STIMSON

RESOURCES & CLIMATE

REPORT

CORVI: Measuring Multidimensional Climate Risks in Suva, Fiji

The Climate and Ocean Risk Vulnerability Index

Environmental Security Program

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The Henry L. Stimson Center
1211 Connecticut Avenue NW
8th Floor
Washington, DC 20036
Tel: 202.223.5956 | Fax: 202.238.9604
www.stimson.org

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Research Team and Acknowledgements

Research Team

The Ocean Policy Research Institute of the Sasakawa Peace Foundation

Dr. Miko Maekawa, Dr. Santosh Rauniyar, Dr. Hide Sakaguchi, Dr. Tomonari Akamatsu

Stimson Center

Jack Stuart (Stimson Research Associate), Natalie Fiertz (Stimson Research Associate), Tracy Rouleau (Stimson CORVI Project Senior Advisor, Natural Resource and Environmental Economist), Sally Yozell (Stimson Senior Fellow and Research Director)

Other

Nagisa Shiiba (Institute for Global Environmental Strategies), Priyatma Singh (University of Fiji), Dhrishna Charan (University of Fiji), Kushaal Raj (Ministry of Economy, Fiji), Arpana Pratap (Pacific Islands Development Forum)

Acknowledgments

The research team wishes to express its appreciation for the support provided by the following organizations.

We are grateful to all of the individuals and organizations that participated in the surveys and interviews, including offices in the Government of Fiji and Suva City Council.

Thank you to the University of Fiji, the Pacific Islands Development Forum, the Fiji Ministry of Economy, and the Ocean Policy Research Institute-Sasakawa Peace Foundation for their invaluable partnership and support in advancing this project.

We appreciate Qlik's continued support of the CORVI Data Portal, which was used to complete CORVI scores and conduct analysis.

We also wish to extend special thanks to the Ocean Policy Research Institute-Sasakawa Peace Foundation and the Nippon Foundation for their generous financial support to the Climate and Ocean Risk Vulnerability Index (CORVI) project.

Introduction

CORVI

As risks from climate change to coastal cities continue to increase, governments, public and private investors, and the insurance industry need targeted risk information to prioritize action and build resilience where it matters most.

In response, the Stimson Center developed the Climate and Ocean Risk Vulnerability Index (CORVI). CORVI is a decision support tool that compares a diverse range of ecological, financial, and political risks across 10 categories and nearly 100 indicators to produce a holistic coastal city risk profile. Each indicator and category is scored using a 1-10 risk scale relative to other cities in the region, providing a simple reference point for decision makers looking to prioritize climate action and resilience investment.

This CORVI Risk Assessment presents a comprehensive profile of climate and ocean risk for the city of Suva, Fiji. The assessment combines empirical data from surveys and from global, national, and local datasets with local information from expert interviews to analyze how climate and ocean risks are impacting the city. The information is used to develop detailed priority recommendations for Suva to reduce its climate vulnerabilities, build resilience, and work to develop a more secure and sustainable future.

Learn more about the CORVI methodology **here**.

This risk profile was produced in collaboration with the Ocean Policy Research Institute of the Sasakawa Peace Foundation (OPRI-SPF), University of Fiji, Pacific Islands Development Forum (PIDF), and the Climate Change and International Cooperation Division, Ministry of Economics.

Suva

Located on the southeast side of the island of Viti Levu, Suva is the economic, political, and cultural center of Fiji. Home to an estimated 94,000 people, about 10 percent of the national population, it also houses important government ministries, international organizations, and the headquarters of most businesses and finance institutions in Fiji. Suva is also Fiji's primary transportation hub; the Suva Wharf and Nausori Airport are both located within the Greater Suva Urban Area (GSUA) boundaries, which includes Suva City and the three municipal towns of Lami, Nasinu, and Nausori. With approximately 75 percent of the Fijian population living in coastal zones on Viti Levu, the ocean and coastal regions are intrinsically linked to the well-being, culture, and identity of Fijians.[1]

However, rapid urbanization in Suva poses many challenges for city officials and residents, including the unregulated expansion of informal housing. These underserved neighborhoods lack the city's public services such as sewage, water, electricity, and garbage disposal, which can adversely affect the health and safety of the residents.[2] Climate change further exacerbates these problems. Increases in sea level, rising sea surface and air temperatures, greater ocean acidification, and growing severity of extreme weather events pose a threat to the livelihood and security of city residents.[3] The geographic scope for this study covers the Greater Suva Urban Area (GSUA), with a population of about 186,000. The GSUA, encompasses the area from the port of Suva in the south to Nausori, which sits on the Rewa River and includes the Suva Nausori Airport.

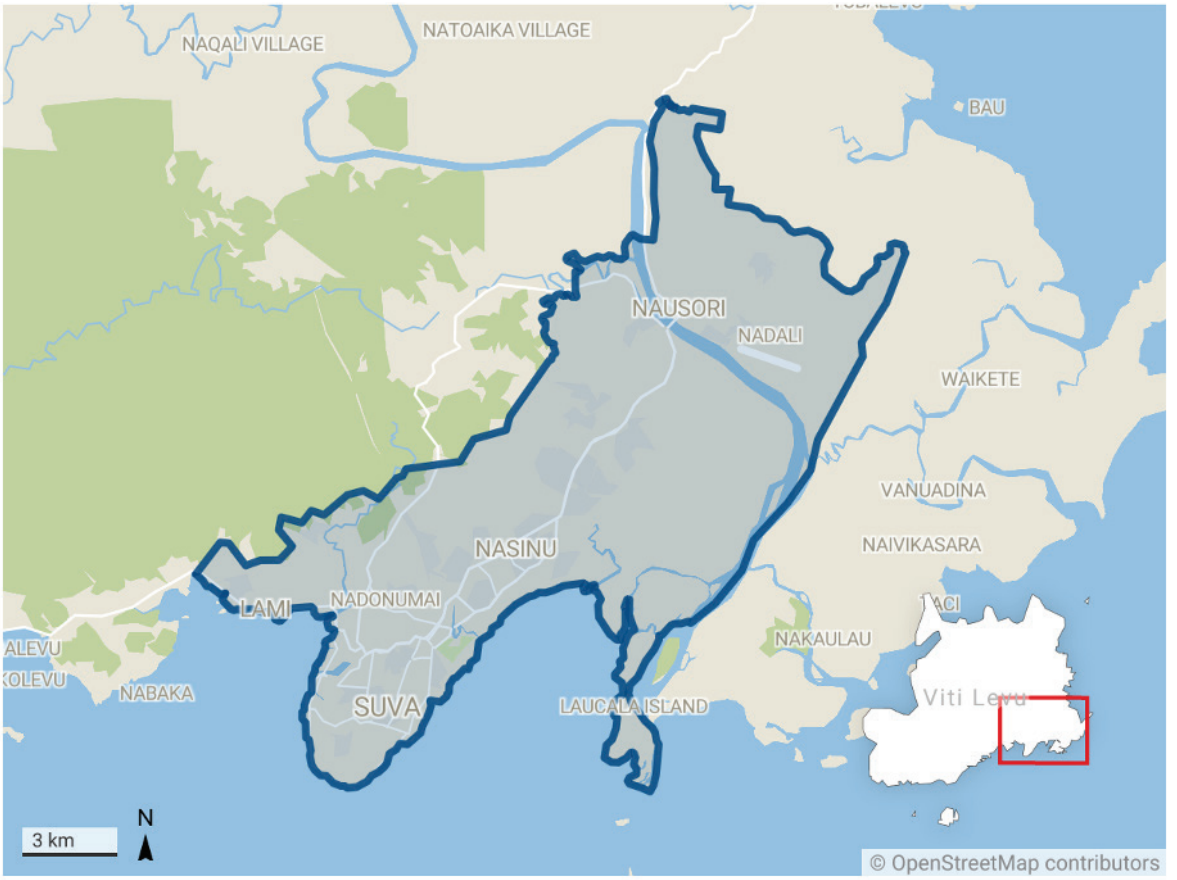
The CORVI risk profile for Suva incorporates empirical data from 74 expert surveys displayed across 10 categories and 97 indicators. The surveys were conducted from February 2020 to March 2021 using a mix of paper-based and online surveys, followed up by additional literature survey during the period of COVID-19 pandemic. These risk scores are supplemented with information from interviews with subject matter experts for the different categories.

Summary Findings

The CORVI analysis highlights significant climate risks to key industry sectors, neighborhoods, and the coastal environment, which are further exacerbated by the unintended consequences of urbanization. These risks are diffuse with medium-high category risk scores spread across Climate (7.24), Major Industries (6.73), Stability (6.03), Geology/Water (5.85), Ecosystems (5.71), and Economics (5.54).

Suva City has experienced frequent extreme weather events in the past few decades. Increasingly severe tropical cyclones, droughts, and periods of excessive rainfall have affected key sectors, neighborhoods, and ecosystems across the cityscape. Increasing demand on land resources due to population growth, combined with climate-related impacts including coastal erosion, inundation, saltwater intrusion and increasing intensity of extreme events contribute to the degradation of arable lands.[4] Land degradation threatens future food security. Experts also noted that government ministry buildings and offices are often located in low lying areas. With increased concern for the future rise in sea level and associated flooding, important administrative and government records and historical documents, many of which are stored on the ground floors, are at risk of being lost or destroyed. In addition, rapid urbanization has led to an increase in the number of people settling informally on the outskirts of the city. These poor neighborhoods are extremely vulnerable to climate hazards and lack the capacity to build resilience.

Study Area: Greater Suva Urban Area



Map: Stimson Center • Created with Datawrapper

Suva Risk Profile

CORVI Category Scores: Low Risk 1 - 2.5 | Medium Risk 2.51 - 5 | Medium-High Risk 5.01 - 7.5 | High Risk 7.51 - 10

Ecological Risk		Financial Risk		Political Risk	
Climate Change	7.24	Major Industries	6.73	Stability	6.03
Geology/Water	5.85	Economics	5.54	Social/Demographics	5.47
Ecosystems	5.71	Infrastructure	5.04	Governance	5.09
Fisheries	4.68				

Table: Stimson Center • Created with Datawrapper

In 2017, the tourism industry contributed approximately 34% towards the gross domestic product (GDP) of Fiji, and attracted more than 842,000 visitors, who spent $1.9 billion. The travel and tourism industry provided 118,500 jobs in Fiji, which accounted for over 36.5% of total employment in the country. This is significantly higher than the global average of the tourism sector supporting 1 in every 10 jobs, an estimate by the World Travel and Tourism Council (WTTC).[5] In 2020, the combined impacts of the COVID-19 pandemic and two cyclones, Yasa and Harold, also affected the tourism economy, and resulted in an estimated 15.7% contraction to Fiji's GDP.[6] Critical coastal ecosystems in and around Suva, including intertidal zones, coral reefs, and mangrove forests, are considerably affected by increasing climate-related disasters, changes in sea surface temperature, and high-levels of shoreline development. Combined, these impacts pose a grave threat to critical natural systems which protect coastlines and underpin the local economy.

Notably, CORVI scores show that experts did not rate the **disaster response capacity** as a major vulnerability, reflected in a medium risk score (4.53). The Fiji National Disaster Management Office (NDMO) has played a major role in improving Fiji's disaster risk reduction and management of disasters. Recent severe tropical cyclones have enabled the Fijian military and police to gain experience in initial disaster response and coordination with donors and domestic stakeholders, including the NDMO, through cluster systems.

In addition, while limitations remain, Fiji has made significant progress in paving the way for climate-resilient development. Domestically, Fiji has been active in creating new policies and legislation to guide its fight against climate change and to improve resiliency to the impacts of climate change, including through the development of the Climate Change Act. The Fiji parliament passed its Climate Change Act in September 2021, providing guidance on the regulation and governance of the national response to climate change. [7] Part 13 of the Act is dedicated to oceans and aims to ensure that climate-related policies adequately capture ocean-related issues. The Act provides guidance on coordination of activities that increase the resilience of oceans by several means, including through reduction of stressors such as pollution and waste and "by improving the resilience of marine ecosystems, mangroves, seagrasses and coral reefs, strengthening land-sea management and sustainably managing the marine resources within Fiji's maritime boundaries" (Climate Change Act, 2021). Through its implementation, the Climate Change Act will work to secure Fiji's battle against climate change through a more resilient, sustainable, and climate-proof society.

- **Develop climate-risk-informed urban planning.** Suva is exposed to severe climate-related disasters, such as tropical cyclones, droughts, intense rainfall, and landslides. Key drivers of these risks are increasingly intense rainfall events, a rapid increase in the urban population, and the expansion of informal and unplanned settlements. There is an urgent need

for a modern climate-resilient metropolitan-level GSUA urban plan taking into consideration current and future risks, and climate adaptation measures. This plan could incorporate climate change projections in infrastructure, spatial planning, and involve broad consultation with stakeholders. The migration of certain government and business functions to other locations on the island of Viti Levu with lower levels of vulnerability are also considered effective adaptation measures.

- **Integrate urban development and natural restoration.** As a rapidly developing city, Suva needs to address the degradation of key ecosystems such as the coastal intertidal zone, mangroves, and coral reefs by integrating conservation and restoration with urban development in coastal areas. Stakeholders in Suva should explore the best mix of green-grey infrastructure and nature-based solutions (NbS), including blue carbon solutions, which could support development that reduces flood risk, restores critical ecosystems, and improves access to climate finance.
- **Enhance the climate resilience of the tourism sector.** Due to the high economic dependence on the recreation and tourism industries, enhancing the climate resilience of the tourism sector is an important part of protecting Fiji's economy. Such measures can include promoting climate-resilient infrastructure by enforcing building codes, promoting LEED certification for new development, improving airports and roads, accommodation, and resort facilities, in line with disaster risk management. Income diversification strategies can also strengthen resilience in the tourism sector. There should be a consideration to diversify the use of the Environmental and Climate Adaptation Levy imposed on prescribed services offered to visitors to scale up climate-resilient tourism.

Ecological Risk

Natural climate-related extreme events and slow-onset environmental degradation have put increased pressure on the coastal areas of Suva. The ecological risk category captures the environmental risks to the city of Suva within four sub-categories: geology and water, climate, ecosystem, and fisheries. Fiji is one of the most vulnerable countries of the world to the risks of climate change and climate variability, like many of its fellow Pacific Island Countries. Extreme weather events, including flooding, storm surges, droughts, and tropical cyclones, have had major impacts on the lives of people, the economy, and the environment. Disaster-related economic losses in the region, as a percentage of GDP, are higher than almost anywhere else in the world, due to the high exposure of population and infrastructure to disaster events. [8] Since 1993, Fiji has recorded a 6 millimeter (0.2 inch) increase in its sea level per year, larger than the global average. Across Fiji, including Suva, the number of cool nights has decreased, and the number of warm days has increased since 1942. Tropical cyclones are predicted to decrease in frequency but increase in intensity. These changing weather patterns have worsened Fiji's susceptibility to viral disease outbreaks. [9] There are signs of degradation in ecosystems, which provide the foundation of livelihoods and economic activities in the capital city.

- The **CLIMATE** category (expert weighted avg 7.24) is the highest scoring category in the assessment and high risk scores for the **number of tropical cyclone**s (8.78), **number of droughts** (8.40), and **number of high rainfall days** (8.04) highlights Suva's vulnerability to diverse climate hazards.
- The **GEOLOGY/WATER** category (expert weighted avg 5.85) includes medium-high risk scores for the **rate of coastal erosion** (6.63), **projected change in sea-level rise** (6.42), **level of geophysical risk of landslides** (6.40), and **degree of saltwater intrusion in coastal aquifers** (6.20) shows the changing nature of the very land on which Suva is built.
- In the **ECOSYSTEM** category (expert weighted avg 5.71), medium-high risk scores for **incidence of high invasive species abundance** (7.30), **rate of occurrence of harmful algal blooms** (6.98), **level of mangrove coverage** (6.15), and **level of coral reef coverage** (5.82) reflect broad-based threats to Suva's marine and coastal ecosystems, reducing the diverse benefits they provide.
- The **FISHERIES** category (expert weighted avg 4.68), the lowest scoring category in the assessment, includes medium risk scores for **level of unreported catch estimate** (3.60) and **capacity of fisheries enforcement institutions** (4.70). However, medium-high risk scores for **nearshore fish stock status** (6.03), **the percent of fisheries certified by the Marine Stewardship Council (MSC)** (5.82), and **foreign vessels fishing in Fiji's Exclusive Economic Zone (EEZ)** (5.27) highlight areas of vulnerability.

Due to its location on the windward side of Viti Levu, most of the areas in the Greater Suva Urban Area (GSUA) experience heavy rainfall, reflected in a high risk score for **number of high rainfall days** (8.04). On the south-eastern slopes of Viti Levu that encompass the GSUA, the average annual rainfall is 3000 mm, which is much higher than that in the lowlands on the western side of the island with 1800 mm.[10] Residents in the area consequently face significant concerns associated with riverbank erosion, inundation, irregular water supply, change in rainfall, and flooding.[11] Extreme rainfall events can inundate the sewer pumping system and increase the **level of risk of landslides**, like the one at the Wainibuku Reservoir in May 2021 that led to water supply disruptions in Suva,[12] reflected in a medium-high risk score (6.40). This type of heavy rainfall and consequent flooding are strongly correlated with La Niña periods while the **number of droughts**, another high level risk (8.40), are more likely during El Niño periods.[13]

The **total number of tropical cyclones** is an ever-present and growing threat to Fiji, reflected in a high risk score (8.78). The EM-DAT natural disaster dataset shows that 15 tropical cyclones hit Fiji between 2004 and 2019, causing substantial damage. Most recently, Cyclone Harold and Cyclone Yasa in 2020 caused tremendous damage in Fiji, with US$ 40 million and US$ 250 million economic loss, respectively.[14] However, due to the geography of Viti Levu, the impacts of extreme storms are highly localized; for example, extreme cyclones

most commonly impact the western side of the island. Suva is protected from cyclones by Suva Bay and surrounding mangrove forests, although experts have expressed concerns that while Suva is sheltered, a lack of awareness and complacency by city residents, disaster response teams, and urban planners to the potential impacts of extreme storms pose substantial risk. The gap between risk and perceived risk is a barrier to the development of effective and sustainable adaptive strategies for climate change in Fiji.[15]

The **projected change in sea-level rise (SLR)** will exacerbate storm surges and raise the water table, thereby increasing coastal flood risk, reflected in a medium-high risk score (6.42).[16] Since 1993, sea levels in Fiji have risen by about 6 mm per year, approximately twice the global average,[17] and by 2100 SLR may reach 0.63 meters.[18] The majority of GSUA's downtown area and shoreline is built on reclaimed land, leaving it vulnerable to coastal flooding,[19] reflected in a medium-high risk scores for the **percent of the metro area at risk of flooding** (5.84) and **rate of coastal erosion** (6.63). Fiji's geographical features of steep-shelved coastlines and narrow fringing reefs, combined with other factors such as sea-level rise, astronomical tides, storm surges, and cyclone wind action, increase the city's vulnerability to coastal flooding events.[20]

Ecosystem degradation and loss can also increase Suva's vulnerability to coastal and ocean hazards. Medium-high risk scores for the **level of seagrass bed coverage** (7.10), **level of mangrove coverage** (6.15), **level of coral reefs coverage** (5.82), and **level of coastal intertidal zone coverage** (5.68) suggest that all four types of ecosystems are facing ongoing threats that are causing them to shrink. This reduces the benefits they provide, including coastal protection from storm surge and habitat provision for marine life.[21]

The Colo-i-Suva Forest Reserve. Credit: Dan Campbell, Shutterstock.

A coral reef located off the northeastern coast of Viti Levu. Credit: Danita Delimont, Shutterstock.

Several experts identified a broad tension between urban expansion and environmental protection, as well as a lack of confidence in government capacity to carry out environmental impact assessments (EIA). Each type of ecosystem, however, also faces specific threats.

Fiji's mangroves cover an estimated 65,243 hectares, shrinking by 1,135 hectares between 2001 and 2018, an annual loss rate of 0.11 percent, primarily due to tropical cyclones. On the southern coast of the island of Viti Levu, where Suva is located, however, small-scale harvesting is the principal cause of mangrove loss.[22] There has been an increase in planning applications to remove mangroves for development to the west of Suva city towards Lami town.

Coral reefs are coming under increased threat from mass bleaching events due to rising ocean temperatures, most notably in 2000. In 2000, bleaching caused the Suva barrier reef to lose approximately 30 percent of coral cover and 45 percent of coral colonies.[23] With increased temperatures projected for the Fiji Islands, bleaching thresholds are likely to be exceeded more frequently, resulting in an increasing number of bleaching events.[24]

Coastal wetlands in Suva are being adversely affected by industrialization, drainage alterations, landfill, nonpoint source pollution, and rapid urbanization,[25] all of which are degrading coastal health in and around the GSUA. Medium-high risk scores for **incidence of high invasive species abundance** (7.30) and **rate of occurrence of harmful algal blooms (HABs)** (6.98) demonstrate additional risks associated with damaging Suva's native ecosystems. In other regions such as the Caribbean, invasive species and HABs have caused further ecosystem damage, limited tourism visitation, and resulted in public health issues.

Fisheries remains an important sector of Suva's economy, with the city landing nearly half of Fiji's total commercial fish catch.[26] The increasing impacts of climate change threaten the marine and coastal ecosystems that sustain the sector. Most notably, major coral bleaching events, with the most significant having taken place in 2005, have harmed important fishery habitat and led to a decline in nearshore fish stocks around the city, reflected in the medium-high risk score for **nearshore fish stock status** (6.03).

Lower risk scores for **capacity of fisheries enforcement institutions** (4.70) and **level of unreported catch estimate** (3.60), however, demonstrate that Fiji has taken steps to reduce the vulnerability of its fisheries. In particular, the Fiji Locally Managed Marine Area is the principal marine conservation network, bringing together diverse stakeholders from civil society, government, academia, and local communities to integrate traditional conservation practices with resource management science.[27] The government of Fiji completed its new National Ocean Policy in 2021 with the support of the World Bank, which aims to increase the coverage of marine protected areas by 2024, with eventual expansion to encompass 30% of the country's waters by 2030.[28] The new policy also aims to restore and maintain the health of Fiji's ocean areas, create more ecotourism opportunities, support food security, and promote the greater inclusion women in ocean management.[29]

Challenges remain, however, particularly around **the percent of fisheries certified by the Marine Stewardship Council (MSC)**, reflected in a medium-high risk score (5.82), and **number of incidents of foreign vessels fishing in the Exclusive Economic Zone (EEZ)**, also a medium-high risk score (5.27). Fiji loses $200-300 million every year to illegal, unreported, and unregulated (IUU) fishing.[30] A significant proportion of this IUU fishing is from Chinese-owned boats.[31] In response, in 2018, Fiji ratified the Port State Measures Agreement, a binding international agreement to prevent, deter, and eliminate illegal, unreported, and unregulated (IUU) fishing.

Suva: Ecological Risk

Each category score comprises multiple indicators.
Low 1 - 2.5 **Medium** 2.51 - 5 **Medium-High** 5.01 - 7.5 **High** 7.51 - 10

Category		Indicator	
Climate Change	7.24	Total Number of Hurricanes/Tropical Cyclones	8.78
		Number of Droughts	8.40
		Number of High Rainfall Days	8.04
		Change in Sea Surface Temperature	6.88
		Number of People Affected by Extreme Weather Events	6.46
		Number of Extreme Heat Events	6.44
		Cases of Vector-Borne Disease Infections	6.15
		Number of Flood Events	5.85
Geology and Water	5.85	Rate of Coastal Erosion	6.63
		Percent of Landscape that is Arable Land	6.43
		Projected Change in Sea-Level Rise	6.42
		Level of Geophysical Risk of Landslides	6.40
		Degree of Saltwater Intrusion in Coastal Aquifers	6.20
		Percent of Metro Area at Risk of Flooding	5.84
		Degree of soil salinity in arable lands	5.76
		Percent of Bodies of Water with High Water Quality	4.85
		Piped Water Supply Continuity	3.43
Ecosystems	5.71	Incidence of High Invasive Species Abundance	7.30
		Level of Seagrass Bed Coverage	7.10
		Rate of Occurrence of Harmful Algal Blooms	6.98
		Percent of GDP Protected by Coral Reefs	6.98
		Level of Mangrove Coverage	6.15
		Level of Coral Reefs Coverage	5.82
		Percent of GDP Protected by Sea Grass Beds	5.68
		Level of Coastal Intertidal Zone Coverage	5.68
		Health of Existing Sea Grass Beds	5.58
		Health of Existing Coral Reefs	5.58
		Health of Existing Mangroves	5.45
		Health of Existing Intertidal Zone	5.23
		Percent of GDP Protected by Intertidal Zone	5.14
		Percent of GDP Protected by Mangroves	5.12
Fisheries	4.68	Nearshore Fish Stock Status	6.03
		Percent of Fisheries Certified by MSC	5.82
		Number of Incidents of Foreign Vessels Fishing in EEZ	5.27
		OffShore Fish Stock Status	5.13
		Number of Fisheries Access Agreements with Foreign Nations	4.91
		Capacity of Fisheries Enforcement Institutions	4.70
		Level of Unreported Catch Estimate	3.60
		Fish Consumption Per Capita	3.06

Table: Stimson Center • Created with Datawrapper

Financial Risk

Between 2010 and 2020, Fiji's economy sustained a GDP growth rate of 3.7 percent,[32] driving significant urbanization in Suva as a key regional hub. High and medium-high risk scores from a high reliance on the tourism industry and the port, together with widespread informal housing and a highly developed shoreline, reflect an economy that is highly vulnerable to climate change. Additional medium-high risk scores for debt ratio, market losses from extreme weather events, and housing damage from extreme weather events reflect the ways that climate change is already impacting Suva. More recently, the COVID-19 pandemic has underlined Fiji's financial vulnerability, causing an estimated economic contraction of 15.7% during 2020.[33]

- The **MAJOR INDUSTRIES** category (expert weighted avg 6.73) highlights the high **percent of the national economy based in the tourism industry** (8.48), and **percent of the national economy based in the port and shipping industries** (7.05), as well as the need to regulate the growing **diversity of lodging types** (8.08).
- The **ECONOMICS** category (expert weighted avg 5.54) shows high and medium-high risk scores in **the percent of GDP generated in coastal cities** (7.66) and **market losses from extreme weather events** (6.60). This highlights the importance of Suva to the economic prosperity of Fiji, as well as the risks posed by climate change to its businesses.
- The **INFRASTRUCTURE** category (expert weighted avg 5.04) highlights risks posed by the **level of informal and unplanned**

Sacred Heart Cathedral in Suva. Credit: Nenad Basic, Shutterstock.

settlements (6.86), the **level of shoreline development** (6.63), and **level of housing damage from extreme weather events** (5.88). In contrast, the **level of resilience for ports and shipping** (4.72), **level of resilience for roads** (4.36), and **percent of the population with adequate access to electricity** (3.42) scored as medium risk scores.

Recreation and tourism are the primary drivers of Fiji's economic growth and its main source of foreign currency. This economic dependence on the tourism industry is reflected in a high risk indicator score for **the percent of the national economy based in the tourism industry** (8.48). The Greater Suva area, which entertains tourists with Fiji's historical heritage such as the Sacred Heart Cathedral, is one of the most popular tourist destinations alongside Nadi Town and Taveuni Island. The tourism sector had experienced stable growth, with tourism earnings increasing by 50 percent between 2012 and 2019, according to the data provided by Bureau of Statistics. However, climate change is directly and indirectly impacting tourism in the region, with coastal erosion and coral bleaching affecting the attractiveness of tourist destinations. In addition, sea level rise and extreme weather events pose a growing threat to coastal-based infrastructure.[34]

The port and the shipping industry are at the core of Suva's industrial presence. Kings Wharf in Suva is the main commercial port for Fiji, handling bulk and container freight for trade. The port and shipping industries are an important economic sector at risk from climate change, reflected in a medium-high risk score for **percent of national economy based in port and shipping industries** (7.05). Experts from the port operating company stated that while the port is vital for businesses in Suva, resilience planning and investment are prevented by insufficient human resources, fragmented initiatives lacking in coordination and strategy, and the absence of a central finance mechanism.

However, the port and shipping sector have started proactively mitigating climate change impacts through a green stewardship program.[35] For instance, plans are underway to establish garden areas in the port complex, and smart energy-efficient light-emitting diodes and water filter recycling tanks are being installed at the wharf operational areas. A new and more efficient electric powered incinerator was commissioned for use at the Port of Suva in 2019. The new incinerator has higher burning capacity and is more energy efficient as compared to the old diesel-powered incinerator which was in use since 1998. These efforts are reflected in a lower risk score for the **level of resilience for port and shipping** (4.72).

Suva Port. Credit: Don Mammoser, Shutterstock.

The CORVI assessment also shows importance of coastal cities for Fiji economy, reflected in a high risk score for **percent of GDP generated in coastal cities** (7.66). This reliance on specific geographical locations for economic activities calls for a more targeted approach for risk management. The main industrial areas in Suva, i.e., manufacturing and food processing, are also vulnerable to the impacts of climate change as factories are usually located in coastal areas, while many other industries, such as boat repair or travel companies, will also likely be affected due to their proximity to coastal zones. The manufacturing industry in Fiji is highly dependent on natural resource use such as water and other locally sourced raw materials.[36] The intensification of climate change will affect Fiji's natural resources in a variety of ways, and this is likely to have a detrimental effect on the manufacturing operations.

In addition, climate change is increasing pressure on key blue economy sectors by undermining coastal ecosystems which offer substantial economic value to the city, reflected in the medium-high risk scores for the **percent of the national economy based in offshore fisheries** (6.16) and **in nearshore fishing industries** (5.79). For instance, the economic value provided by the coastal ecosystems to fishing at Navakavu, approximately 13km west from the capital city of Suva, is estimated to generate net benefits of just over US$1.8 million per year.[37] Suva is one of the major fishery landing sites, and nearly half of the Fiji's total landings from coastal commercial fisheries (about 5,500 tons per year) are made in Suva.[38] Fisheries in the city used to be under threat from foreshore reclamation projects and from anthropogenic biochemical pollution,[39] but are now suffering from diminishing fish stocks, particularly near the shore. More recent natural resource management strategies, including marine protected areas (MPAs) and LMMAs in Fiji, are not large enough to have a meaningful impact in reversing these declining fish stocks.[40]

Further evidence of Suva's economic vulnerability to climate change is revealed in the medium-high risk score for **market losses from extreme weather events** (6.60). For example, national economic losses from Tropical Cyclone Winston in 2016, one of the most devastating cyclones in the history of the island, reached US$1.4 billion, corresponding to about 31 percent of GDP. It also caused inflation to rise to 5 percent, mainly due to a shortage of agricultural products.[41]

Higher risks in the **level of shoreline development** (6.63) and the **level of informal or unplanned settlement** (6.86) were also noted as significant points of vulnerability. Climate change has increased costs for businesses located in coastal areas, causing businesses to relocate and reducing employment, according to interviewees.[42] Other experts frequently commented on the vulnerability of the city's aging infrastructure.

Residents of informal settlements in Suva are considered to be the most vulnerable demographic group at risk from the impacts of climate change.[43] Although the Fijian government enforced the Urban Growth Management Plan for the greater Suva region in 2006 with the aim of guiding strategic investments and expansion to safer lands, high-risk informal settlements remain in low-lying areas, exacerbating the vulnerability of the poorest city residents, in areas such as Lami town. Low-income residents are more vulnerable to climate risks due to a lack of financial resources to implement resilience measures and recover from extreme weather events, reflected in a medium-high risk score for **income inequalit**y (5.81).

Experts frequently commented on the vulnerability of the city's aging infrastructure.[44] Much of Suva's public infrastructure, including sewage, solid waste management, and transport, was designed and built in 1942 and has not kept pace with rapid urban growth.[45] Since the first City Planning Scheme for Suva was prepared in 1979, city-specific planning has become outdated.[46] Though piecemeal amendments have been made since then, the plan has not undergone a comprehensive review and update.[47]

In 2019, the Fijian government announced that it is in the process of developing a new master plan for the city in collaboration with the Singapore Cooperation Enterprise.[48] The plan will address key issues, including transportation, land use planning and zoning, the tourism industry, and urban settlements.[49] Finally, while the **percent of the population with adequate access to electricity scored as medium risk** (3.42), experts noted electrical infrastructure is the most vulnerable to the impacts of climate change, noting that other critical infrastructure, such as water and sewage, depend heavily on electricity and any disruption to their electricity supply would cripple the infrastructure of Suva.

Suva: Financial Risk

Each category score comprises multiple indicators.
Low 1 - 2.5 **Medium** 2.51 - 5 **Medium-High** 5.01 - 7.5 **High** 7.51 - 10

Category		Indicator	
Major Industries	6.73	Percent of National Economy Based in Tourism Industry	8.48
		Diversity of Lodging Types	8.08
		Percent of National Economy Based in Port and Shipping Industries	7.05
		Percent of National Economy Based in Off Shore Fisheries	6.16
		Percent of National Economy Based in Near Shore Fishing Industry	5.79
		Percent of National Economy Based in Agriculture	4.66
Economics	5.54	Percent of GDP Generated in Coastal Cities	7.66
		Market Losses from Extreme Weather Events	6.60
		Debt Ratio (% of GDP)	6.28
		Income Inequality	5.81
		Urban Unemployment Rate	5.29
		Level of Informal Economy	5.26
		National Youth Unemployment Rate	4.96
		National Unemployment Rate	4.57
		National GDP Per Capita	3.92
Infrastructure	5.04	Level of informal or unplanned settlement	6.86
		Level of Shoreline Development	6.63
		Level of Housing Damage from Extreme Weather Events	5.88
		Percent of Low-Income Housing in Relation to Flood Zones	5.58
		Proportion of Wastewater Safely Treated	5.53
		Percent of People Living Below 5 Meters Above Sea Level	5.53
		Degree of Compliance with Solid Waste Management Procedures	5.13
		Level of Water Distribution Infrastructure Resilience	4.99
		Level of Resilience for Ports and Shipping	4.72
		Level of Resilience for Airports	4.72
		Level of Commercial Infrastructure Damage from Extreme Weather Events	4.57
		Renewable Energy Share in Total Energy Consumption	4.52
		Level of Grid Resilience	4.40
		Level of Resilience for Roads	4.36
		Percent of Population with Adequate Access to Electricity	3.42

Table: Stimson Center • Created with Datawrapper

Political Risk

Like many coastal cities in the Pacific region, Suva's population is highly reliant on ocean-dependent industries, such as tourism and shipping, which are vulnerable to climate change. This economic vulnerability is heightened by poverty, inequality, and lack of access to healthcare. Other key issues identified include progress in coordinated disaster response. However, a lack of government capacity and transparency hamper further resiliency efforts.

- The **STABILITY** category (expert weighted avg 6.03) highlights a high risk scores for the **percent of people employed in tourism** (7.00), the **percent of people employed in the port and shipping industries** (6.41), and the **percent of people employed in the commercial fishing industry** (6.19) which are vulnerable to climate change. A medium-high risk score for **level of social tension** (6.17) reflects historic and ongoing social and political tensions.
- The **SOCIAL/DEMOGRAPHICS** category (expert weighted avg 5.47) shows medium-high risk scores for the **urban population density** (6.96), **percent of the population below the poverty line** (6.83), and the **urbanization rate** (6.16) reflect challenges posed by rapid unmanaged urbanization.
- In the **GOVERNANCE** category (expert weighted avg 5.09), medium-high risk scores for the **level of perceived transparency within government** (5.69), **investment in climate resiliency development projects** (5.46), and the **capacity of ethic enforcement bodies** (5.45) reflect some areas of potential vulnerability around effectively investing and implementing projects to improve Suva's climate resilience.

High economic reliance on climate-vulnerable industries is a key feature of the risk profile. Travel and tourism accounted for 35.3 percent of national GDP in 2018,[50] and accounted for over one-quarter of employment,[51] reflected in a medium-high risk score for the **percent of people employed in tourism** (7.00). The COVID-19 pandemic underlined this vulnerability. Fifty percent of tourism businesses were still closed in July 2020,[52] and international visitor spending fell by more than 80% between 2019 and 2020.[53] The impacts of Hurricanes Harold and Yasa compounded the effects of the pandemic. Due to the large role of the tourism industry and spillover effects on other sectors, Fiji's economy contracted by 17% in 2020, two and a half times more than the largest previous economic contraction in the last sixty years.[54] In addition to the physical impacts of extreme weather impacts on Fiji's tourism infrastructure, tropical cyclones hurt the tourism industry by reducing the confidence of international tourists.[55]

The **level of social tension** also scored as medium-high risk (6.17). This reflects historic instability. In the early 2000s, a series of coups lowered Fiji's growth path and led to a decline in development assistance.[56] Social tensions also grew in 2020 and 2021 around quarantine measures, the passage of a controversial land law that critics claimed would remove power from landowners, and the arrest of opposition lawmakers in late summer 2021.[57] The unrest escalated in December 2022 when Prime Minister Bainimarama called in the military after refusing to concede power following elections on December 14.[58] Ethnic divides may be another underlying factor of social instability in Fiji, particularly in urban areas. Land ownership and access to natural resources are one of the primary reasons for inter-ethnic tensions with Indo-Fijians residing or farming on land leased by the indigenous Fijians who have a strong attachment to their land and fear expropriation by the government.[59]

Rapid population growth and urbanization in the GSUA may exacerbate these tensions over land ownership and access to natural resources. Fiji's rapid urban population growth is twice the rate of national population growth,[60] and has compounded many of Suva's urban challenges, reflected in a medium-high risk score for the **urbanization rate** (6.16). Suva's outward expansion faces geographic constraints, driving increased **urban population density**, reflected in a medium-high risk score (6.96). This has led some new arrivals to settle on fragile and hazard-prone land,[61] making them more vulnerable to climate impacts. These impacts, together with the climate impacts on key economic sectors such as tourism and fisheries, may entrench poverty in Fiji and throughout the Pacific.[62]

Suva City Center. Credit: ChameleonsEye, Shutterstock.

Other social factors which could contribute to social vulnerability and instability include the **percent of the population living below the poverty line** (6.83), which reached a national rate of 24% in 2020.[63] The urban poverty rate was 17%, including an urban child poverty rate of over 22%.[64] Additionally, the total health expenditure of Fiji was relatively low in the region, at 3.42 percent of GDP,[65] reflected in a medium-high risk score for **access to healthcare** (5.13). However, the government has made efforts to integrate climate change and healthcare systems, such as the Climate Change and Health Strategic Action Plan 2016–2020 and the "Guidelines for Climate Resilient and Environmentally Sustainable Health Care Facilities", launched in March 2021 to build climate resilience throughout the health system. Limited available resources have constrained implementation.

Several challenges impede the implementation of coordinated resilience planning and strategy. The two highest risk scores in the Governance category – **level of perceived transparency within government** (5.69) and **capacity of ethic enforcement bodies** (5.45) – indicate a lack of confidence among the experts surveyed on government transparency and the capacity of ethic bodies. Although the 2013 Constitution of the Republic of Fiji places an emphasis on good governance and transparency, incomplete accountability processes and a lack of coordination between governing institutions hamper government capacity.[66] In addition, the Open Budget Survey 2010 ranks Fiji second last in a list of 94 countries ranked on the degree to which citizens could access government financial documents.[67] Fiji also ranks lowest among Pacific Island nations in the Freedom House Political Rights index.[68] Overall, transparency and accountability in government should be prioritized in the implementation of climate resilience projects.[69]

The GSUA, which includes Suva city, Lami town, Nasinu town, and Nausori town, is administered by the four municipalities, respectively, headed by a government appointee known as a Special Administrator under the Local Government Reform (2008). Under the Local Government Act (Cap.125), the councils of the municipalities are mandated to observe, deliver, and enforce laws relating to urban management, including the maintenance of basic urban services such as public health, garbage collection, recreational areas, roads, and drainage systems.[70] However, responsibilities between the national government and the local municipalities are sometimes blurred, for instance, building of new roads and the allocation of budgets. The municipalities also face the challenge of not being able to collect the council rates (revenues) from the population residing in informal settlements and the existing five iTaukei (Indigenous Fijian) villages within the GSUA,[71] although the need for provisions service is increasing.

Fiji National Government Offices, Suva. Credit: maloff, Shutterstock.

In response to these challenges, Fiji published its Comprehensive National Adaptation Plan in 2018. This plan incorporates a robust climate adaptation decision-making strategy, and incudes plans for the relocation of communities most severely affected by the impacts of climate change, reflected in a medium score for **national climate adaptation planning** (4.86). Notably, CORVI scores show that experts did not rate the **disaster response capacity** as a major vulnerability, reflected in a medium risk score (4.53). The Fiji National Disaster Management Office (NDMO) has played a major role in improving Fiji's disaster risk reduction and management of disasters. Recent severe tropical cyclones have enabled the Fijian military and police to gain experience in initial disaster response and coordination with donors and domestic stakeholders, including the NDMO, through cluster systems.

Finally, while not explicitly included in the CORVI assessment, climate change can also impact culture and erode identity. This is highly applicable to indigenous Fijians who share strong attachment to their land and ocean. Eroding coastlines have contributed to migration/relocation, which causes some erosion of traditional hierarchies, values, and governance structures.[72] Traditional governance structures are often essential for effectively managing coastal ecosystems, such as mangrove forests, coral reefs, and nearshore fisheries. These attributes are key contributors to resilience in many Melanesian cities such as Honiara, Solomon Islands, and Port Villa, where community-based approach to adaptation supplements the lack of institutional capacity.[73] The expiring native land lease and financial instability emanating from loss of farmland are the growing reasons for Indo-Fijians to migrate to cities in search of better livelihood and job security for their children.

Suva: Political Risk

Each category score comprises multiple indicators.
Low 1 - 2.5 | Medium 2.51 - 5 | Medium-High 5.01 - 7.5 | High 7.51 - 10

Category		Indicator	
Stability	6.03	Percent of people employed in tourism	7.00
		Percent of people employed in port and shipping industries	6.41
		Percent of people employed in the commercial fishing industry nationwide	6.19
		Level of Social Tension	6.17
		Percent of people employed in agriculture	5.80
		Number of years that the current government structure has been in place	5.53
		Percent of people employed in Artisanal and Subsistence Fishing	5.33
		Number of Incidences of Civil Unrest or Instability	4.96
Social and Demographics	5.47	Percent of Urban Population Below 30 Years of Age	7.32
		Percent of International Migrants Living in Country	7.12
		Urban Population Density	6.96
		Percent of Population Below Poverty Line	6.83
		Urbanization Rate	6.16
		Dependency Ratio	5.56
		Percent of Adult Citizens Living Outside of the Country	5.18
		Urban Population	4.93
		Percent of Population Achieving Proficiency in Literacy and Numeracy	4.20
		National Population Density	3.80
		National Population	3.25
Governance	5.09	Level of Perceived Transparency within Government	5.69
		Investment in Climate Resiliency Development Projects	5.46
		Capacity of Ethics Enforcement Bodies	5.45
		Civil Society Participation	5.35
		Rule of Law	5.32
		Access to Healthcare	5.13
		National Climate Adaptation Plan	4.86
		Capacity of Current Disaster Response	4.53
		Voter Turnout	4.10

Table: Stimson Center • Created with Datawrapper

The Status of Urban Resilience Planning in Suva

The Government of Fiji recognizes the threat of climate change and has developed numerous policy frameworks to build resilience. Fiji's 5-Year and 20-Year National Development Plan (NDP), released in 2017, emphasizes the importance of building resilience and climate change adaptation, especially water infrastructure, agriculture, and electricity facilities. It also notes that the government is exploring options to decentralize its offices currently based in Suva to the Western and Northern divisions. This was followed by Fiji's National Climate Change Plan 2018-2030 and National Adaptation Plan (NAP) in 2018. The NAP provides a comprehensive and critical assessment of climate change implications for key sectors. It identifies 160 adaptation measures across 10 components, such as food security, human settlement, and biodiversity, to be prioritized over the next five years. Few of these measures specifically target Suva, and although there are many measures addressed to local government, this absence may make it more challenging to address Suva's specific vulnerabilities.

Furthermore, there have been several attempts to integrate climate change and healthcare systems. Fiji has an approved national Climate Change and Health Strategic Action Plan 2016–2020, which aims to build climate resilience throughout Fiji's health system and ultimately protect the Fijian population. In addition, the 'Guidelines for Climate Resilient and Environmentally Sustainable Health Care Facilities' was launched in March 2021. This is a direct outcome of the Climate Change and Health Strategic Action Plan 2016-2020.

Adaptation and resilience-building actions are highlighted in the Fiji's Climate Change Act 2021 which was enacted in September 2021. The Act sets "Fiji's 2030 marine protected area target, which is for 30% of Fiji's internal waters, archipelagic waters, territorial seas, contiguous zone and exclusive economic zone to be designated as a marine protected area by 2030".[74] The Minister responsible for climate change is requested to take steps to promote the achievement of the long term ocean sustainability target and the above mentioned 30 by 30 goal by the development and implementation of the National Ocean Policy (NOP). The National Ocean Policy Steering Committee will be established, reflecting the whole-of-government approach, which is the thrust of this Act, to guide and monitor the resilience-building measures, among other tasks. The development of integrated risk scenarios is one of the priority areas of the Act, and thus the CORVI risk assessment that provides a snapshot of comprehensive risk factors and their impacts on the Suva city is a useful took in leading adaptation efforts in the right direction to respond to ocean and climate crises. The Act mandates the preparation of a National Adaptation Plan on land-use planning and urban development.

These illustrations suggest that Fiji has made significant progress in paving the way for climate-resilient development. However, there are several limitations. For instance, the lack of available data in most developing countries makes the assessment of climate risks a challenging task. Many countries in the Pacific struggle with insufficient data, particularly at city level. This hinders local assessment, and Suva is no exception. Rapidly growing economies and the development of the coastal zones are also deterring the government and private sectors from fully considering sustainability and climate-resiliency in the longer term. In particular, unplanned development and/or inadequate consideration of crucial local ecosystems tend to cause conflict situations that disrupt resiliency planning.

Recommendations to Build Resilience

Despite informational and institutional shortcomings, Fiji has made considerable progress in strengthening coastal climate resilience. Yet climate and ocean risks, compounded by urbanization and economic changes, continue to rise. Although Fiji has a comprehensive multi-stage adaptation planning process, the data and analysis included in this assessment can assist with prioritization, down-scaling, and implementation of those strategies to address the climate risks facing Suva.

The CORVI assessment shows that risks are concentrated under Climate Change (7.23), Major Industries (6.73), and Stability (6.02). The analysis identified growing risks from extreme weather events, a high reliance on climate-vulnerable industries, vulnerable marine and coastal ecosystems, and the impacts of unmanaged urban population growth as key areas of concern. The following priority actions will help Suva move forward with a climate-resilient and sustainable development pathway.

Develop climate-risk-informed urban planning

Risk-informed urban planning allows cities to reduce the risk to unprepared populations. The CORVI risk assessment highlights that Suva is exposed to severe climate-related disasters, such as tropical cyclones (8.78), droughts (8.40), and intense rainfall (7.96). Landslides are also a major geographical risk to people in vulnerable areas (6.77) and are commonly linked to intense rainfall events. There has also been a recent rapid increase in urban population under the age of 30 (7.32), exacerbating the expansion of informal and unplanned settlements (6.68). To combat these compounding risks, urban planning should be based on up-to-date information on hazards together with other factors that shape the city's vulnerability, including informal housing, aging infrastructure, and lack of awareness of risks.

Risk-informed planning in Suva, as a capital city and administrative center, would also have benefits for building resilience nationwide. For instance, interviewees mentioned that major government departments are situated along the coast and are highly susceptible to coastal flooding, which would present a risk of disruption and chaos of national governance, driven by localized extreme climate events.

Future industrial development should be moved away from coastal areas. The CORVI findings show that Fiji's economy relies on industrial activities in coastal cities (7.66), and there have been substantial shoreline developments (6.63). Relatively high climate risks, such as coastal erosion (6.63) and flooding events (5.83) have resulted in a highly vulnerable economy.

One strategy to reduce Fiji's vulnerability to coastal risks could be dispersing manufacturing facilities and offices to other locations on the island of Viti Levu with lower levels of vulnerability. Promoting this kind of decentralization of would likely require strengthening transportation and communication networks between Suva and other cities. Another strategy to consider could be the decentralization of industries and government agencies that are currently concentrated in the Greater Suva Urban Area (GSUA). Dispersing some of these to other towns would also strengthen linkages between the national and subnational adaptation planning and implementation processes, which is a priority action area in the National Adaptation Plan.[75]

Spatial planning would help to address these root causes and ensure a sustainable and resilient city. The recent NDP for Fiji has emphasized vulnerability assessment and climate change projections in infrastructure and urban planning. A modern climate-resilient metropolitan-level GSUA planning framework would support and guide investments in basic infrastructure services, including informal settlements, to support an environmentally sustainable and inclusive urban environment. To adopt a truly integrated development approach as stated in Fiji's NDP, consultations could be initiated between various stakeholders including government, NGOs, the private sector, and the community. This will help to develop a consensus on how future disasters and stresses will impact GSA visions, strategic development priorities and the types of institutional reform, policies, and investments that will be required to address various shocks. While Fiji's National Adaptation Plan highlights improved climate

information services and management as one of its key components, there is a need for practices to incorporate developed information such as hazard maps and meteorological prediction systems into urban planning at the sub-national level. A risk-informed urban planning toolkit that includes concrete steps to utilize available information and resources to effectively plan climate-proof land use and urban developments in the city, would be an effective option. The potential leading organization could be the National Disaster Management Office, who plays a substantial role in tackling the issues of climate change, emergency response, and relocation.

Integrate urban development and natural restoration

This assessment highlights degradation of the coastal intertidal zone and mangroves as key vulnerabilities in Suva. Although the government's adaptation plan recognizes upgrading infrastructure as essential to build resiliency in the city, the roles of key ecosystems that provide protection to communities, such as mangroves and coral reefs are not clearly articulated.

Suva is a rapidly developing city with an increasing focus on coastal zones. This has contributed to the tension between urban development plans and environmental sustainability, for example, mangroves have been cleared to create space for new infrastructure. There is also a lack of appreciation of the cumulative climate impacts and the impact of such developments on a more regional scale. According to the Ministry of iTaukei Affairs and the Ministry of Land, urban planning and resilience measures must be sensitive to the land rights structure of Fiji, where there are three types of landowners: native or iTaukei land, freehold land, and state-owned land. The study area included all three land types, and as such, decision makers should be mindful of this interplay between governmental and traditional governance structures when designing climate-oriented policies.

While tensions between urban developments and ecological considerations are likely to continue, several experts noted a lack of granularity in this debate. According to them, not all mangroves are equally important for protecting a city and supporting marine ecosystems. With the inclusion of mangroves on carbon markets and in selling carbon credits, Fiji is investing in the protection of these blue carbon sources, and this new initiative and direction has the potential to advance coastal protection and resilience. A blue carbon framework that identifies these highly critical ecosystems to guide a long-term strategy of supporting mangrove protection and restoration could be a way forward. A smart city program that promotes green growth initiatives is discussed in Fiji's recent NDP. A new framework that accelerates green infrastructure, integrates financial innovation, and includes effective monitoring and evaluation mechanisms would contribute to the success of the smart city program.

To overcome several of the challenges currently faced by the GSUA community, access to adequate blue/green climate resilient infrastructure and financial resources is required. Integrating green-grey infrastructure with nature-based solutions (NbS) should allow for developments that reduce physical risk, restore critical ecosystems, and improve access to climate finances. The development of strong public-private partnerships would help to enable economic growth for the region, which, in turn, would improve the delivery of services to those who most need them. There is also an urgent need to create greater awareness on the issue of climate change among the local communities, especially in areas where mangrove and coral reef destruction is occurring. This will help residents to better consider the long-term implications of their actions and to encourage behaviors that will increase their resilience to climate change impacts.

Enhance the climate resilience of the tourism sector

Overcoming vulnerability stemming from high economic dependence on the recreation and tourism industries (8.48) is also important in building resilience. Tourism in Fiji is largely characterized by coastal activities such as diving, cruising, and other marine leisure tourism, which causes vulnerability to coastal disasters or erosion. Based on Fiji's National Climate Change Policy, the government has promoted climate-resilient infrastructure, for instance, by enforcing building codes, and can further those efforts by integrating sustainability practices such as promoting LEED certification for new development. In addition to efforts to enhance the resilience of key social infrastructures such as airports and roads, the infrastructure associated with disaster risk

management, including accommodation and resort facilities, should also be strengthened. In the face of the global pandemic, the Fijian government has emphasized that a more sustainable, inclusive, and resilient tourism sector is required as the foundation of COVID-19 recovery through long-term tourism diversification.

Furthermore, the CORVI assessment indicates that a large volume of the population engages in the tourism sector (7.23). Municipalities may consider providing support to the population employed in the tourism sector, as efforts to sustain their livelihood in the case of a drop in tourism flow due to another disaster or crisis would strengthen the social capital of the GSUA communities. One possible solution to scale up climate-resilient tourism is to diversify the use of the Environmental and Climate Adaptation Levy imposed on prescribed services offered to visitors, which was introduced by the Environmental Levy Act 2017. Currently, it is primarily utilized for environmental protection, but there is potential to expand its purpose to climate change adaptation strategies, such as providing financial incentives to businesses in the tourism sector to improve their disaster risk management strategies and provide social and economic protection to their employees.

Income diversification is another possible way to strengthen economic resilience. Income diversification has not received much attention previously but recently key stakeholders such as the Fijian Competition and Consumer Commission,[76] the private sector,[77] and the World Bank[78] have highlighted its importance. Diversification strategies could include business services, ICT (information, communication, and technology), light manufacturing, and construction. Workers in the tourism industry could also diversify their income and strengthen food security through such measures as backyard gardening.

Appendix

ORGANIZATIONS SURVEYED	ORGANIZATIONS INTERVIEWED
Biosecurity Office	Biosecurity Office
Climate Change and International Cooperation Division, Ministry of Economics	Conservation International
Conservation International	Delegation of EU Pacific
Delegation of EU Pacific	Fiji Fishery Industry Association
Fiji Fishery Industry Association	Fiji Ports Corporation Ltd
Fiji Ports Corporation Ltd	German Corporation for Technical Cooperation International Union for Conservation of Nature and Natural Resources (IUCN)
Fiji Revenue Custom Service	iTaukei Affairs Board
German Corporation for Technical Cooperation International Union for Conservation of Nature and Natural Resources (IUCN)	Ministry of Industry, Trade, and Tourism
iTaukei Affairs Board	Ministry of Land & Mineral Resources
Market Development Facility	National Disaster Management Office
Ministry of Industry, Trade, and Tourism	Pacific Islands Development Forum
Ministry of Land & Mineral Resources	Sugar Research Institute Fiji (SRIF)
Ministry of Local Government	Suva City Council
Ministry of Rural and Maritime Development	The University of Fiji
My Fiji Shark	University of South Pacific
National Disaster Management Office	World Wildlife Fund
Pacific Community	
Pacific Islands Development Forum	
Sugar Research Institute Fiji (SRIF)	
Suva City Council	
The University of Fiji	
University of South Pacific	
World Bank	
World Wildlife Fund	

Introducing the Climate and Ocean Risk Vulnerability Index

Urban coastal areas and island states are likely to experience the earliest onset and potentially most severe impacts from climate change. However, the risks associated with climate change for specific coastal cities are much more difficult to untangle. In order for coastal cities to efficiently allocate resources and enact effective adaptation strategies, they must understand their multidimensional climate risks. These efforts are impeded by incomplete data.[79] In small island developing states and least developed coastal countries data on climate risks is rarely available at the city or island level and, when it does exist, it is often poorly managed and stored in silos that make access and use difficult, even for city government officials.[80] This issue is compounded by technical, financial, and capacity gaps, trapping coastal cities and island states in a vicious cycle where they cannot develop holistic strategies to prioritize investment and access the funds needed to implement resilience actions.

Without data at the appropriate geographic scale, decision makers are often left with the choice of either waiting for greater data availability or attempting to downscale national-level data. Neither of these is an ideal solution for effective climate change adaptation.

Despite these challenges, decision makers need to act now in the face of uncertainty to build resilience to the climate crisis. To do this, they need tools that will enable them to consider multidimensional climate risks, develop cohesive strategies, and utilize this information to unlock additional climate finance and implement resilience actions.

In response, the Stimson Center developed the Climate and Ocean Risk Vulnerability Index (CORVI). CORVI is a decision support tool that compares a diverse range of climate-related risks across the land and seascape to produce a coastal city or island state risk profile.[81] These risks are displayed across 10 categories, grouped under three risk areas: ecological, financial, and political (see figure 2). The 10 categories are in turn made up of close to 100 indicators, covering a range of issues including the vulnerability of vital infrastructure, the health of marine ecosystems, and urbanization dynamics in the chosen coastal city. Each indicator and category is scored using a 1-10 risk scale relative to other cities in the region, offering a simple reference point for decision makers looking to pinpoint and categorize climate risks. The CORVI risk scores that form the basis of a coastal city risk profile are augmented with existing academic and gray literature, government documents, and key informant interviews to develop a comprehensive narrative and understanding of the coastal city's climate risks and to identify priority policy recommendations.

> In multiple meetings with stakeholders, experts noted that data gaps impeded their ability to assess multidimensional climate risks and provide evidence-based policy recommendations to key decision makers.[82]

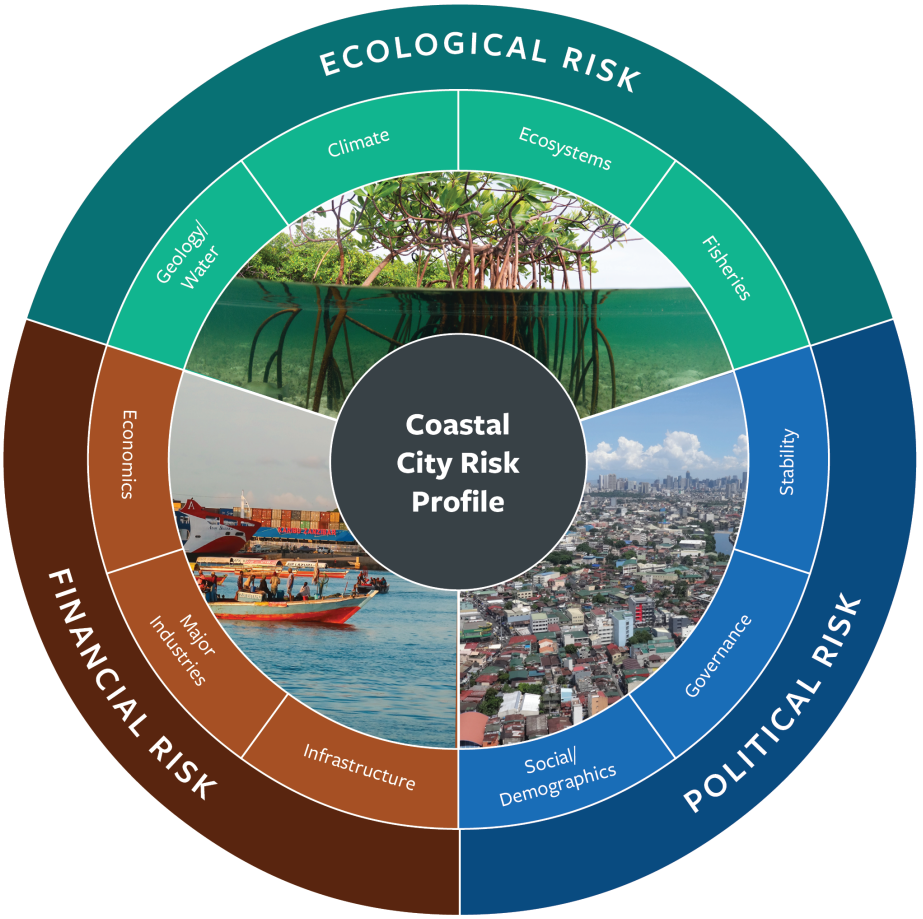
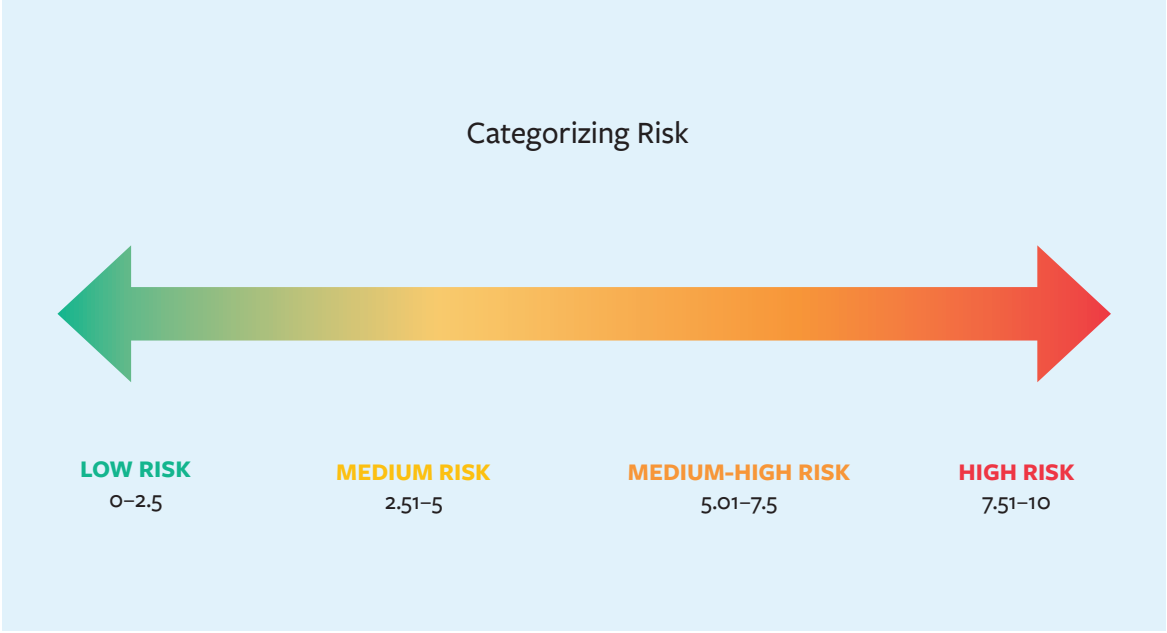


Figure 2: CORVI Risk Types and Categories

How CORVI is Different

CORVI builds on the work of previous indices but is distinct in three ways.

1. **City-Based:** Unlike many other indices that tend to focus on the national level, CORVI is city-based, providing subnational-level detail on the nature and impact of climate and ocean risks. This focus is based on extensive interviews with potential issuers of the CORVI tool, who noted the difficulty of downscaling national-level risk and vulnerability data to inform policy action to build climate resilience in specific communities.
2. **Holistic:** CORVI looks across a broad set of ecological, financial, and political risk factors that are connected to climate change impacts and that influence vulnerability of coastal cities and their residents. As part of the category and indicator selection process, indicator inclusion was primarily based on its ability to capture and explain climate change risks in coastal cities, and not on whether data was available. This approach promotes a holistic understanding of climate change impacts on coastal cities.
3. **Data-Driven:** Through its utilization of SEJ, CORVI is suited to producing actionable insights in data-sparse environments. By combining empirical and survey data across a wide range of indicators, CORVI fills data gaps to provide a holistic assessment, while reducing data availability bias. This approach provides a contextual and data-driven evaluation of climate and ocean vulnerability.



CORVI was successfully piloted in the coastal cities of Castries, Saint Lucia and Kingston, Jamaica. These first two CORVI city assessments demonstrated the value of CORVI's holistic approach in helping leaders and decision makers prioritize actions and smart investments for risk reduction in coastal cities. Despite the challenges posed by COVID-19, data and recommendations from both risk profiles are beginning to be incorporated into urban resilience planning.[83]

In collaboration with a wide range of on-the-ground research institutions, and the support of local and national governments, CORVI is now active in 15 coastal cities and island states around the world. In addition to providing decision makers in the specific city with a complete risk picture, each risk profile is added to a global database to improve decision makers' understanding of regional risk dynamics.

INTERPRETING RISK SCORES

Low risk scores mean that either the coastal city has successfully built resilience in the issue area or the indicator is not as relevant for understanding risk in that city.

Medium risk scores indicate that while resilience has been built to address the specific risk, future changes could destabilize resilience gains.

Medium-High risk scores mean that current measures are insufficient and more attention is required to build resilience against future climate security impacts.

High risk scores indicate that the issue area represents a key threat to the coastal city with the potential to undermine the security of its residents.

ADVANCING THE SUSTAINABLE DEVELOPMENT GOALS

CORVI aims to contribute to the delivery of the SDGs—an essential framework to guide lasting, positive change. Twenty-seven CORVI indicators are directly related to SDGs, with a further 13 indicators indirectly supporting the implementation of an SDG indicator or target. By providing data and information to measure climate risks in coastal cities, CORVI supports the delivery of the following SDGs:

CORVI ASSESSMENTS COMPLETED

- Basseterre, St. Kitts and Nevis
- Castries, St. Lucia
- Chattogram, Bangladesh
- Dagupan, Philippines
- Dar es Salaam, Tanzania
- Kingston, Jamaica
- Mombasa, Kenya
- Suva, Fiji

PILOT RAPID ASSESSMENTS

- Bridgetown, Barbados
- Colombo, Sri Lanka
- Tarawa, Kiribati

ASSESSMENTS UNDERWAY

- Belize City, Belize
- Roseau, Dominica
- Port Louis, Mauritius
- Toamasina, Madagascar

Indicators

To ensure that the CORVI indicator scores provide a holistic risk rating, each comprises five factors: current, past, and expected trends, the rate of change of the risk, and the impact of this risk on the coastal city.

1. The **BASELINE** measures the current level of risk for each indicator relative to other coastal cities in the region. Baseline data for economic and social indicators are derived from the most recent year of complete data. Climate indicators use an extended time period of 15 years.[84]
2. **PAST TREND** assesses the trend of risk for the past 10 years, measured from the baseline year. The only exception to the 10-year trend measure is the climate indicators, which use a 15-year trend horizon to account for slow-onset changes.
3. **EXPECTED TREND** assesses the anticipated trend of risk in the next 10 years, measured from the baseline year. The only exception to the 10-year trend measure is the climate indicators, which use a 15-year trend horizon to account for slow-onset changes.
4. **MAGNITUDE** assesses the degree of expected future trend change relative to other cities in the region. Change that happens more quickly than expected are assumed to increase risk when compared to changes that take place over a longer time scale. This assumes that longer periods of change contribute to less risk, as decision makers have more time to adapt and build resilience.
5. Finally, **IMPACT** assesses the importance of change for each indicator in describing future risk in the coastal city.

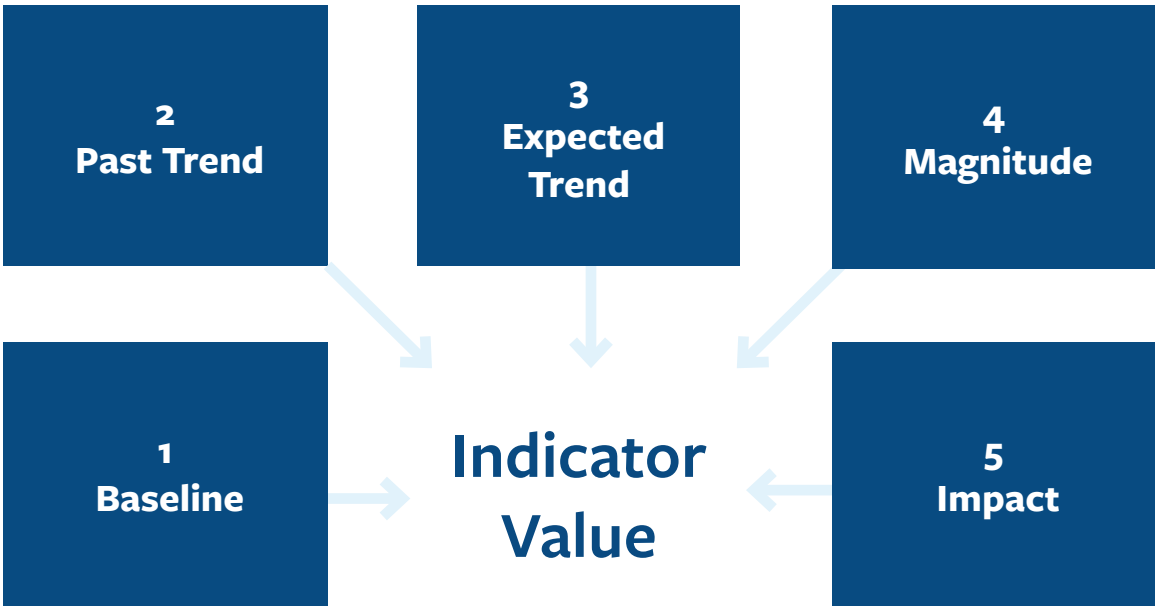


Figure 3: Indicator Factors

Data Collection and Structured Expert Judgement

To overcome data gaps, CORVI employs structured expert surveys to collect data that is otherwise unavailable. This primary data is combined with secondary data using structured expert judgment (SEJ) to produce a comparative score for each indicator in the assessment.[85] SEJ is a well-established social science technique that seeks to quantify risk when preexisting secondary data is inadequate. Through interviews and surveys, as well as a series of weighting procedures to ensure that data is representative, SEJ allows researchers to quantify topics that might otherwise be challenging to study in such a systematic fashion.

To apply SEJ to CORVI, subject matter experts across academia, government, civil society, and the private sector are identified through research and extensive outreach to stakeholders in the target coastal cities. These experts then refer the project team to other experts and stakeholders with appropriate expertise using "snowball sampling."[86] To guard against confirmation bias, survey answers are compared to a regional secondary empirical dataset to weigh the expert responses by utilizing a coherence check.[87] The coherence check ensures that experts whose answers do not match secondary data are not weighed as highly as those who do.

This approach has several strengths. First, CORVI incorporates the views of subject matter experts and local stakeholders at each stage of its implementation. This allows the final product to better reflect the specific context it is seeking to measure and provide more focused information for end users. Second, pairing primary survey data with secondary data through SEJ allows CORVI to provide insight into risks relating to urban coastal environments that existing secondary datasets do not cover. While the use of SEJ allows CORVI to assess a diverse range of risks, however, it should not be regarded as a substitute for empirical data collection. Rather, SEJ is best viewed as an alternative research technique specialized to analyzing topics with significant data gaps.[88]

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