Technology Needs Assessment and Technology Action Plans for Climate Change Mitigation (2014)
- Second National Communication on Climate Change (2012)
- State of the Nation on Climate Change (2010)
- First National Communication on Climate Change (2000)

KEY RESOURCES[1]

1. CIA World Factbook. 2018. https://www.cia.gov/library/publications/the-world-factbook/geos/ce.html
2. World Bank. 2011. http://sdwebx.worldbank.org/climateportal/countryprofile/doc/GFDRRCountryProfiles/wb_gfdrr_climate_change_country_profile_for_LKA.pdf
3. World Bank. 2018. http://sdwebx.worldbank.org/climateportal/countryprofile/home.cfm?page=country_profile&CCode=LKA
4. World Health Organization. 2015. http://www.searo.who.int/srilanka/documents/review_of_climate_change_srilanka.pdf
5. Sri Lanka Climate Change Secretariat Ministry of Mahaweli Development and Environment. 2016. http://www4.unfccc.int/nap/Documents%20NAP/National%20Reports/National%20Adaptation%20Plan%20of%20Sri%20Lanka.pdf
6. Kottawa-Arachchi. 2017. https://www.researchgate.net/publication/320613961_Climate_climate_change_impacts_on_biodiversity_and_ecosystems_in_Sri_Lanka_A_REVIEW
7. USAID. 2015. https://www.climatelinks.org/sites/default/files/asset/document/Sri%20Lanka%20Climate%20Info%20Fact%20Sheet_FINAL.pdf
8. De Zoysa. 2014. http://file.scirp.org/pdf/OJF_2014101715460663.pdf
9. Ministry of Environment, Sri Lanka. 2011. http://www.climatechange.lk/adaptation/Files/Final_Climate_Change_Vulnerability_Databook.pdf
10. Ministry of Environment, Japan. 2016. https://www.env.go.jp/en/earth/cc/casestudy/2016/casestudy_1_4.pdf
11. South Asia Policy and Research Institute. 2017. https://docs.wfp.org/api/documents/WFP-0000039591/download/?_ga=2.260245198.210120516.1519925292-1940334105.1519657401

[1] This "Key Resources" section lists works cited in preparing the Climate Risk Profile.

12. UNDP. 2016. http://www.undp.org/content/dam/LECB/docs/pubs-reports/UNDP-LECB-Assessment-Sri-Lanka-Power-Sector.pdf
13. Sri Lanka Ministry of the Environment. 2012. http://unfccc.int/resource/docs/natc/lkanc2.pdf
14. Map provided by Global Precipitation Climatology Centre (GPCC). 2015. GPCC Normal Version 2015 0.25 degrees. https://kunden.dwd.de/GPCC/Visualizer
15. Satyanarayana, B. et al. 2017 https://www.sciencedirect.com/science/article/pii/S235198941730121X
16. Blankespoor, B. et al. 2016. Mangroves as a protection from storm surges in a changing climate.
17. International Federation of Red Cross and Red Crescent Societies. 2017. https://reliefweb.int/sites/reliefweb.int/files/resources/MDRLK007dfr.pdf

SELECTED ONGOING EXPERIENCES[2]

Below are selected projects focused on climate change adaptation, or some aspect of it, in Sri Lanka.

Selected Program	Amount	Donor	Year	Implementer
Safe Disaster-Resilient Drinking Water to Floods and Drought Prone Areas in Sri Lanka	$1 million	USAID	2016 - present	Government of Sri Lanka
Climate Resilience Improvement Project (CRIP)	$110 million	The World Bank	2014 - present	The World Bank
Renewable Energy for Rural Economic Development	$75 million	The World Bank	2002 – 2011	Government of Sri Lanka
Ecosystem Conservation and Management	$45 million	The World Bank	2016 – present	Government of Sri Lanka - Ministry of Tourism and Sports
Water Supply and Sanitation Improvement Project	$165 million	The World Bank	2015 – present	Government of Sri Lanka
Sri Lanka Agriculture Sector Modernization Project	$125 million	The World Bank	2016 – present	Government of Sri Lanka
Protect Oceans by Improving Waste Management	$625,000	USAID	2017 – present	USAID

[2] This "Selected Ongoing Experiences" section lists a selection of ongoing development projects and interventions directly or indirectly relevant to climate risk management and adaptation in Sri Lanka. Experiences were identified primarily via desk review of USAID, multilateral development bank, and other international donor programming. Experiences listed are not meant to be comprehensive.