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Adaptive Resilience in the Freely Associated States: Assessing State Capacity to Cope with Climate Change

ICAAD. (2022). Coastal view of Palau [Photograph]. ICAAD. https://icaad.ngo/cofa-negotiations/

Team Members: *Michelle Ahn, Bhavana Bellamkonda, Peter Brukx, Jackson Dalman, Mae Lewis-Workman, Amanda Long, Brendan McCarthy*
Project Advisor: *Professor Joseph Pfeifer*
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TABLE OF CONTENTS

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ABOUT

This Capstone project was undertaken on behalf of the School of International and Public Affairs (SIPA) at Columbia University by Master of Public Administration and Master of International Affairs students.

SIPA is one of the nation's premier public policy schools with a 75-year history of educating dedicated public service professionals. Through a combination of rigorous social science research and education from academics and professional practitioners, SIPA is educating generations of future leaders across public, private, and non-profit sectors.

SIPA's Capstone Consultancy Workshop project creates an opportunity for students to conduct a live semester-long research project with an external client. Each Capstone Workshop pairs students across a variety of disciplines–in this project, International Security Policy, Human Rights and Humanitarian Policy, and Energy and Environment–to conduct cross-disciplinary research under the guidance of an expert faculty advisor.

The client for this Capstone Workshop, The *Center for Excellence in Disaster Management and Humanitarian Assistance* (CFE-DM), is a Department of Defense organization comprising nearly 30 subject matter experts that provide academic research, civil-military coordination training, and operational insights to support decision-making before, during, and after crises. The Center is a direct reporting unit to U.S. Indo-Pacific Command (USINDOPACOM) and is located on Ford Island, Joint Base Pearl Harbor-Hickam, Hawaii.

ACRONYMS

CCI	2050 Climate Change Impacts Report
CFE-DM	Center for Excellence in Disaster Management and Humanitarian Assistance
COFA	Compact of Free Association
DOD	U.S. Department of Defense
DOI	U.S. Department of Interior
ENSO	El Niño-Southern Oscillation: a periodic climate phenomenon that includes fluctuations in the sea surface temperatures across the central and eastern tropical regions of the Pacific Ocean.
FAS	Freely Associated States
FDI	Foreign Direct Investment
FSM	Federated States of Micronesia
GCF	Green Climate Fund
GDP	Gross Domestic Product
GNI	Gross National Income
ICT	Information and Communications Technology
IMF	International Monetary Fund
JSAP	Joint State Action Plan
MPA	Marine-Protected Area
ODA	Official Development Assistance
O&M	Operations and Maintenance
PDC	Pacific Disaster Center
PFM	Public Financial Management
PIC	Pacific Island Countries
PIAMP	Palau Infrastructure Asset Maintenance Plan
PNIIP	Palau National Infrastructure Investment Plan

PPUC	Palau Public Utilities Commission
PRIF	Pacific Region Infrastructure Facility
RMI	Republic of the Marshall Islands
SIDS	Small Island Developing States
STEM	Science, Technology, Engineering, and Math
USAID	U.S. Agency for International Development
USCG	United States Coast Guard
USD	U.S. Dollar
USINDOPACOM	United States Indo-Pacific Command
USTDA	United States Trade and Development Agency

EXECUTIVE SUMMARY

The genesis of this report was a modest question: Why do some countries struggle to adapt to climate change despite the availability of strong development partnerships and financing commitments? Across each of the Freely Associated States, we determined that the answer to this question lies in a series of capital constraints—including human, physical, financial, natural, and political capital—that inhibit the effective implementation and maintenance of long-term adaptation initiatives. While distinct, we found that each of the Freely Associated States faces similar challenges owing to their geographic isolation/dispersion, small size, and shared climate vulnerabilities. They include the following:

1. **Outward migration of youth populations** to the United States—owing to greater economic opportunity as well as better access to healthcare and education—**limits the availability of skilled labor,** which often requires large infrastructure development partners to bring in outside contractors to implement their projects.
2. Most of the built infrastructure is located along the coast. The **harsh climate** of the small island states **causes infrastructure to deteriorate quicker**, requiring frequent investments in maintenance and repair. These maintenance efforts are stymied by a weak labor force, ineffective public financial management, and few long-term development partnerships.
3. The **geographic dispersion** of the populated islands within each country, particularly RMI and FSM, complicates infrastructure development, supply chains, and the delivery of social services.
4. Small or underdeveloped private sectors—combined with a narrow tax base, limited domestic resource mobilization opportunities, and (for FSM and RMI) weak tourism industries—present **few opportunities for economic growth.**
5. **Weak accountability mechanisms** can increase the likelihood of significant spending errors as well as corruption. **Dysfunctional internal controls**–arising from capacity gaps in both political culture and technical skills–can inhibit forward planning and incentivize reactionary, rather than preventative, government investments.
6. **Donors remain highly fragmented.** While large, multilateral funds are becoming more available for climate adaptation, they also come with a host of cumbersome reporting requirements. Managing these funds requires significant organizational capacity, placing additional **strain on fragile administrative systems**.

These constraints underscore the urgency of investing in governance capacity and human security in the Freely Associated States. Put simply, effective climate adaptation hinges not only on investments in climate-smart agriculture but also on initiatives aimed at improving socio-economic development. Should these two approaches remain separate, the Federated States of Micronesia, the Republic of Palau, and the Marshall Islands will unfortunately fail to reap the benefits of climate-security programming.

Recognizing that resources are limited, we leveraged our analysis of the capital constraints to identify priority areas of need in each country's context. Our policy recommendations are summarized below:

Federated States of Micronesia

- Incorporate local apprenticeships into the Yap airport runway expansion to both develop workforce talent and enhance local buy-in for increased U.S. military presence on the island.
- Offer scholarships for training in specific climate adaptation occupations such as land surveying, construction, plumbing, etc.
- Distribute solar energy to outlying communities and schools to provide consistent access to energy services and enhance the quality of life for vulnerable populations.
- Invest in new or refurbished rainwater catchment systems.
- Re-introduce the Peace Corps for mid- or late-career professionals.
- Strengthen Seabees' permanent deployment to rejuvenate long-standing goodwill while advancing local infrastructure and workforce capacity.
- Empower civil society, especially independent journalists, to strengthen accountability and governance capacity.

Republic of Palau

- Invest in human capital development by expanding trade school pathways for high school students.
- Create new jobs by passing resilient infrastructure building code improvements, creating a greater supply of contractors.
- Scale contractor capacity by investing in reskilling programs for career switchers.
- Target employment opportunities within the Public Utilities Commission, Climate Change Office, and Planning and Permitting Groups.
- Protect coral reefs and mangrove infrastructure to build resilience to storms and coastal flooding via natural infrastructure.
- Install rooftop solar and at-home, behind-the-meter battery storage to support local electricity demand.
- Increase renewable energy capacity to reduce vulnerability to economic shocks from volatile energy markets.
- Facilitate the distribution of at-home, life-saving disaster management tools such as water filtration tablets in the event of drought or physical infrastructure deterioration.

Republic of the Marshall Islands

- Invest in health capacity by scaling innovative and secure tele-health technologies and by enhancing collaboration between U.S. Naval Ship hospitals and RMI population centers.
- Improve clean water access by expanding the water grid and pumping capacity, and by implementing redundant water generation and catchment systems.
- Enhance early warning and preparedness by joining the Regional Integrated Multi-Hazard Early Warning System for Africa and Asia International.
- Invest in sea walls and natural barriers in Ebeye and Majuro to protect vulnerable communities against sea level rise.
- Enrich English language learning across the RMI to prepare Marshallese for better jobs in the United States and within the U.S. military.
- Scale vocational training opportunities in STEM, construction, and entry-level medicine, and encourage firms to create joint job ventures in the RMI.
- Increase collaboration with American universities and invest in research and exchange programs with Marshallese student groups.
- Augment U.S. Coast Guard presence in the RMI's waters to help prevent illegal fishing

Our policy recommendations reflect a holistic research process, examining what has been tried before, why and where previous efforts have been ineffective, and how they can be successful in the future given the capital constraints and priority areas of need at hand.

INTRODUCTION

As climate change amplifies the effects of natural hazards and contributes to instability of food and water systems around the world, island nations in the Indo-Pacific region are acutely at risk. Rising sea levels, intensifying cyclones, and less predictable rainfall patterns position low-lying states, including those of Micronesia, at the forefront of the climate crisis. In March 2024, the Presidents of both the Federated States of Micronesia and the Republic of Palau declared a national emergency in response to severe drought conditions and prolonged water shortages. Months prior, a series of extreme waves inundated a small island in the Kwajalein Atoll of the Marshall Islands, causing severe damage to a U.S. space and missile defense testing range.

In reference to the Indo-Pacific, the United States' latest National Security Strategy (2022) states that the U.S. has a "vital interest in realizing a region that is open, interconnected, prosperous, secure, and resilient."[1] The Strategy also emphasizes the centrality of regional alliances and partnerships in building collective capacity in the Indo-Pacific. Chief among these regional alliances is the Compacts of Free Association (COFA), which the Biden Administration's 2022 Indo-Pacific Strategy refers to as "the bedrock of the U.S. role in the Pacific."[2] Renewed in March 2024, the revised Compacts provide an additional 20 years of bilateral economic assistance to support basic public service delivery and economic self-sufficiency across key sectors, including environment, health, infrastructure, and education. The three bilateral partners under the Compacts–the Federated States of Micronesia (FSM), the Republic of the Marshall Islands (RMI), and the Republic of Palau–play an important role in bolstering U.S. security presence in the Indo-Pacific amid growing strategic competition.

As the U.S. Indo-Pacific Command (USINDOPACOM) and its partners seek to reduce the potential impacts of climate change on readiness and regional stability, decision-makers also need to understand the implications of climate change for human and state security within the Freely Associated States (FAS). What are the pathways to build resilience to these impacts? What resources are needed and what are the associated challenges in accessing and successfully leveraging them?

Climate resilience researchers, practitioners, and governance experts in the region identify critical gaps between adaptation planning and implementation and between expressed needs and governance capacity. Additional analysis is required to understand the discrete barriers to climate adaptation in each country's context. Why, for example, are multi-billion-dollar infrastructure development programs failing within a few years of completion in the FSM? And why are local

[1] "National Security Strategy." The White House, October 12, 2022. https://www.whitehouse.gov/wp-content/uploads/2022/10/Biden-Harris-Administrations-National-Security-Strategy-10.2022.pdf.
[2] "Indo-Pacific Strategy of the United States." The White House, February 2022. https://www.whitehouse.gov/wp-content/uploads/2022/02/U.S.-Indo-Pacific-Strategy.pdf.

governments struggling to invest in early warning systems in the RMI despite the availability of bilateral and multilateral development assistance?

Developed in partnership with the *Center for Excellence in Disaster Management and Humanitarian Assistance* (CFE-DM), this report aims to dissect the underlying factors influencing a state's capacity to cope with climate change, relying on a holistic, multi-dimensional approach rooted in an analysis of five types of capital inputs (human, physical, financial, natural, and political). The primary objective is to understand which factors have the greatest effect on a country's capacity to adapt to and cope with climate change, and to identify priority areas of need for targeted short- and long-term investments. The research team relied on a combination of quantitative analysis based on the *Pacific Disaster Center's* (PDC) Indo-Pacific 2050 Climate Change Impact Analysis as well as qualitative analysis based on a series of in-depth interviews with climate adaptation experts, disaster management officials, regional stakeholders, and local civil society organizations.

The report will begin with a discussion of the methodological framework and process. For each of the three FAS–the FSM, RMI, and Palau–the report provides a high-level overview of the country and its primary climate threats before assessing the core material inputs needed to adapt to climate change (e.g., infrastructure maintenance, rainwater catchment systems, etc.). The report then synthesizes quantitative and qualitative analyses to assess the country's unique capital constraints to financing or implementing these adaptation initiatives. These insights are designed to identify priority areas of need in terms of targeted bilateral and multilateral interventions, taking into account both what's been tried before and where donors are directing the most funding and attention. Finally, the report will offer evidence-based recommendations for where resources could be directed to strengthen resilience and build countries' capacity to adapt to climate change.

METHODOLOGY

This report dissects each country's **"adaptive resilience," or the capacity of social, economic, and environmental systems to cope with a hazardous event, trend, or disturbance by responding in ways that maintain their essential function and structure.** To capture the complex concept of "adaptive resilience," the report applies a mixed-method approach to understand the factors underlying a country's vulnerability to and capacity to cope with climate disasters. By combining quantitative and qualitative research, this approach ensures that the analysis reflects the realities on the ground, substantiating data with 1) inputs from experts working directly on climate resilience in the region, 2) individuals and communities experiencing the direct consequence of climate change, and 3) local nongovernmental organizations (NGOs) and government stakeholders working to build resilience to climate hazards.

Quantitative Approach

This report builds on the notional findings from the PDC's 2050 Climate Change Impact Analysis to assess governance and coping capacity in the Freely Associated States. The PDC developed their study at the request of CFE-DM to support CFE-DM's execution of the USINDOPACOM 2022 climate change wargame and characterize elements of climate-security risk across a region of strategic importance to the United States. To do this, the PDC created two composite indices: the Vulnerability Index and the Coping Capacity Index. Each of these composite indices attempts to capture complex concepts that cannot be conveyed via a single raw indicator.[3]

Figure 1: Defining PDC Vulnerability and Coping Capacity Indices

Index	Definition[4]	Examples of Indicators Included[5]
Vulnerability Index	Exposure to climate hazards is compounded by socioeconomic vulnerabilities which predispose areas to greater disaster impacts.	- Five year annual inflation - Adult literacy - New HIV infections - Recent disaster deaths - Youth unemployment
Coping Capacity Index	A country's inability to cope with hazard events stemming from a lack of systems and capabilities to absorb and respond to disruptions further compounds the effects of hazards. Assessing coping capacity provides visibility into the status of governance and capacity within each country.	- Mobile phone access - Government effectiveness - GNI per capita - Hospital bed density - Internet server access

To analyze the underlying drivers of each of the above composite indices, i.e., the discrete factors contributing to weak coping capacity and high vulnerability, this report replicates and distills the PDC's methodology. Specifically, the PDC compiles the raw data for each of the indicators, standardizes them to fit on a zero to one scale, feeds them into sub-indices to pair related indicators, and then averages the sub-indices to create the two composite indices, which also range on a scale of zero to one.[6] Desirable marks include a low score on the Vulnerability Index, indicating a low

[3] Nardo, Michela, Michaela Saisana, Andrea Saltelli, Stefano Tarantola, Anders Hoffman, and Enrico Giovannini. "Handbook on Constructing Composite Indicators: Methodology and User Guide." Organisation for Economic Co-operation and Development, August 9, 2005. https://www.oecd-ilibrary.org/docserver/533411815016.pdf?expires=1711138623&id=id&accname=ocid177456&checksum=9D929CFF533B6C03DB0AB48E37262057, p. 8.
For a full discussion about the pros and cons of composite indices and their use, please see Appendix 1.

[4] Green, Joseph, Kevin Madaya, Adam Gramman, and Erin Hughey. "2050 Climate Change Impact Analysis: Anticipating Climate Change Impacts to Enhance Climate Security Across the Region." Maui, Hawai'i, USA: Pacific Disaster Center, 2023. https://www.cfe-dmha.org/LinkClick.aspx?fileticket=-PYj1b0z9vQ%3D&portalid=0#:~:text=Over%2080%25%20of%20the%20population,increase%20from%20the%20year%202000.&text=Extreme%20heat%20and%20intensified%20tropical,in%20the%20Indo%2DPacific%20region, p. 17.

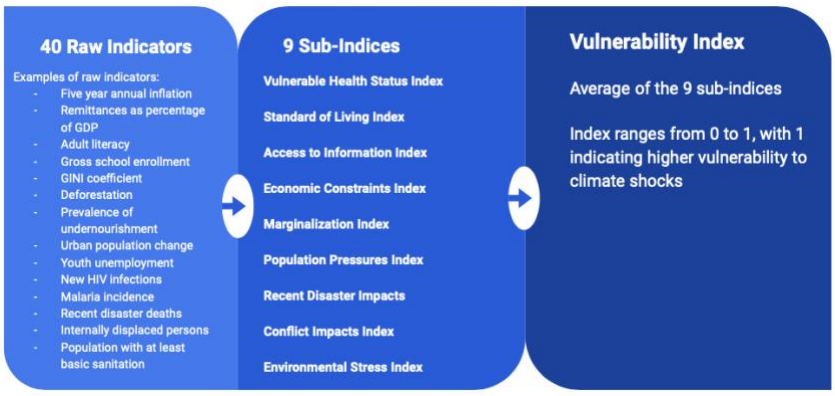
[5] For a full list of indicators and their sources, please see Appendix 4 and 5.

[6] For an in-depth explanation of the composite index construction, standardization process, and the sub-indices, please see Appendix 1.

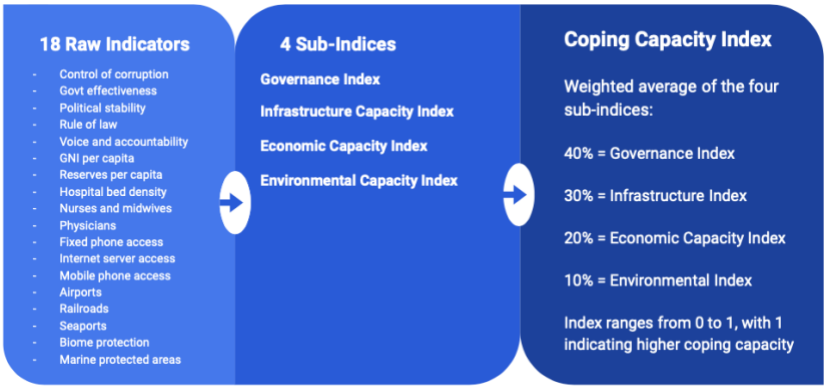
vulnerability to climate shocks, and a high score on the Coping Capacity Index, indicating a high capacity to cope with climate shocks.

Figure 2: Process for Creating Vulnerability and Coping Capacity Indexes

	Process	Example
Step 1	Compile raw data for each of the indicators from a range of open sources, including the World Bank, UN and National Geospatial Intelligence Agency.	Mobile Phone Access was sourced from the World Bank through the "mobile cellular subscriptions (per 100 people)" indicator. In 2021, FSM had 19 mobile cellular subscriptions per 100 people.
Step 2	Standardize the data to fit on a zero-to-one scale.	FSM was the worst-performing country in the World Bank's data set in terms of Mobile Phone Access, so FSM was assigned a value of 0. The best-performing country was Hong Kong, which received a value of 1.
Step 3	Feed into sub-indices to pair related indicators	Mobile Phone Access was combined with Fixed Phone Access and Secure Internet Server Access to create the Communications Capacity Index.
Step 4	Average the sub-indices to create the Vulnerability and Coping Capacity Indices	The Communications Capacity Index was paired with the Health Care Capacity Index and Transportation Capacity Index to create the Infrastructure Capacity Index. The Infrastructure Capacity Index then feeds directly into the Coping Capacity Index.[7]



[7] For an in-depth explanation of the composite index construction, standardization process, and the sub-indices, please see Appendix 1.



Lack of available data was a key limitation in the development of the two indices. Nearly half of the source data required to construct the Vulnerability Index were unavailable or outdated for the Freely Associated States.[8] Consequently, producing the Vulnerability Index would require overweighting the available data inputs, resulting in a final index value that reflects a distorted view of the country's vulnerability to hazardous events. To avoid those distortions, this report does not analyze the Vulnerability Index. Instead, the report devotes greater attention to the Coping Capacity Index, which benefits from more comprehensive input data.

While this report largely omits the findings from the Vulnerability Index due to data gaps, several indicators from the composite sub-indices are leveraged to substantiate the qualitative analysis, including remittances as a percent of GDP and trade surplus. These remain valuable measures which are referenced throughout the report.

Qualitative Approach

This report also utilizes a qualitative approach to reinforce and strengthen the data from the PDC's Coping Capacity Index. The Coping Capacity Index was created to generate insights for the broader Indo-Pacific region; therefore, the indicators often fail to resonate in the narrower context of the Freely Associated States, where data is sparse and often inaccessible. To develop a more holistic understanding of the Freely Associated States' capacity to cope with climate impacts, this report also relies on dozens of rigorous, in-depth stakeholder interviews. The team consulted experts from a wide range of disciplines – from water security to economic development to disaster relief– to ensure the Coping Capacity Index accurately reflected a country's real ability to cope (see Appendix 7).

Expanding the Definition of "Coping Capacity"

The PDC defines a weak coping capacity as "a country's inability to cope with hazard events stemming from a lack of systems and capabilities to absorb and respond to disruptions."[9]

[8] We deemed an indicator outdated if the most recent data point was more than five years old.

[9] Green, Joseph, Kevin Madaya, Adam Gramman, and Erin Hughey. "2050 Climate Change Impact Analysis: Anticipating Climate Change Impacts to Enhance Climate Security Across the Region." Maui, Hawai'i, USA: Pacific Disaster Center, 2023. https://www.cfe-dmha.org/LinkClick.aspx?fileticket=-

In the context of this report, this definition has been slightly modified to isolate *government* capacity to cope with climate change, specifically with regard to long-term adaptation. Thus, **the term "coping capacity" will henceforth refer to "the ability of a country's governance system and institutions to adapt to climate-related shocks and stressors stemming from a lack of systems and capabilities to absorb and plan for disruptions."**

Weak coping capacity—driven by capital constraints—limits the ability of small island developing states (SIDS) to plan for and implement adaptation initiatives, exposing the country to acute and prolonged risks. In effect, these capacity constraints threaten long-term development efforts and challenge the execution of essential climate adaptation programs at scale. These adaptation programs may include, for example, repairing irrigation systems to protect homes against sea level rise, installing rainwater catchment systems to combat water scarcity, or investing in saltwater resistant crops in over-wash areas.

In order to dissect the underlying factors influencing a state's capacity to cope with climate change, this report will rely on a holistic, multi-dimensional approach rooted in an analysis of the five forms of capital: human, physical, financial, natural, and political (see Figure 3).

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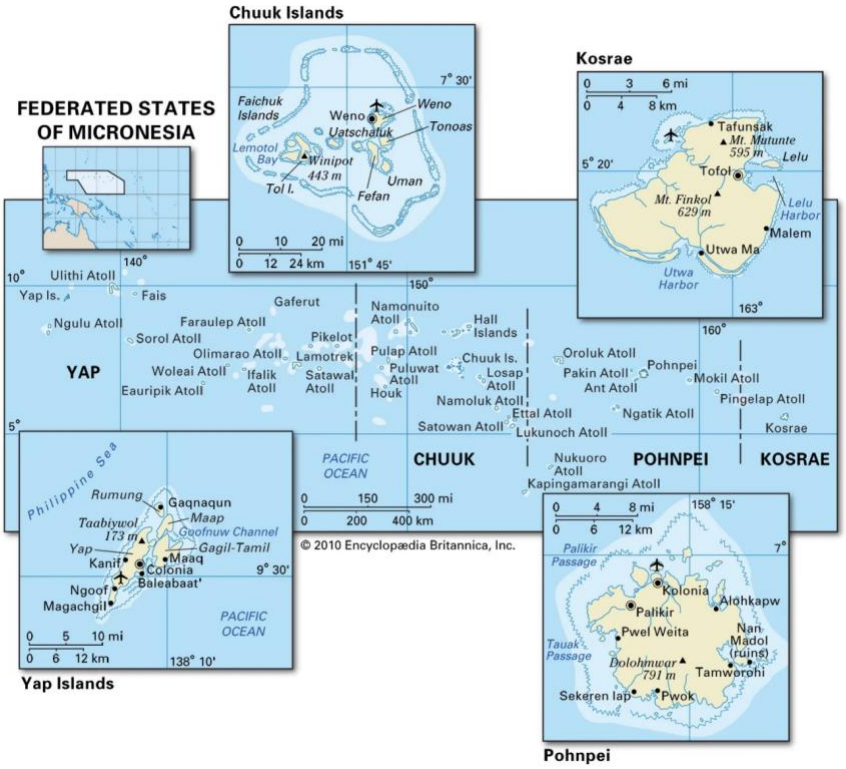
Figure 3: Defining the Five Forms of Capital

	Definition	Examples	Relevant Indicators from PDC Coping Capacity Index
Human	The health, wellbeing, intellectual engagement, motivation, competence, and skills of individuals within the workforce and broader population	- Access to skilled labor force - Workforce training programs - Outward migration - Technical skills: management, climate resilience, budgeting, long-term planning, patient services, engineering, etc. - Access to technology	- Nurses and Midwives per 1,000 People - Physicians per 1,000 People
Physical	Infrastructure systems and structures, as well as any other hard assets necessary for the procurement, transformation, or disposition of climate adaptation initiatives	- Roads, bridges, sea walls, water storage tanks - Digital connectivity: broadband, fiber optic cables, 5G networks	- Seaports - Airport Density - Road/Railroad Density - Hospital Bed Density - Fixed Phone Access - Mobile Phone Access - Secure Internet Server Access
Financial	The sum of funds available for government entities to invest in climate adaptation	- Access to liquid capital - Grants - Micro-loan programs - Long-term development financing - Official development assistance (ODA) - Foreign direct investment (FDI) - GDP growth - Remittances	- GNI per Capita - Reserves per Capita

Natural	Renewable and nonrenewable natural resources that exist within an ecosystem, particularly those required for climate adaptation and preparation	- Climate and weather events/patterns - Freshwater resources - Soil - Agroforestry resources - Physical geography	- Biome Protection - Marine Protected Areas
Political	Government rules, systems, structures, interactions, and norms that help to facilitate the effective management of climate-related initiatives	- Effective governance institutions - Public financial management, including budgeting and enforcement of rules/regulations - Political will - Free and fair electoral processes - Public accountability - Civic engagement and citizen involvement in political process - Foreign influence and strength of bilateral partnerships - Regulatory quality	- Voice and Accountability - Rule of Law - Political Stability - Government Effectiveness - Control of Corruption

The following sections will provide an assessment of the Freely Associated States' unique climate-related challenges, and the material investments each country requires to adapt to them. We will use this capital framework to assess the political, social, economic, natural, and financial constraints governments face in implementing and scaling these adaptation initiatives. This analysis will serve to identify priority areas of need, including socio-economic developments and workforce training prerogatives, that will help each country to better adapt to the disruptive effects of a changing climate.

THE FEDERATED STATES OF MICRONESIA (FSM)



COUNTRY OVERVIEW

Geography	The FSM is comprised of four states from west to east, Yap, Chuuk, Pohnpei, and Kosrae, and consists of over 600 small islands and atolls in the Caroline Islands archipelago (Western Pacific), approximately 1,020 kilometers (km; 634 miles) southeast of Guam and 5,633 km (3,500 miles) southwest of Hawaii.[10] With the exception of Kosrae, all states have inhabited outer-island atolls. The country's land area is small at 274 square miles. Individually, the states' land areas are Yap 48 square miles, Chuuk 49 square miles, Pohnpei 133 square miles, and Kosrae 43 square miles. However, the country as a whole occupies more than 1 million square miles of the Pacific Ocean.[11]

[10] Abiad, Hatem, Mara Langevin, Tiare Eastmond, and Andrea Cecchi. "Federated States of Micronesia - Disaster Management Reference Handbook." Center for Excellence in Disaster Management and Humanitarian Assistance (CFE-DM), November 2022. https://www.cfe-dmha.org/LinkClick.aspx?fileticket=JW1yRA1G7MU%3d&portalid=0, p. 10

[11] Ibid.

Population Distribution	Population: ~105,000. Approximately half of the total population resides in Chuuk State, with 77 percent of the total population residing in rural areas.[12]
Governance System	The majority of government functions – beyond defense and foreign affairs – are carried out at the state rather than the national level. Each of the four state governments (Yap, Chuuk, Pohnpei, and Kosrae) has an elected governor and a unicameral legislature; there are no political parties.[13]
Sources of Economic Revenue	External grants account for slightly less than half of government revenue, most of which is U.S. government aid from the COFA. Fishing license fees to foreign vessels account for about another quarter of revenue. The services sector – including government employment – is a large source of income and tax revenue.[14]
Dietary Staples	Much of the FSM's manufactured goods, fuel, and food, including rice, fruits, vegetables and meat, must be imported. Poultry, pigs, reef fish, and dogs are other common food sources. The traditional dietary staples are breadfruit, taro, coconuts, bananas, yams, and cassava; sweet potatoes also are grown on some of the high islands.[15] Outlying islands are more reliant on traditional crops and subsistence farming than population centers of the high islands, which have greater access to imported foods.

The FSM is benefitting from increased international attention and financing directed towards the Indo-Pacific region. External development grant levels, particularly aimed at climate adaptation projects, are historically high; meanwhile, the United States recently approved new economic support measures under the COFA for the next 20 years, and steady increases in fisheries revenues and overseas tax domicile revenues have resulted in large fiscal surpluses at the federal level in recent years.

However, large structural development issues remain unresolved. Lack of economic growth is driving high rates of outward migration (particularly by skilled workers), an overreliance on external funding continues to expose FSM to external shocks, and weak long-term planning capacity limits the utility of deployable funds. These structural challenges ultimately undermine FSM's resilience to near-term climate threats and its ability to adapt to long-term climate pressures, making FSM more dependent on external actors to help it cope with the effects of climate change.

[12] Ibid, p. 12
[13] Ibid, p. 14
[14] Ibid.
[15] Ibid.

CLIMATE-RELATED THREATS AND ASSOCIATED IMPACTS

The impacts of climate change are already evident in FSM. **Sea levels** in the region are anticipated to rise by approximately seven to 18 centimeters by 2030, and by as many as 35 centimeters by 2050 (depending on emission reduction scenarios). This makes **saltwater intrusion** from extreme king tides more frequent, **contaminating freshwater supplies**, damaging soil, and degrading **critical infrastructure** near coastlines. **Extreme weather events** that damage maritime, air, and telecommunications infrastructure upon which FSM depends for food, water, energy, and emergency services are projected to become more intense.[16] (See Appendix 8 for additional information on the climate-related threats and associated impacts in FSM.)

ADAPTATION NEEDS

What material resources does the FSM require to address these climate threats?
To cope with the effects of climate change and its second- and third-order effects—from food insecurity to water scarcity and critical infrastructure damage—researchers have identified several adaptation priorities for the FSM:

Infrastructure Maintenance and Repair

More than 71 percent of built infrastructure in the FSM is located within 500 meters of the coastline. This includes critical transportation facilities such as seaports and airports, as well as five of the country's seven medical facilities.[17] Typhoons and tidal flooding increasingly threaten this coastal infrastructure, requiring enormous investments in maintenance and repair. The International Monetary Fund (IMF) estimates that, for Pacific Island countries, infrastructure maintenance costs between six and nine percent of annual GDP, totaling more than $1 billion USD for the region every year.[18]

The tropical environment of the FSM is already exceptionally harsh on infrastructure. A series of factors–including hot temperatures, high humidity and UV radiation, hard rains, saltwater ocean spray, and aggressive local molds and bacteria–mean installed infrastructure in FSM often needs more frequent maintenance than that in more temperate climates.[19]

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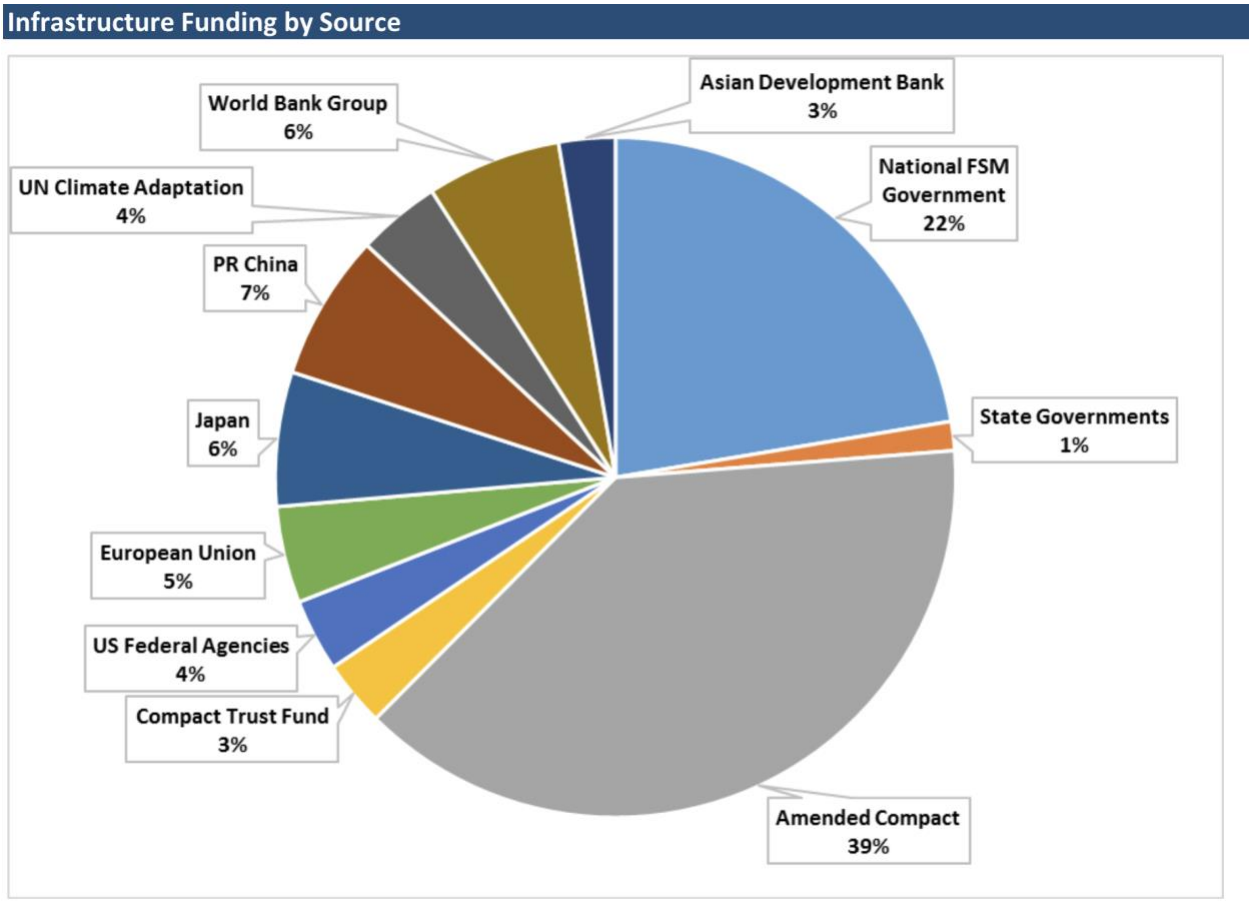
[16] For a more in-depth exploration of the climate-related risks and threats that FSM faces, see the Appendix 8.
[17] PIRCA. "Climate Change in the Federated States of Micronesia: Indicators and Considerations for Key Sectors," July 19, 2023. https://pirca.org/2023/07/19/climate-change-in-the-federated-states-of-micronesia-indicators-and-considerations-for-key-sectors/.
[18] Fouad, Manal, Todd Schneider, Natalija Novta, Gemma Preston, and Sureni Weerathunga. "Unlocking Access to Climate Finance for Pacific Island Countries." IMF Public Financial Management Blog, September 30, 2021. https://blog-pfm.imf.org/en/pfmblog/2021/09/unlocking-access-to-climate-finance-for-pacific-islands-countries.
[19] Kelly, Doug. "Renewable Energy For Micronesia – Micronesian Seminar." Micronesia Seminar, September 2006. https://micsem.org/micronesian-counselo/renewable-energy-for-micronesia/?id=1930&type=micronesian-counselo&pid=1930.

Figure 4: FSM's Infrastructure Funding by Source (2014)



Source: "Federated States of Micronesia Infrastructure Development Plan FY2016-FY2025." Department of Transportation, Communication & Infrastructure, October 2015. https://dofa.gov.fm/wp-content/uploads/2018/12/FSM-Infrastructure-Development-Plan-2016-2025.pdf.

In the FSM, infrastructure priorities include repairing and "climate proofing" critical roads and seaports. The road network in the FSM is constructed and maintained by state governments, although most funding is sourced from the national government.[20] Intense rainfall frequently damages road networks, and subsequent ad-hoc repairs are quickly washed away during the next storm. **When severe weather events render these road networks inoperable, healthcare facilities become inaccessible, fewer children attend school, and food and energy imports go to waste.** The costs to economic growth, meanwhile, cannot be overstated; roughly 10 percent of Compact infrastructure funds are devoted to infrastructure maintenance.[21] The Dekehtik Causeway

[20] "Readiness Proposal with The Secretariat of the Pacific Regional Environment Programme (SPREP) for the Federated States of Micronesia." Green Climate Fund, May 3, 2023. https://www.greenclimate.fund/sites/default/files/document/20230503-fsm.pdf.

[21] "Federated States of Micronesia Infrastructure Development Plan FY2016-FY2025." Department of Transportation, Communication & Infrastructure, October 2015. https://dofa.gov.fm/wp-content/uploads/2018/12/FSM-Infrastructure-Development-Plan-2016-2025.pdf.

in Kolonia, Pohnpei, for example, serves as an essential transport link between the seaport and airport but is frequently flooded during storm surges, requiring constant repair.[22]

Climate-resilient upgrades include improving drainage systems and tidal flows, building additional water crossings, repairing potholes, elevating vulnerable segments above sea level, and re-designing road sections to preserve coastal ecosystems.[23] Several infrastructure development programs in the FSM have actually exacerbated coastal hazards, contributing to increased erosion, flooding, and saltwater intrusion. These include the construction of seawalls, reef flat dredging, land reclamation in flood-prone areas, and building new roads over critical mangrove forests. Investments are now required to rehabilitate these fragile transportation networks.[24]

Improved Water Storage Capacity

Approximately 60 percent of freshwater resources in the FSM are in the form of surface water in small, intermittent streams that require treatment before use. The remaining 40 percent comes from groundwater resources, as residents of the low-lying atolls fully depend on rainwater and shallow wells for water security.[25] Erratic rainfall patterns, as well as more frequent droughts and over-wash events, deplete the supply of potable water across the FSM. To better prepare for variations in freshwater availability, the government of the FSM must invest in additional water storage capacity, including community water tanks and individual rainwater catchment systems. Previous development efforts to increase water storage capacity faced challenges with proper maintenance and delivery of catchment systems to remote atolls that lack port infrastructure.[26]

Investments in Conservation and Natural Infrastructure

Marine resources are essential to the FSM's economy and food supply but face mounting environmental pressures. Climate scientists estimate that the aragonite saturation state, a proxy for the coral reef growth rate, is expected to dip below the threshold level in the FSM by as early as

[22] PIRCA. "Climate Change in the Federated States of Micronesia: Indicators and Considerations for Key Sectors," July 19, 2023. https://pirca.org/2023/07/19/climate-change-in-the-federated-states-of-micronesia-indicators-and-considerations-for-key-sectors/, p. 39.

[23] Alejandrino-Yap, Maria Corazon, Matthew Dornan, Kerry McGovern, and John Austin. "Infrastructure Maintenance in the Pacific: Challenging the Build-Neglect-Rebuild Paradigm." Pacific Region Infrastructure Facility, 2013. https://www.theprif.org/sites/default/files/documents/build_neglect_rebuild_revised_full_report_2014.pdf, p. 30

[24] PIRCA. "Climate Change in the Federated States of Micronesia: Indicators and Considerations for Key Sectors," July 19, 2023. https://pirca.org/2023/07/19/climate-change-in-the-federated-states-of-micronesia-indicators-and-considerations-for-key-sectors/, p. 41.

[25] Abiad, Hatem, Mara Langevin, Tiare Eastmond, and Andrea Cecchi. "Federated States of Micronesia - Disaster Management Reference Handbook." Center for Excellence in Disaster Management and Humanitarian Assistance (CFE-DM), November 2022. https://www.cfe-dmha.org/LinkClick.aspx?fileticket=JW1yRA1G7MU%3d&portalid=0, p. 62.

[26] SPC Climate Change Projects. "Climate Change & Water Security in FSM," April 13, 2016. https://ccprojects.gsd.spc.int/climate-change-water-security/.

2030.[27] Together with rising ocean temperatures and increased risks of coral bleaching, these trends threaten the sustainability of coral reefs around the FSM. Coral reefs are critical to maintaining healthy fish stocks—an essential food staple and source of economic revenue—as well as to reducing coastal inundation. The fishing sector constitutes approximately two percent of the local economy, with revenue from the sale of fishing licenses earning the FSM around $150 million USD per year.[28] Researchers have also found a positive correlation between coral reef height and reduced wave-driven flooding. The conservation of marine resources—including coral reefs and fish stocks—is thus an essential climate adaptation priority. These conservation efforts could include scaling community-owned fishery management systems; developing Marine Protected Areas (MPAs); and investing in sustainable, small-scale aquaculture.

In addition to marine conservation, the FSM requires investments in climate-smart agriculture to maximize crop productivity and build resilience to climate change. The FSM's mangrove forests, for example, offer remarkable dividends in terms of climate adaptation and food security, shielding infrastructure from rising tides, mitigating coastal erosion, facilitating the uptake of carbon dioxide, and sequestering nutrients to protect coral reefs and seagrasses.[29] Investing in these indigenous forests, as well as in adaptable varieties of traditional food crops such as taro and cassava, is now essential to improving livelihoods and food security. Scaling alternate crop production methods such as micro-gardening, agroforestry, and small plot intensive farming also requires significant financial, human, and intellectual capital.[30]

[27] Chapman, Alex, William Davies, Ciaran Downey, and MacKenzie Dove. "Climate Risk Country Profile: Micronesia." World Bank, 2021. https://climateknowledgeportal.worldbank.org/sites/default/files/country-profiles/15818-WB_Micronesia%20Country%20Profile-WEB.pdf, p. 19.
[28] Ibid
[29] PIRCA. "Climate Change in the Federated States of Micronesia: Indicators and Considerations for Key Sectors," July 19, 2023. https://pirca.org/2023/07/19/climate-change-in-the-federated-states-of-micronesia-indicators-and-considerations-for-key-sectors/, p. 40.
[30] Ibid, p. 31.

Coordinated, Long-Term Planning Across All Four States

The FSM had made some progress toward strengthening the legal and institutional framework for climate change adaptation, but streamlined planning across all four states remains a core challenge. In 2021, each state released a Joint State Action Plan (JSAP) for Disaster Risk Management and Climate Change that outlines priorities for reducing climate-related risks and vulnerabilities. While the JSAPs have helped to advance climate adaptation activities at the state level, they have also hampered coordination efforts between national, state, and local authorities.[31] Without a coordinated, long-term, nationwide approach, projects are often duplicated, state and local budgeting processes become complicated, and climate financing mechanisms remain unevenly distributed. The Green Climate Fund (GCF) released a bid for proposals on this line of effort in May 2023, but progress remains slow.[32]

From fiscal year 2024 onwards, the federal budget will significantly shrink. Due to the adoption of a new constitutional amendment, Fishing Access Fees, previously the largest single contributor to the federal budget, will be cut by 50 percent; the remaining 50 percent of revenue will now be distributed to the states instead of to the federal government.[33] This will likely contribute to greater decentralization and more state-driven climate adaptation planning.

[31] Abiad, Hatem, Mara Langevin, Tiare Eastmond, and Andrea Cecchi. "Federated States of Micronesia - Disaster Management Reference Handbook." Center for Excellence in Disaster Management and Humanitarian Assistance (CFE-DM), November 2022. https://www.cfe-dmha.org/LinkClick.aspx?fileticket=GEzceMcF7Q8%3d&portalid=0, p. 35.

[32] "Readiness Proposal with The Secretariat of the Pacific Regional Environment Programme (SPREP) for the Federated States of Micronesia." Green Climate Fund, May 3, 2023. https://www.greenclimate.fund/sites/default/files/document/20230503-fsm.pdf.

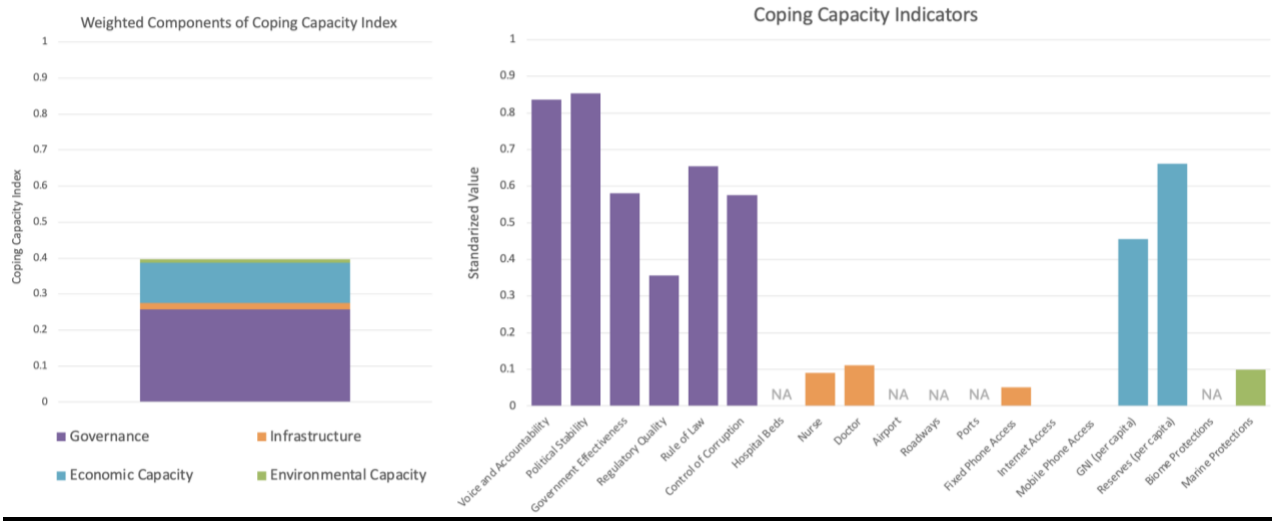
[33] Office of the President, Federated States of Micronesia. "President Simina Issues Presidential Proclamation for the Amendments to the Constitution of the Federated States of Micronesia." *Facebook*, October 3, 2023. https://www.facebook.com/photo/?fbid=704339935074961&set=a.314044377437854.

CAPACITY CONSTRAINTS

What are the underlying impediments to investing in, implementing, and scaling sustainable adaptation efforts in FSM? What capital constraints can be identified?

Quantitative Analysis: Data Findings

Figure 5: Coping Capacity Breakdown in Federated States of Micronesia



Interpretation: The height of the figure on the left represents the FSMs Coping Capacity Index value (0.4), and the color-coded components reflect the contribution of each subindex (Governance, Infrastructure, Economic Capacity, and Environmental Capacity) to the overall Coping Capacity value, where the height of each component corresponds to the sub-index value. The figure on the right presents the standardized values for the indicators included in each of the four sub-indices, and are color-coded as such.

The figure above displays the contributions of each indicator to the overall Coping Capacity Index for the FSM. Indicators relating to governance (in purple) are relatively high in the FSM, indicating the presence of well-functioning government institutions.[34] The exception is the *regulatory quality* indicator; the low score suggests potential government limitations in supporting and sustaining private sector growth.

Economic capacity (in blue) is a weakness for the FSM, with a relatively low indicator value for *gross national income (GNI) per capita*. While the *reserves per capita* index value is relatively high, FSM remains vulnerable to economic shocks due to their strong dependence on foreign aid.

[34] See Appendix 6 for specific definitions

According to the data, weak infrastructure systems hinder the FSM's coping capacity, evidenced by the series of low infrastructure scores in orange. The infrastructure index is composed of inputs relating to health, transportation, and communications. Source data for the discrete transportation inputs were unavailable for all COFA countries and, therefore, do not contribute to the infrastructure index. The health care inputs, namely the *number of doctors and nurses (per capita)*, are another source of weakness in the FSM. Communications infrastructure is similarly lacking, with incredibly low indicator values for *internet service*, and *mobile phone and fixed phone (landline) access* (in orange). Communications infrastructure is critical to both national economic development objectives and to the daily lives of residents. Furthermore, sufficient connectivity is crucial for timely and effective communications during the event of a natural disaster.

Environmental capacity (in green) is a composite of a country's terrestrial biome and marine protections, measured as the proportion of each biome and marine area that lies within a protected zone. Only data on *marine protections* was available for the FSM. This indicator scored quite low, suggesting a negative impact on the FSM's overall coping capacity.

Qualitative Analysis of Capacity Constraints: Five Forms of Capital

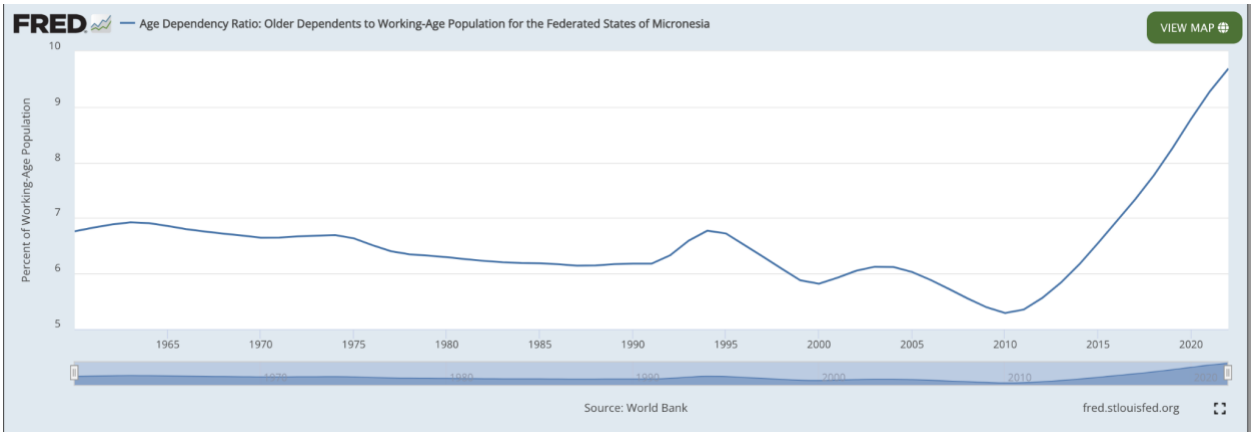
Human Capital

In the FSM, significant capacity constraints arise from a chronic shortage of skilled labor, owing mostly to unique migration opportunities created by the Compact that enable FSM citizens to live and work in the U.S. without a visa. FSM citizens emigrate to the United States in large numbers relative to FSM's total population, where they can often earn up to four or five times more than they could by staying at home.[35] This wage gap is particularly stark for skilled workers, many of which receive U.S. federal education aid through Pell Grants and other forms of aid to attend college in the U.S. After the completion of their degree, many face the difficult choice to either return home, where it is often difficult for them to find jobs that reflect their degrees and skills, or to stay in the United States, where they can make much more money and live with material comforts such as air conditioning and reliable internet access that often do not exist in many parts of the FSM. As a result, the International Monetary Fund (IMF) estimates that FSM's population has fallen by around 10 to 15 percent in the last decade.[36]

[35] IMF. "Federated States of Micronesia: 2023 Article IV Consultation-Press Release; Staff Report; and Statement by the Executive Director for Federated States of Micronesia," March 4, 2024. https://www.imf.org/en/Publications/CR/Issues/2024/03/04/Federated-States-of-Micronesia-2023-Article-IV-Consultation-Press-Release-Staff-Report-and-545538, p. 4.

[36] Ibid

Figure 6: Since 2010, the ratio of older dependents to the working-age population in the FSM has roughly doubled, owing to high rates of outward migration.



Sources: World Development Indicators | DataBank. "Age Dependency Ratio, Old (% of Working Age Population)," March 28, 2024. https://databank.worldbank.org/reports.aspx?dsid=2&series=SP.POP.DPND.OL; FRED, Federal Reserve Bank of St. Louis. "Age Dependency Ratio: Older Dependents to Working-Age Population for the Federated States of Micronesia." FRED, Federal Reserve Bank of St. Louis, July 4, 2023. https://fred.stlouisfed.org/series/SPPOPDPNDOLFSM.

Lack of access to healthcare and education present key capacity limitations. **The states of Chuuk, Kosrae, and Yap have only one state-run hospital each, and each lacks the staffing, equipment, and essential facilities to deliver comprehensive care.** While the Pohnpei State Hospital operates a 24/7 emergency unit, it remains inaccessible to patients from rural areas and the outer islands.[37]

FSM only has **2.2 nurses** and **one physician per 1,000 people**, placing the country in the lowest 40% globally for this measure (World Bank).

These remote and vulnerable atolls, such as Namonuito Atoll and the Mortlock Islands, are challenging and expensive to reach, as the time required to transport workers and ship raw materials between and to these outer islands is significant. For example, it takes about 14 hours over open ocean to reach Weno from Namonuito Atoll via ship. One interviewee from Onoun Island in Namonuito Atoll illustrated how difficult it is for people to live that far from social services, explaining that her brother died on the journey from Onoun to Weno while seeking healthcare, and that she would never be able to move back home because of the unavailability of convenient health services. The effects of climate change are most visible today on these outer, low-lying atolls and are contributing to the migration of these outer island residents to FSM population centers in the high islands and abroad.

[37] PIRCA. "Climate Change in the Federated States of Micronesia: Indicators and Considerations for Key Sectors," July 19, 2023. https://pirca.org/2023/07/19/climate-change-in-the-federated-states-of-micronesia-indicators-and-considerations-for-key-sectors/, p. 48.

Scarce skilled labor inhibits government and multilateral partners from implementing and maintaining large-scale, labor-intensive development projects, including infrastructure construction, marine conservation programs, agricultural innovations, and water storage installations. These shortages create a high demand for foreign workers. Filipinos have historically constituted a significant proportion of the foreign labor force, but in mid-2018, the Philippine Overseas Employment Administration issued a ban on the deployment of Filipino workers to the FSM amid mounting labor abuse complaints in Pohnpei and Chuuk. The ban froze several major infrastructure projects under the government's Pave the Nation initiative.[38] While the ban has since been lifted, access to skilled labor remains extremely limited. As a result, delays in contracting and procurement are ubiquitous, and long-term planning and infrastructure maintenance and repair is severely constrained.

Natural Capital

Local communities depend on coral reef ecosystems, mangroves, and wetlands that protect villages and communities from storms and flooding. However, these natural assets are frequently threatened by the direct effects of climate change, such as increases in sea level, strong winds, ocean temperature rises, and ocean acidification. Infrastructure development efforts have also had a deleterious effect on natural capital such as mangroves, which have been removed in order to pave way for new coastal infrastructure such as roads and buildings. A new resort hotel on the northern side of Weno in Chuuk, for example, required the clearing of a large swath of mangroves. Sediment runoff from coastal development is one of the greatest stressors for coral reefs and reefs themselves are often used as material for construction. Pohnpei now has over 50 dredge sites and mangrove clearings as a result of infrastructure development.[39]

Fisheries constitute an important part of both government revenue and local food sources. Fishery resources in the FSM can be divided into offshore and inshore categories. Offshore resources are the species of fish, primarily tuna, that are caught in the open waters beyond the reef lagoons and are typically caught by the commercial deep-sea fishing vessels that pay the fishing license fees that support the government's budget. Inshore resources, known as "reef fish," are caught within the reef lagoons and are what locals catch for their sustenance and occasional sale. Offshore resources are much more stringently regulated (with the help of the U.S. Coast Guard) than inshore fishing of reef fish, as officials recognize locals' reliance on reef fish as a core food source. However, overharvesting of reef fish is a serious issue, particularly near urban centers, with local stakeholders reporting diminishing hauls and additional efforts required to catch reef fish.[40] Inshore resources are also being negatively impacted by the damage to coral reef biodiversity through ocean acidification and infrastructure development as described above.

[38] Pacific Island Times. "Labor Ban Lifted; Philippines Ready to Send Workers to Micronesia," October 19, 2023. https://www.pacificislandtimes.com/post/labor-ban-lifted-philippines-ready-send-workers-to-micronesia.
[39] Food and Agriculture Organization of the United Nations. "Micronesia (Fed. States) - Fishery and Aquaculture Country Profiles," August 2023. https://www.fao.org/fishery/en/facp/fsm.
[40] Ibid.

Physical Capital

The harsh climate of the FSM often accelerates the deterioration of critical infrastructure,[41] which has led to the failure of several previous attempts to electrify rural communities through solar energy due to a high maintenance burden.[42] High humidity and exposure to saltwater can corrode metal components in infrastructure such as bridges, pipelines, and solar panels, weakening their structural integrity. Moreover, periodic heavy rainfall, tropical storms, and typhoons can erode protective barriers and hasten their premature deterioration. Saltwater intrusion and prolonged exposure to ultraviolet radiation can also cause concrete surfaces to crack, fade, and become brittle over time. As a result, infrastructure projects in the FSM require regular maintenance and repair. **Without the labor force required to staff these maintenance initiatives, however, an exhausting cycle of "build, neglect, repair" ensues.**[43] This rapid deterioration limits the efficacy of infrastructure investments and their effect on overall growth. Despite averaging infrastructure spending at 12 percent of GDP from FY 2004-19, in alignment with other PICs, the FSM's growth rate lags behind the PIC average (see Figure 7).[44]

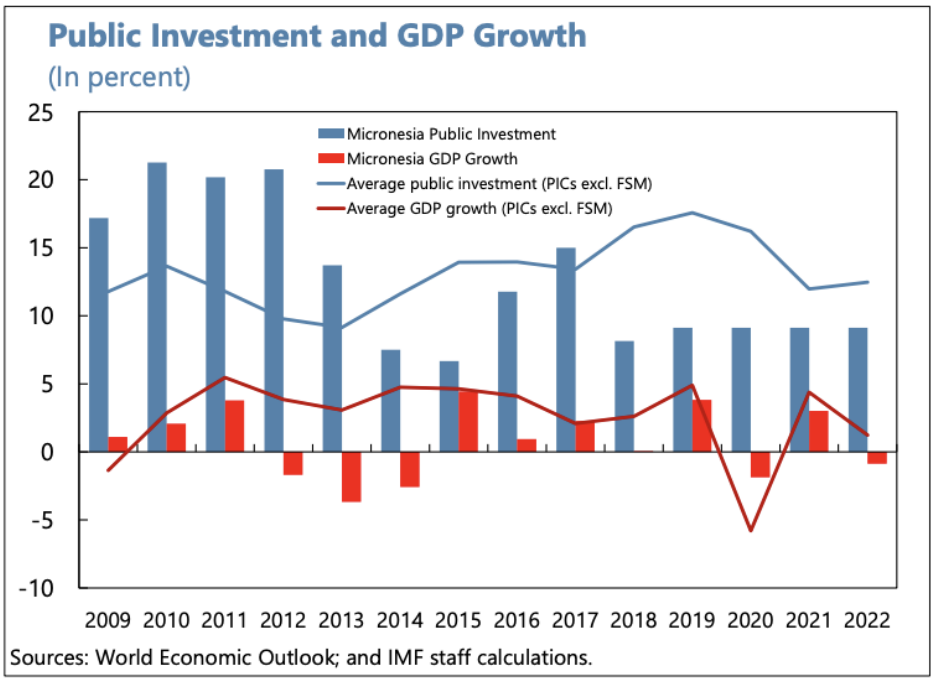
[41] Kelly, Doug. "Renewable Energy For Micronesia – Micronesian Seminar." Micronesia Seminar, September 2006. https://micsem.org/micronesian-counselo/renewable-energy-for-micronesia/?id=1930&type=micronesian-counselo&pid=1930.

[42] Bruton, Larry. "Successful Renewable Energy Projects in the FSM." Presented at the 26th Pacific Islands Environment Conference, Saipan, Northern Mariana Islands, June 2009. https://19january2017snapshot.epa.gov/www3/region9/islands/conf09/Larry-Bruton.pdf.

[43] Alejandrino-Yap, Maria Corazon, Matthew Dornan, Kerry McGovern, and John Austin. "Infrastructure Maintenance in the Pacific: Challenging the Build-Neglect-Rebuild Paradigm." Pacific Region Infrastructure Facility, 2013. https://www.theprif.org/sites/default/files/documents/build_neglect_rebuild_revised_full_report_2014.pdf, p. 6.

[44] IMF. "Federated States of Micronesia: 2023 Article IV Consultation-Press Release; Staff Report; and Statement by the Executive Director for Federated States of Micronesia," March 4, 2024. https://www.imf.org/en/Publications/CR/Issues/2024/03/04/Federated-States-of-Micronesia-2023-Article-IV-Consultation-Press-Release-Staff-Report-and-545538, p. 8.

Figure 7: Public Investment and GDP Growth in FSM Compared to Other Pacific Island Countries



Source: IMF. "Federated States of Micronesia: 2023 Article IV Consultation-Press Release; Staff Report; and Statement by the Executive Director for Federated States of Micronesia," March 4, 2024. https://www.imf.org/en/Publications/CR/Issues/2024/03/04/Federated-States-of-Micronesia-2023-Article-IV-Consultation-Press-Release-Staff-Report-and-545538, *p. 12.*

The FSM only has **6.2 landline subscriptions** and **19.5 mobile phone subscriptions per 100 people**, and fewer than **20 secure internet services per 100,000 people**, making it one of the weakest countries globally in terms of communications infrastructure. (World Bank)

Mobile phone access is also limited by weak telecommunications infrastructure. Cell coverage is only available on the main high islands of each state (and to varying degrees), concentrated in the few islands with a stable electricity supply. Outer islands lack any mobile phone coverage, leaving them unable to communicate effectively in the event of a natural disaster and severely constraining their ability to build socioeconomic resilience through remote education and jobs.[45]

Financial Capital

The FSM's macroeconomic outlook remains subdued and highly volatile, with real GDP growth hovering at around one to two percent annually due to persistent vulnerability to external shocks, weak public investment management, and inadequate long-term planning. This figure is

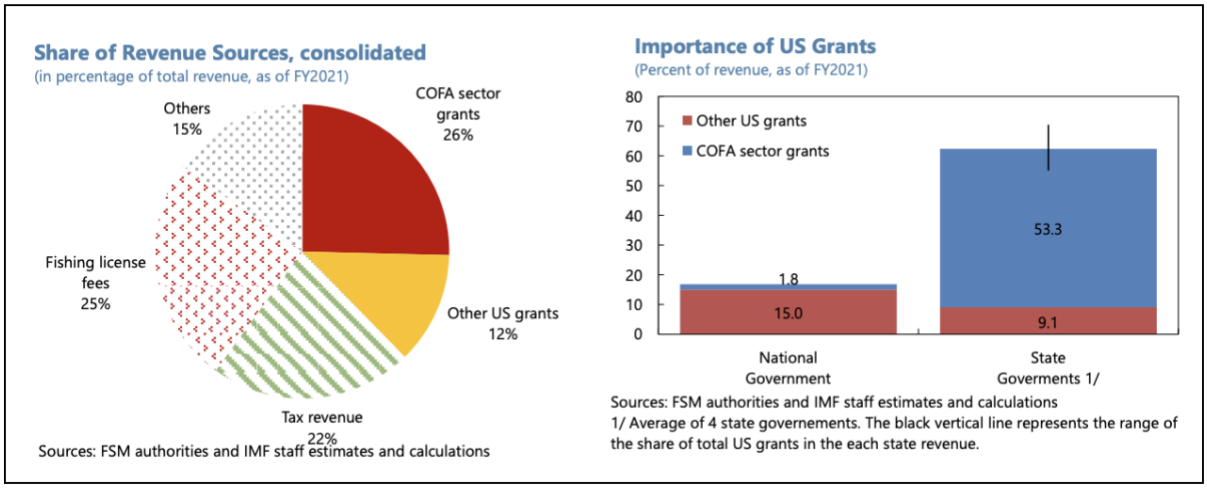
45 "Project Information Document - Digital Federated States of Micronesia." World Bank, March 31, 2020. https://documents1.worldbank.org/curated/en/791101578622391269/pdf/Project-Information-Document-Digital-Federated-States-of-Micronesia-P170718.pdf.

significantly below the average of 2.97 percent and 6.5 percent in other PICs and low-income countries in Asia, respectively.[46]

The FSM's limited export base and services sector has contributed to a significant trade imbalance, and its weak tax-to-GDP ratio[47]—which is lower compared to many other developing countries (around nine percent)—has constrained the government's fiscal capacity and public spending on essential services. Private sector development in the FSM remains severely constrained, as the government employs approximately two-thirds of the labor force.[48] Little to no competition between the public and private sectors reduces efficiency, stymies innovation, and promotes heavy reliance on external assistance. Official development assistance (ODA) constitutes between 20 and 25 percent of GDP in the FSM,[49] but numerous factors continue to discourage foreign investment, including high credit costs, poor trade infrastructure, limited formal banking systems, etc.[50]

[46] IMF. "Federated States of Micronesia: Selected Issues," March 4, 2024. https://www.imf.org/en/Publications/CR/Issues/2024/03/04/Federated-States-of-Micronesia-Selected-Issues-545541, p. 4.
[47] IMF. "Federated States of Micronesia: 2023 Article IV Consultation-Press Release; Staff Report; and Statement by the Executive Director for Federated States of Micronesia," March 4, 2024. https://www.imf.org/en/Publications/CR/Issues/2024/03/04/Federated-States-of-Micronesia-2023-Article-IV-Consultation-Press-Release-Staff-Report-and-545538, p. 48.
[48] Abiad, Hatem, Mara Langevin, Tiare Eastmond, and Andrea Cecchi. "Federated States of Micronesia - Disaster Management Reference Handbook." Center for Excellence in Disaster Management and Humanitarian Assistance (CFE-DM), November 2022. https://www.cfe-dmha.org/LinkClick.aspx?fileticket=GEzceMcF7Q8%3d&portalid=0, p. 93.
[49] World Bank Open Data. "Net ODA Received (% of GNI) - Micronesia, Fed Sts," March 28, 2024. https://data.worldbank.org.
[50] IMF. "Federated States of Micronesia: 2023 Article IV Consultation-Press Release; Staff Report; and Statement by the Executive Director for Federated States of Micronesia," March 4, 2024. https://www.imf.org/en/Publications/CR/Issues/2024/03/04/Federated-States-of-Micronesia-2023-Article-IV-Consultation-Press-Release-Staff-Report-and-545538, p. 45.

Figure 8: Sources of Government Revenue in the FSM: The COFA and other U.S. grants constitute more than one-third of government revenue.



Source: IMF. "Federated States of Micronesia: 2023 Article IV Consultation-Press Release; Staff Report; and Statement by the Executive Director for Federated States of Micronesia," March 4, 2024. https://www.imf.org/en/Publications/CR/Issues/2024/03/04/Federated-States-of-Micronesia-2023-Article-IV-Consultation-Press-Release-Staff-Report-and-545538, *p. 44.*

Donors, meanwhile, remain highly fragmented. While large, multilateral funds are becoming more available for climate adaptation, they also come with a host of cumbersome reporting requirements.[51] Managing these funds requires significant organizational capacity, placing additional strain on fragile administrative systems in FSM.

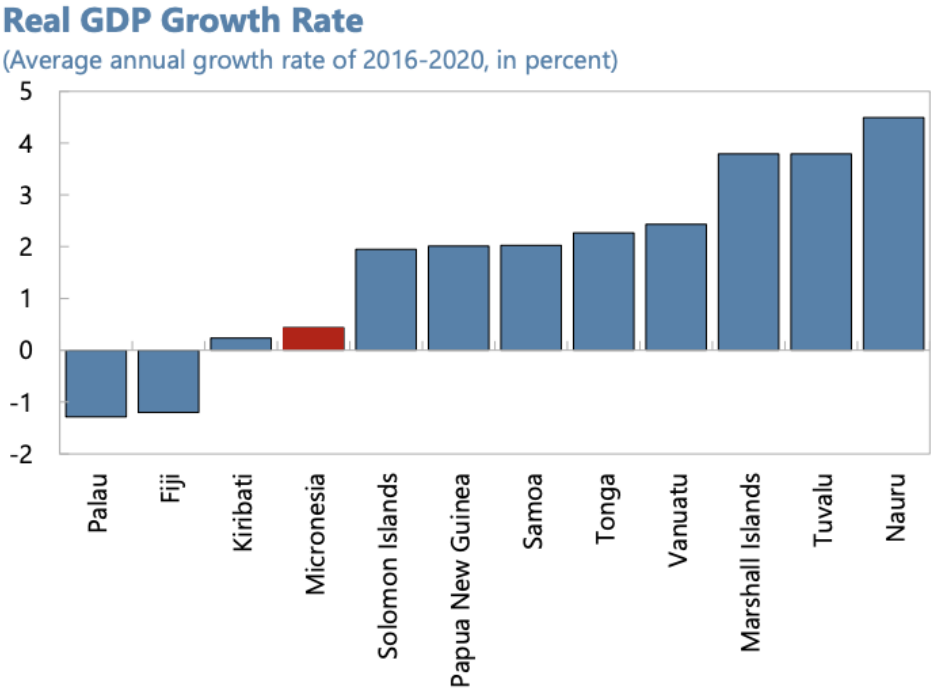
Representatives from the U.S. Department of the Interior Office of Insular Affairs, which administers the sector grants to the FAS under the COFAs, also cited challenges aligning funding priorities of the U.S. with those of the sovereign FAS. For example, while the Environmental Sector Grant funds nearly all of FSM's government spending on that initiative, the vast majority of compact funds are spent on administration and overhead, with little money left over for programming such as water quality monitoring. If the Department of the Interior tries to push too hard for change, the sovereign governments may view it as micromanaging their own priorities, which include maximizing employment. On the other hand, an FSM social activist cited the challenges of managing cumbersome reporting requirements, as they exact a high administrative burden that reduces the effectiveness of allocated funds**. The new Compacts, given final approval in 2024, allow more freedom for the FAS governments to set funding priorities and budgets for COFA funds, but increase reporting requirements post-implementation.**[52]

[51] PIRCA. "Climate Change in the Federated States of Micronesia: Indicators and Considerations for Key Sectors," July 19, 2023. https://pirca.org/2023/07/19/climate-change-in-the-federated-states-of-micronesia-indicators-and-considerations-for-key-sectors/, p. 27.
[52] U.S. Department of the Interior, Office of Insular Affairs. SIPA Capstone Team Interview, March 13, 2024.

FSM's new Compact includes $114 million USD in mandatory annual appropriations beginning in FY 2024 by the U.S. to the FSM,[53] an increase of 38 percent from the previous COFA period, which was $82.5 million USD in FY 2023.[54]

Enormous disparities exist between the required external financing, the approved funding, and the actual disbursements. For example, total approvals for the Pacific Islands' Green Climate Fund through May 2021 were only about half of the estimated annual needs; total disbursements were only around a quarter.[55]

Figure 9: FSM's real GDP growth rate lags behind that of other Pacific Island Countries.



Source: IMF. "Federated States of Micronesia: 2023 Article IV Consultation-Press Release; Staff Report; and Statement by the Executive Director for Federated States of Micronesia," March 4, 2024. https://www.imf.org/en/Publications/CR/Issues/2024/03/04/Federated-States-of-Micronesia-2023-Article-IV-Consultation-Press-Release-Staff-Report-and-545538, p. 23.

[53] *After Fully Passing U.S. Congress, President Biden Has Just Signed the Amended Compact Act of 2023 into Law. H.E. President Wesley W. Simina Addresses the Nation with the Official Announcement - Providing Important Updates and next Steps*. Facebook, 2024. https://www.facebook.com/piofsm/videos/after-fully-passing-us-congress-president-biden-has-just-signed-the-amended-comp/758847759721035/.

[54] U.S. Department of the Interior. "OIA Announces $82.5 Million in Compact Funding to Help Strengthen Federated States of Micronesia Communities," September 2, 2022. https://www.doi.gov/oia/press/oia-announces-825-million-compact-funding-help-strengthen-federated-states-micronesia.

[55] Green Climate Fund. "Micronesia (Federated States Of)." Green Climate Fund, April 26, 2023. https://www.greenclimate.fund/countries/micronesia.

Political Capital

Government administrative capacity, public accountability, and cultural idiosyncrasies all pose significant barriers to improved coping capacity in FSM. A recent IMF report[56] concluded that weak public financial management (PFM) remains a significant barrier to effective climate adaptation. A robust PFM system should ensure that government resources are allocated toward essential investments and reforms, including infrastructure repair, conservation efforts, and additional water storage capacity. In the FSM, budget execution is constrained by human resource limitations, weak administrative systems such as procurement and accounting, and insufficient accountability mechanisms or internal controls. Dysfunctional internal controls–arising from capacity gaps in both staffing and technical skills–can inhibit forward planning and incentivize reactionary, rather than preventative, government investments. This often means that infrastructure repair in FSM is conducted only on an ad hoc or "as needed" basis rather than as an ongoing maintenance prerogative. **The national project of infrastructure maintenance is also complicated by the fact that activities such as road repairs are typically managed at the state level but financed by Palikir, creating recurrent disagreements over relevant responsibilities and causing frequent delays in fund disbursements.**

Each state in the FSM enjoys a high degree of political autonomy that is fiercely defended but impairs coordinated policy implementation across the nation. Each has its own constitution and laws, as well as climate change adaptation policies. Another practical obstacle is the diversity of languages spoken across the FSM. Each state has its own distinct cultures, languages, and dialects, adding further complexity to the landscape of the FSM. As a result, any centralized planning process must typically use English as the common language and employ the use of translators in all consultation activities. This decentralization has led to fragmented, uneven development efforts and an inability for the national government to encourage capacity development and institutional coordination across the four islands. These physical barriers also raise the costs of importing essential infrastructure materials.

Land is an exceptionally precious resource in these small islands. Land rights in the FSM are a complex cultural issue that have long impeded infrastructure development projects. Traditionally, land was not owned by individual immediate family units but by many members of clan lineage. As cultures throughout the FSM have shifted attention away from the extended family and toward the immediate family, disputes have arisen when the master of a lineage sells rights to land that other members of a lineage disagree with, and subsequently also demand payment for.

Strategic allocation of resources such as payments for easements is particularly challenging in Chuuk, home to roughly half of the FSM's population. Unlike other states in the FSM, Chuuk

[56] IMF. "Federated States of Micronesia: 2023 Article IV Consultation-Press Release; Staff Report; and Statement by the Executive Director for Federated States of Micronesia," March 4, 2024. https://www.imf.org/en/Publications/CR/Issues/2024/03/04/Federated-States-of-Micronesia-2023-Article-IV-Consultation-Press-Release-Staff-Report-and-545538

never benefited from an overarching political structure to unify villages before colonization. Whereas Pohnpei, Kosrae, and Yap have a cultural history of traditional leaders whose authority extended across several villages and who could make resource allocation decisions for a larger community, a formal, sustained political community in Chuuk never manifested above the village level (other than what outsiders imposed on them). As a result, political cooperation in Chuuk has always depended heavily on negotiated material exchanges, a principle known as *ichietiw*,[57] where resources are divided evenly among stakeholders like food at a table, rather than allocated strategically. *Ichietiw* in land rights can turn into endless delays and cost overruns as clan landowners try to maximize easement and land payments without the limits that would come with a traditional leadership structure that could make strategic decisions for the greater good.[58] Although eminent domain is written into the Chuuk State Constitution, it is not used in practice.

This problem is also exacerbated by a commonly held view that the FSM government is a source of foreign aid money that is only minimally reliant on taxpayer revenues, encouraging whoever may have a tenuous lineage-based claim to the land to jump in and demand more easement money. As a result, former FSM President Manny Mori, who is Chuukese, has said that infrastructure planning and land rights are the top impediments to development in Chuuk,[59] echoing former Chuukese public servants and state legislators.[60]

Poor accountability mechanisms in the FSM can increase the likelihood of significant spending errors as well as corruption. In an open letter to the FSM's congress and state governors in 2023, former President David Panuelo accused Beijing of "political warfare" and alleged that Chinese officials have routinely bribed elected representatives in Micronesia in exchange for controversial development bids.[61] Former governor of Yap State, Henry Falan, has described attempted bribery by a Chinese company that sought to win support for a 10,000-room resort on Yap, and for his subsequent impeachment after he opposed the plan.[62] The plan was scrapped after a backlash on social media and the electoral defeat of the pro-Chinese legislators.

Moreover, accountability for service provision is severely constrained by a lack of openness, transparency, and civic engagement. Only one newspaper, the *Kaselehlie Press*, remains

[57] Hezel, Francis X. "The Chuuk Problem: At the Foot of the Political Pyramid – Micronesian Seminar." Micronesia Seminar, April 2004. https://micsem.org/micronesian-counselo/the-chuuk-problem-at-the-foot-of-the-political-pyramid/.
[58] Ibid.
[59] *Chuuk State Separation Initiative*. COM-FSM National Campus, 2015. https://www.youtube.com/watch?v=WIfmxOFuhQ8.
[60] *Love Of Chuuk*, Micronesian Seminar, 2016. https://www.youtube.com/watch?v=RdeDcCG_B0k.
[61] Paskal, Kleo. "Micronesia's President Writes Bombshell Letter on China's 'Political Warfare.'" FDD, March 9, 2023. https://www.fdd.org/analysis/2023/03/09/micronesias-president-writes-bombshell-letter-on-chinas-political-warfare/.
[62] The Fourth Branch. "Interview: Yap State Governor Henry Falan — The Fourth Branch," November 10, 2022. http://www.tfbmicronesia.com/articles/2022/11/10/interview-yap-state-governor-henry-falan.

operable in the FSM, but even former President Panuelo says the outlet "can't get too close to any issue that could disrupt social cohesion." The FSM's legacy of censorship dates to the early 1990s, when *FSM News* owner Sherry O'Sullivan was made persona non grata for criticizing public officials in the press. As a result, journalism in the FSM acts as a weak government accountability mechanism, inhibiting public oversight and transparency. Micronesian culture traditionally discourages open criticisms of others, a tension reflected in the customary restraints placed on freedom of expression in the FSM constitution.[63] It includes freedom of expression so long as traditional leaders are still honored and paid their due respect. Social activists from the FSM acknowledge that even posting government criticism on social media is risky, and argue the government aims to keep civil society weak and disorganized.[64]

WHAT HAS BEEN TRIED BEFORE?

Key Climate Adaptation Projects (2018-2024)

External grants for climate adaptation projects are at a historic high in the FSM. The unique funding arrangement under the Compact adds a layer of complexity to capturing the external adaptation funding environment in the FSM. For example, the United States is allocating $25 million USD to FSM infrastructure through the Compact in fiscal year 2024 alone. While not explicitly earmarked for climate adaptation, the funding is used by the FSM to finance projects such as road construction, similar to the World Bank's Priority Road Improvements & Management Enhancements (PRIME) project and Strategic Climate-Oriented Road Enhancements (SCORE) projects.

Project Title and Donor	Category	Objective	Timeline and Status (Ongoing/ Completed)	Lifetime Budget (USD)
Climate Change Adaptation Solutions for Local Authorities in the FSM (Green Climate Fund)	Environment, Health, Sanitation, Food Security, Disaster Risk Reduction	Build the capacity of local authorities to deliver climate change adaptation services by enhancing their technical expertise	2021-2028, Under implementation	$19.7M
Ecosystem-based Adaptation for Reducing Community Vulnerability to Climate Change in Northern Pacific Small Island Developing States (Green Climate Fund)	Environment and Conservation	Establish small-grant facilities to finance and scale conservation and ecosystem-based adaptation projects	TBD, Approved (not yet implemented)	$9.9M
Climate resilient food security for farming households across the FSM (Green Climate Fund)	Food Security	Increase the resilience of FSM's most vulnerable communities to climate change-induced food insecurity	2021-2026, Under implementation	$9.4M
Priority Road Improvements & Management Enhancements (PRIME) Project (World Bank)	Infrastructure	Improve the climate resilience of FSM's primary road network	2021-2028, Under implementation	$40M

[63] Hezel, Francis X. "Freedom of Information: Who Has a Right to What? – Micronesian Seminar." Micronesia Seminar, May 17, 1995. https://micsem.org/micsem-discussion/freedom-of-information-who-has-a-right-to-what/; *see* FSM Const. Art. V., https://www.fsmlaw.org/fsm/constitution/article5.htm.
[64] Field interviews

Strategic Climate-Oriented Road Enhancements (SCORE) Project (World Bank)	Infrastructure	Improve the climate resilience of FSM's secondary road network	2022-2028, Under implementation	$35.3M
Advancing Delivery of the East Micronesia Cable Project (USAID, Japan, Australia)	Connectivity	Connect the state of Kosrae in FSM, Tarawa in Kiribati, and Nauru to the existing HANTRU-1 cable in Pohnpei, FSM; provide faster, higher quality and more reliable communications across three Pacific countries	2023-TBD, Under implementation	$95M
Project for Strengthening Public Financial Management (World Bank)	Governance	Improve tax administration and the completeness, reliability and timeliness of financial reports of the National and State Governments	2018-2025, Under implementation	$11M
Federated States of Micronesia Maritime Investment Project (World Bank)	Environment	Improve the safety, efficiency and climate resilience of maritime infrastructure and operations in the FSM, and in the event of an eligible crisis or emergency, to provide an immediate response to the eligible crisis or emergency	2019-2024, Under implementation	$38.49M
Digital Federated States of Micronesia Project (World Bank)	Connectivity	Support the rollout of terrestrial fiber infrastructure, connect outer islands to basic broadband services, establish the critical foundations for digital government services, and strengthen the legal and regulatory enabling environment for the digital economy	2020-2026, Under implementation	$30.8M

The government of the FSM has pursued numerous road construction development projects in recent years, corresponding with rapid growth in the number of vehicles on the main islands. Current projects under the "Pave the Nation" initiative, funded primarily by the World Bank, build on the successes of previous road infrastructure projects. Historically, road projects in the FSM have been funded primarily by the national government, the United States (indirectly through Compact grants to the FSM government), multilateral development banks, and more recently the People's Republic of China.

Recent successful Chinese projects include the Pohnpei Secondary Road and Kahmar Bridge project. U.S.-funded and FSM-led efforts to build a circumferential road around Weno, the capital and population center of Chuuk State, have had mixed results. While the completion of concrete roads in the northwestern downtown commercial area and near the state governmental office areas have been successful, as well as a small portion at the far side of the island in Sapuk, the long-awaited road connecting rural areas in Sapuk to the downtown area has run into huge cost overruns, due in part to a bribery scandal involving a U.S.-based contractor and challenges securing easements for road paving.[65]

The Green Climate Fund has initiated several adaptation programs in the FSM in recent years to enhance food security through climate-smart agricultural practices, ecosystem restoration for coastal protection, watershed management, fisheries management, water security infrastructure, and climate-based education initiatives.

[65] Johnson, Giff. "Lyon's Bribery Admission Raises More Questions." *The Marshall Islands Journal*, February 22, 2019. https://hawaiifreepress.com/Portals/0/Article%20Attachments/Article%20Attachments%202019/Journal%202-22-2019%20Lyon%20FSM%20PMU.pdf.

Although the U.S. is the largest source of foreign assistance to the FSM by far, the vast majority of this funding has been indirect, channeled through the FSM federal government in the form of Compact grants. Compact sector grants pay for nearly all of FSM national spending in education and health infrastructure and services, for example. Due to the indirect nature of this funding, in addition to the fact that FSM citizens tend to view Compact funds less like foreign aid and more like a rental payment, U.S. development assistance is sometimes less plainly visible than foreign assistance from other countries.[66]

China, for example, tends to invest in highly visible material infrastructure projects. Recent projects include the state government offices of Chuuk and Pohnpei, the National Convention Center, the personal residences of top FSM government officials, and climate-resilient roads and bridges.[67] A Chinese-funded sustainable farming program on Pohnpei is known to also provide produce to Chinese research vessels in the area.[68] It is worth noting FSM maintains a policy of receiving only grants (and no loans) from China due to concerns over "debt-trap diplomacy."

Japan, another major donor, tends to invest in education and social infrastructure, such as fire trucks, school buses, and school buildings.[69] Japan was the former colonial overlord of the region for over 40 years and benefits from an even longer history of Japanese trade in the region, particularly in Chuuk, and today many Micronesians have Japanese ancestry. The European Union similarly invests in development projects such as water security and electricity access in outlying islands, typically deploying funds through the Pacific Community (SPC).[70] Australia's development funding to FSM focuses on health, education, social, and fisheries assistance.[71]

The U.S. is beginning to adopt more direct funding schemes through its development agencies, outside of the regular compact grants through the Department of Interior. Recent examples include a U.S. Agency for International Development (USAID)-funded bridge construction and U.S. Trade

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[66] U.S. Department of the Interior, Office of Insular Affairs. SIPA Capstone Team Interview, March 13, 2024.
[67] Lawler, Dave. "How China's Push for Influence in Micronesia Is Testing U.S. Power in the Pacific." Axios, November 29, 2023. https://www.axios.com/american-military-chinese-competition-micronesia.
[68] Wright, Stephen, and Zhuang Jing. "China Builds Roads, Provisions Its Ships – in US Ally Micronesia." Radio Free Asia, September 28, 2023. https://www.rfa.org/english/news/china/bri-micronesia-09282023153637.html.
[69] "Japan's Official Development Assistance to the Federated States of Micronesia." The Embassy of Japan in the FSM, December 2018. https://www.mofa.go.jp/files/000447552.pdf.
[70] "EU and SPC Agreement Supports FSM, Marshall Islands, and Palau to Build Resilience to El Nino." The European Union North Pacific Readiness for El Nino Project, 2017. https://www.eeas.europa.eu/sites/default/files/eu-spc_media_release_.pdf.; Pacific Community: Geoscience, Energy, and Maritime Division. "Flipping the Switch: Affordable, Reliable and Renewable Energy Solutions for the Federated States of Micronesia | SPC Geoscience, Energy and Maritime Division," August 24, 2020. https://gem.spc.int/news/2021/02/flipping-the-switch-affordable-reliable-and-renewable-energy-solutions-for-the.
[71] Australian Government, Department of Foreign Affairs and Trade. "Australia's Development Assistance to the Federated States of Micronesia | Australian Government Department of Foreign Affairs and Trade," 2024. https://www.dfat.gov.au/geo/federated-states-of-micronesia/development-assistance/development-assistance-in-federated-states-of-micronesia.

and Development Agency (USTDA) preliminary studies and pilot projects into wireless broadband for underserved and remote communities.[72]

POLICY RECOMMENDATIONS

Analysis: Assessing Priority Areas of Need

Given the identified capital constraints, climate adaptation efforts should prioritize workforce development and training, long-term infrastructure management, and partnership strengthening. While funding for adaptation infrastructure exists, effective deployment of those funds is often hampered by a dearth of skilled labor at the local level as well as governance issues. Finally, personal relationships are paramount to the successful implementation of any adaptation programs in the country. **In the words of Father Fran Hezel, the first rule of life in the region is that "it's personal, not strategic."[73] If you don't have a good personal relationship with people there first, no amount of planning will get you anywhere.**

Workforce Development and Training

- **Incorporate local apprenticeships into Yap Airport runway expansion:** The Air Force has submitted a FY25 budget request to spend $400 million USD to expand the runway at Yap International Airport to serve as a potential diversion point and to enhance distributed force posture as part of the "Guam Cluster." Planned military construction includes not only extending the runway but also supporting infrastructure for utility construction (including potential renewable energy installations), stormwater management, erosion control, and earthwork and grading for site preparation. These construction skills would not only be useful for local climate-adaptive infrastructure construction, but also help develop local workforce talent for further planned military construction in Joint Task Force Micronesia (on Tinian and elsewhere) and enhance local buy-in for increased U.S. military presence on the island.

- **Offer scholarships for training in specific climate adaptation jobs** (meteorology, land surveying, construction work, etc.) that are accompanied by a job promise and an obligation to work in the islands for a set period of time.

[72] U.S. Trade and Development Agency. "USTDA Advances Affordable Connectivity in Micronesia, Pacific Islands," April 4, 2024. https://www.ustda.gov/ustda-advances-affordable-connectivity-in-micronesia-pacific-islands/.

[73] Hezel, Francis X. SIPA Capstone Team Interview, February 2022.

Infrastructure

- **Distribute solar energy for outlying communities and schools:** Combat high fuel and electricity costs with solar energy to supply air conditioning for increasingly hot nights. These developments could be paired with connectivity stations. Making life at school more appealing will encourage students to spend more time at school where they can continue to learn. These solar development projects should be accompanied by maintenance training for contractors.

- **Invest in new or refurbished rainwater catchment systems** with adequate filtration equipment and maintenance training, while also distributing inexpensive water purification aids such as MadiDrops, Life Straws, and FoliaWater Filters.

Partnerships

- **Re-introduce Peace Corps,** not just for recent college graduates but for mid- or late-career professionals with relevant skills seeking adventure.[74] The United States' unique people-to-people ties with the FSM are one of its strongest assets, not just for climate adaptation, but for broader political ties and trust-building.

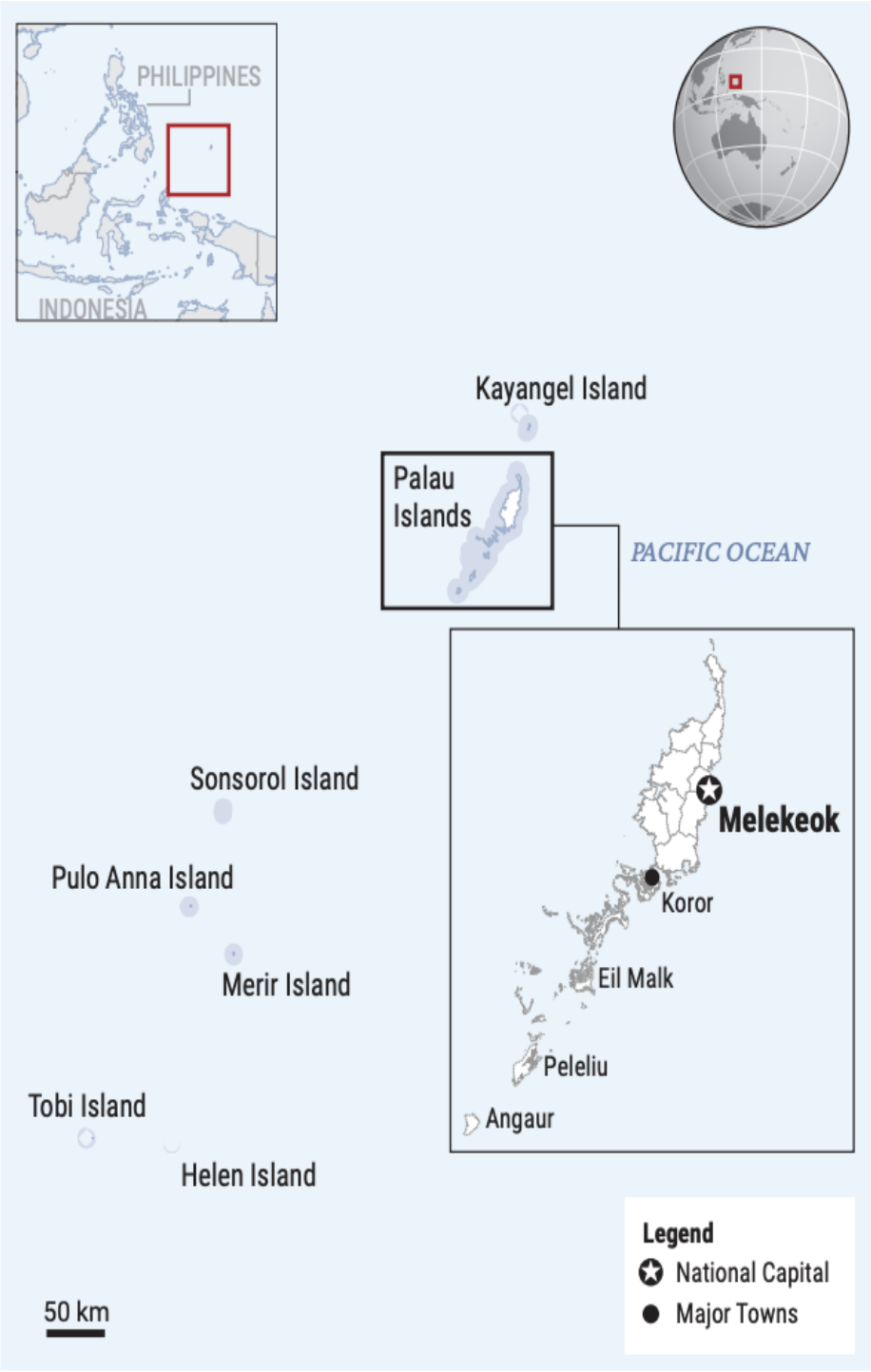
- **Strengthen Seabees permanent deployment:** U.S. Navy Seabees from the Naval Mobile Construction Battalion 5 are already permanently deployed in Pohnpei and Yap, providing workforce training and renovating public buildings and roads. The Yap detachment was re-established in 2020. Seabees have had a presence in the FSM since the late 1960's, and many Micronesians have personal connections to and fond memories of prior Seabee Civil Action Teams.[75] The recent return to Yap has been well received, and re-establishing more constant presences in Chuuk and Kosrae could tap into long-standing goodwill while advancing local infrastructure and workforce capacity.

- **Empower civil society,** such as professional local journalism that can enhance accountability and governance capacity. Such policies must, however, be mindful of the importance of deference in local culture and what impression it may leave on local leaders, whom China is currently feting.

[74] Recommended by the former Governor of Yap State, Henry Falan. *See: Falan, Henry. "The Return of the Peace Corps Experienced Professionals Wanted." Pacific Island Times, September 4, 2022. https://www.pacificislandtimes.com/post/the-return-of-the-peace-corps-experienced-professionals-wanted.*

[75] Garrigues, Brad. "Seabees Return to Yap - 50 Years of Good Will." Defense Visual Information Distribution Service, March 6, 2020. https://www.dvidshub.net/news/364691/seabees-return-yap-50-years-good-will.

REPUBLIC OF PALAU



COUNTRY OVERVIEW

Geography	Palau's territory consists of over 500 islands, divided into 16 states, across the Micronesia subregion. The islands together comprise 1,000 miles of coastline.
Population Distribution	Population: 21,779 people.[76] This population is primarily spread across two states, Koror and Airai. Population Density: 39 people/sq mi.[77]
Governance System	Palau's national government consists of an executive, legislative, and judiciary branch. The President is the head of state and government and serves an elected four-year term. The legislative branch is similarly elected for four-year terms. The Palau judiciary includes a Supreme Court, the Court of Common Pleas, and the Land Court. The U.S. is responsible for Palau's national defense. Each of Palau's 16 states has a separate constitution and traditional systems that govern state policy.[78]
Sources of Economic Revenue	Tourism constitutes an estimated 40 percent of Palau's GDP. Other contributors include fishing and subsistence agriculture.[79] As of 2021, the nation's gross national income per capita was over $13,000 USD.[80] Palau relies heavily on U.S. direct assistance provided by the COFA. Palau receives additional bilateral aid from countries with which it has diplomatic ties, such as Australia, Japan, and Taiwan. The nation also receives significant FDI flows from China, Taiwan and Singapore into its tourism and real estate industry.
Dietary Staples	The traditional dietary staples in Palau are fish, taro, cassava, sweet potato, yam, banana, papaya, coconut, betel nut, and breadfruit. In recent years, however, Palauan diets have increasingly shifted towards imported foods, which currently make up 80 to 85 percent of food consumption and are generally less healthy than locally produced foods.[81]

[76] "Palau." In *The World Factbook*. Central Intelligence Agency, April 24, 2024. https://www.cia.gov/the-world-factbook/countries/palau/#people-and-society.
[77] World Bank Open Data. "Population Density (People per Sq. Km of Land Area) - Palau," March 28, 2024. https://data.worldbank.org.
[78] Abiad, Hatem, Ganesh Navaratnam, and Kaustubh Kukde. "Palau - Disaster Management Reference Handbook." Center for Excellence in Disaster Management and Humanitarian Assistance (CFE-DM), January 2023. https://www.cfe-dmha.org/LinkClick.aspx?fileticket=GEzceMcF7Q8%3d&portalid=0.
[79] Ibid.
[80] "GNI per capita, Atlas method (current US$) - Palau." *World Bank Open Data*, https://data.worldbank.org/indicator/NY.GNP.PCAP.CD?locations=PW
[81] "Pathways to Sustainable Food Systems in Palau." Government of the Republic of Palau, September 2021. https://www.unfoodsystemshub.org/docs/unfoodsystemslibraries/national-pathways/palau/2021-09-17-en-palau-pathways-to-sustainable-food-systems.pdf?sfvrsn=19fbffe9_1.

The Republic of Palau's small size has historically limited economic diversification, and the Island's dispersion and geographical isolation expose Palau to external shocks.[82] The island nation relies heavily on tourism and external support. The country's tourism sector was severely impacted by the COVID-19 pandemic; however, the sector made a significant rebound in 2023, with the number of visitors increasing nearly threefold.[83] In response to the growth in tourism, Palau's construction sector is expected to rebound, supporting the growth of public infrastructure and contributing to the nation's economic growth. While Palau's economic forecast looks relatively strong in the coming years, the extensive development and adaptation needs continue to warrant external support.

CLIMATE-RELATED THREATS AND ASSOCIATED IMPACTS

Palau has already seen the impacts of climate change, with **severe typhoons, drought, sea level rise, and coastal flooding** continuing to heighten insecurity. Typhoons, sea level rise, and coastal flooding increase the frequency of overwash events that shut down electricity, sewage, food, and water access. **Droughts**, which have become more frequent and severe in recent years due to reduced rainfall and increased evaporation, amplify threats to agriculture, livelihoods, and public health.[84] (See Appendix 8 for additional information on the climate-related threats and associated impacts in Palau.)

ADAPTATION NEEDS

Natural Infrastructure Investment and Maintenance

Mangroves, seagrass beds, and coral reefs serve as natural infrastructure to reduce the effects of flooding, erosion, storm surges, and high winds, thereby protecting Palau's coastal communities. Furthermore, the natural wildlife habitats supported by these ecosystems are a main attraction for the tourism sector, which sustains Palau's economy. These ecosystems are under stress due to climate change and the human impacts of construction, which diminishes the protective natural infrastructure by depositing sedimentation that inhibits their growth. The degradation of Palau's coastal environment threatens both communities relying on the country's coastlines and the

[82] IMF. "Republic of Palau: 2023 Article IV Consultation-Press Release; Staff Report; and Statement by the Executive Director for Republic of Palau," December 21, 2023. https://www.imf.org/en/Publications/CR/Issues/2023/12/21/Republic-of-Palau-2023-Article-IV-Consultation-Press-Release-Staff-Report-and-Statement-by-542638.

[83] Asian Development Bank. "Palau Growth Outlook Up As Tourism Climbs — ADB." Text, April 18, 2024. Marshall Islands, Micronesia, Federated States of, Palau. https://www.adb.org/news/palau-growth-outlook-tourism-climbs-adb.

[84] For a more in-depth exploration of the climate-related risks and threats that Palau faces, see the Appendix.

surrounding waters for food and their tourism-based economy. The restoration and protection of existing natural infrastructure thus serves as a core natural adaptation priority for Palau.[85]

Improved Water Storage Capacity, Filtration, and Sewage Infrastructure

Roughly three-quarters of households in Koror and Arai, Palau's two most populous states, receive water from the Ngerimel Dam. The remaining population relies on groundwater sources and rainfall for their water supply. Regardless of access to piped or treated water, the vast majority of households rely on rain catchment systems for some amount of their household water supply.[86]

According to a water security expert with the Asia Pacific Center on Security Studies, droughts in the region are getting longer and more severe with each occurrence, making at-home filtration options increasingly important for the households that rely on rain and groundwater resources– even as these resources are becoming increasingly scarce.[87] Recently, the government of Palau released an "Extreme and Exceptional Drought Warning" in April 2024, demonstrating heightened water insecurity across the islands.

Moreover, Palau's sewage network, which is already in a state of disrepair, experiences overflow at low-lying pump stations as a result of groundwater infiltration. Overflow can lead to sewage leakage into the surrounding environment and cause health risks for residents. Pumps susceptible to infiltration therefore need to be rehabilitated or replaced to minimize the risk of overflow. Palau's outlying islands are especially vulnerable to weak sewage systems, having not received any capital investment or substantial maintenance since 2010.[88]

Physical Infrastructure Investment and Relocation

A significant proportion of Palau's population and infrastructure are located in low-lying coastal areas vulnerable to flooding and sea-level rise. Key infrastructure, including transportation facilities (roads, airports, and seaports), hospitals, and schools, have already experienced damage from coastal flooding. Palau's Public Infrastructure and Industry Ministry highlights the need for investment in climate-proofing health facilities, and relocating the nation's largest hospital to a new facility with limited exposure to climate threats.[89] Similarly, Palau's Ministry of Education has indicated the need to relocate isolated, low-lying schools to clustered campuses on higher

[85] Miles, Wendy, Zena Grecni, Erbai Xavier Matsutaro, Patrick Colin, Victoria Keener, and Yimnang Golbuu. "Climate Change in Palau: Indicators and Considerations for Key Sectors." East-West Center, October 27, 2020. https://www.eastwestcenter.org/publications/climate-change-in-palau-indicators-and-considerations-key-sectors.

[86] Abiad, Hatem, Ganesh Navaratnam, and Kaustubh Kukde. "Palau - Disaster Management Reference Handbook." Center for Excellence in Disaster Management and Humanitarian Assistance (CFE-DM), January 2023. https://www.cfe-dmha.org/LinkClick.aspx?fileticket=GEzceMcF7Q8%3d&portalid=0.

[87] Allen, Ethan. SIPA Capstone Team Interview, March 13, 2024.

[88] "Sector Assessment (Summary): Multisector." Palau Public Utilities Corporation Reform Program. Asian Development Bank, November 2020. https://www.adb.org/projects/documents/pal-54151-001-rrp.

[89] Palau Ministry of Finance. "Palau National Infrastructure Investment Plan 2021-2030." Pacific Region Infrastructure Facility, September 2021. https://www.theprif.org/sites/default/files/documents/PRIF_PalauNIIP-2021_Web_0.pdf.

ground.[90] Sections of the Babeldaob loop, Palau's largest road, traverse low-lying lagoons that could be subject to flooding and damage from sea-level rise. These areas of the loop will need to be "climate-proofed" to ensure the continued operation of the road. Improvements to the road could include refurbished road drainage systems and elevating low-lying segments above sea level.[91]

Palau, which is highly dependent on imported fossil fuels for energy, is vulnerable to the price volatility and supply shocks associated with oil markets. The steep price of fuel imports, which is only likely to increase amid climate change, subjects Palau to financial precarity that impedes the country's ability to focus on climate adaptation goals. Additionally, **aging infrastructure across generation, distribution, and transmission makes it difficult for the Palau Public Utilities Commission (PPUC) to manage its electricity market efficiently. In 2019, the PPUC was unable to meet total energy demand and was forced to ration power, which caused severe economic disruptions.[92]**

To create energy security across fossil fuel imports and the current domestic supply, Palau's National Energy Plan aims to expand the share of renewable energy to 45 percent of total electricity generation by 2025.[93] This goal will reduce diesel imports, which currently account for 95 percent of energy generation, and fortify domestic energy generation. In 2023, Palau launched two solar plus storage energy projects to meet their renewable energy goals; however, these projects will only meet 25 percent of the nation's energy demand, leaving ample room for improvements in renewable energy security.[94] Furthermore, the dispersed nature of Palau's geography means that outlying islands are unable to access clean energy from these solar plus storage projects, hence rural areas will continue to rely on expensive and pollutive diesel imports until new renewable energy projects are deployed.

Agriculture, Food Security, Research and Development

With more than 80 percent of food imported, Palau is especially vulnerable to shocks in the global food supply, which are exacerbated by climate change. Price spikes in imported foods can have

[90] "Palau Development Plan 2023-2026." Government of Palau, November 17, 2022. https://www.palaugov.pw/wp-content/uploads/Palau-Development-Plan-PDP-2023-2026.pdf.
[91] Ibid.
[92] "Sector Assessment (Summary): Multisector." Palau Public Utilities Corporation Reform Program. Asian Development Bank, November 2020. https://www.adb.org/projects/documents/pal-54151-001-rrp.
[93] Ibid.
[94] Colthorpe, Andy. "Western Pacific's Biggest Solar-plus-Storage Project Inaugurated in Palau." Energy-Storage.News, June 22, 2023. https://www.energy-storage.news/western-pacifics-biggest-solar-plus-storage-project-inaugurated-in-palau/.

ripple effects through the country's economy. Furthermore, the low-nutritional value associated with imported foods presents a key health concern.[95]

Research into farming methods is necessary to improve food security in Palau. As the likelihood of saltwater intrusion into taro fields rises, research and development of salt-resistant strains of crops, such as taro, would mitigate saltwater dangers to local food products. Other examples of research into cultivated wetland crops have demonstrated erosion control, soil health improvements, and sediment pollution mitigation across the coastline and nearshore coral reefs.[96]

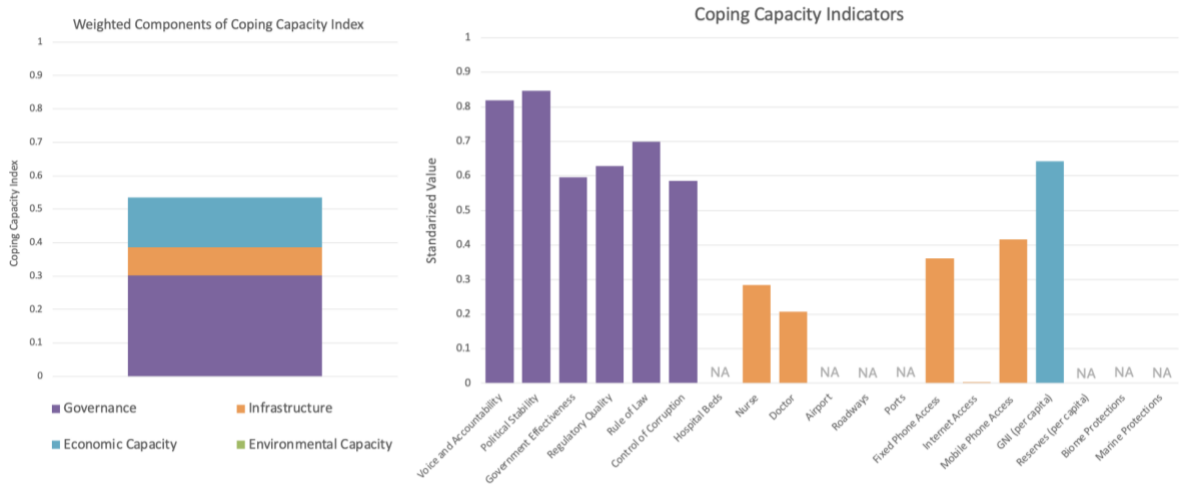
Research and development can also help to prevent maladaptation. For example, in Palau, seawalls are built with the intention of reducing erosion but often unintentionally re-distribute waves and thus erosion down the coastline, resulting in beach loss down-shore.[97] These maladaptive land-use decisions can be mitigated with more research and development focus and funding.

CAPACITY CONSTRAINTS

What are the underlying impediments to investing in, implementing, and scaling sustainable adaptation efforts in Palau? What capital constraints can be identified?

Quantitative Analysis: Data Findings

Figure 10: Coping Capacity Breakdown in Palau



[95] Miles, Wendy, Zena Grecni, Erbai Xavier Matsutaro, Patrick Colin, Victoria Keener, and Yimnang Golbuu. "Climate Change in Palau: Indicators and Considerations for Key Sectors." East-West Center, October 27, 2020. https://www.eastwestcenter.org/publications/climate-change-in-palau-indicators-and-considerations-key-sectors.

[96] Koshiba, Shirley, Meked Besebes, Kiblas Soaladaob, Madelsar Ngiraingas, Adelle Lukes Isechal, Steven Victor, and Yimnang Golbuu. "2000 Years of Sustainable Use of Watersheds and Coral Reefs in Pacific Islands: A Review for Palau." *Estuarine Coastal and Shelf Science* 144 (May 1, 2014): 19–26. https://doi.org/10.1016/j.ecss.2014.02.006.

[97] Ibid.

Interpretation: The height of the figure on the left represents Palau's Coping Capacity Index value (0.54), and the color-coded components reflect the contribution of each subindex (Governance, Infrastructure, Economic Capacity, and Environmental Capacity) to the overall Coping Capacity value, where the height of each component corresponds to the sub-index value. The figure on the right presents the standardized values for the indicators included in each of the four sub-indices, and are color-coded as such.

The above figure displays the contributions of each indicator to the overall Coping Capacity Index for Palau. Indicators relating to governance (in purple) are relatively high across the board. Environmental capacity data was unavailable for the country.

Economic capacity (in blue) appears to be a relative strength, with a high *gross national income (GNI) per capita* indicator. As of 2021, Palau had a per capita income of $13,000 USD, placing it in the top third of all countries worldwide and making it the highest earner among the three COFA countries. Data on Palau's reserves were unavailable; however, the country's domestic funding remains somewhat limited, made clear by the fact that Palau relies heavily on external funding for development and the provision of public services. In 2019 for example, over a quarter of Palau's government spending was funded through U.S. assistance.[98] Hence, despite the relatively high *GNI per capita* in the country, Palau's financial capital remains constrained.

Weak infrastructure is the greatest threat to Palau's coping capacity, as reflected by low infrastructure indicators (in orange). The health infrastructure inputs, namely the *number of doctors and nurses (per capita)*, is a clear weakness for the country. Internet infrastructure is similarly lacking, with an incredibly low indicator value for *internet service*. To a lesser degree, *mobile phone and fixed phone access are* also lacking. A weak communications infrastructure contributes to a lower standard of living, impedes emergency management efforts, and limits the country's attractiveness to tourists and foreign investors.

Qualitative Analysis of Capacity Constraints: Five Forms of Capital

Human Capital

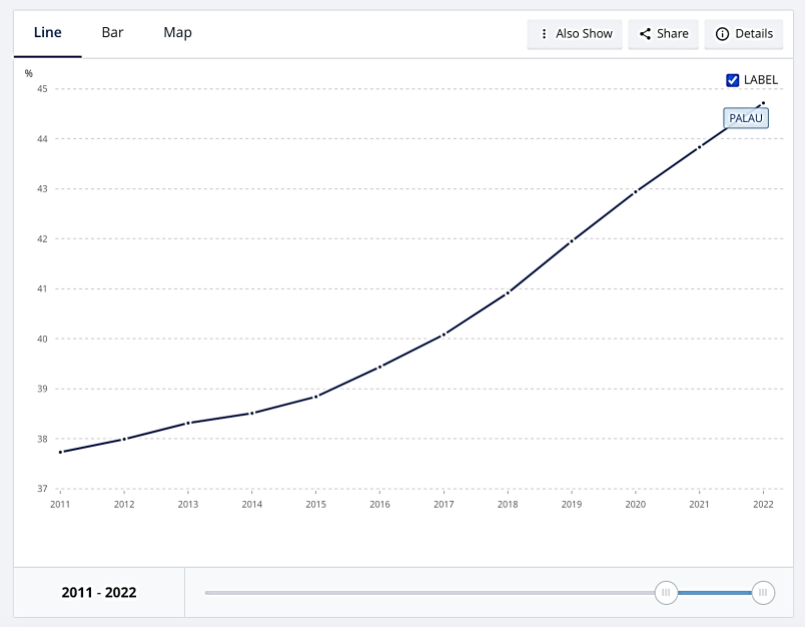
Palau is facing significant challenges related to intellectual and human capital shortages. Since 1994, nearly half of Palau's population has emigrated.[99] Over time, the outward migration of working-age adults has increased the age dependency ratio, as can be seen in Figure 11. The reduction in the available workforce has resulted in chronic labor shortages, inhibiting the implementation of infrastructure projects that require contractor support. Additionally, a greater

[98] "2022 Investment Climate Statements: Palau." United States Department of State, https://www.state.gov/reports/2022-investment-climate-statements/palau/.

[99] Kesolei, Ongerung Kambes. "29 Years of Independence: Palau at a Crossroads." Pacific Island Times, September 30, 2023. https://www.pacificislandtimes.com/post/29-years-of-independence-palau-at-a-crossroads.

portion of government funds will need to be allocated to social services to support non-working residents such as children and elderly dependents, placing a budgetary constraint on climate adaptation initiatives.

Figure 11: The age dependency ratio in Palau has skyrocketed since 2011, indicating an insufficient number of people in the workforce who can support the dependent, aging population.

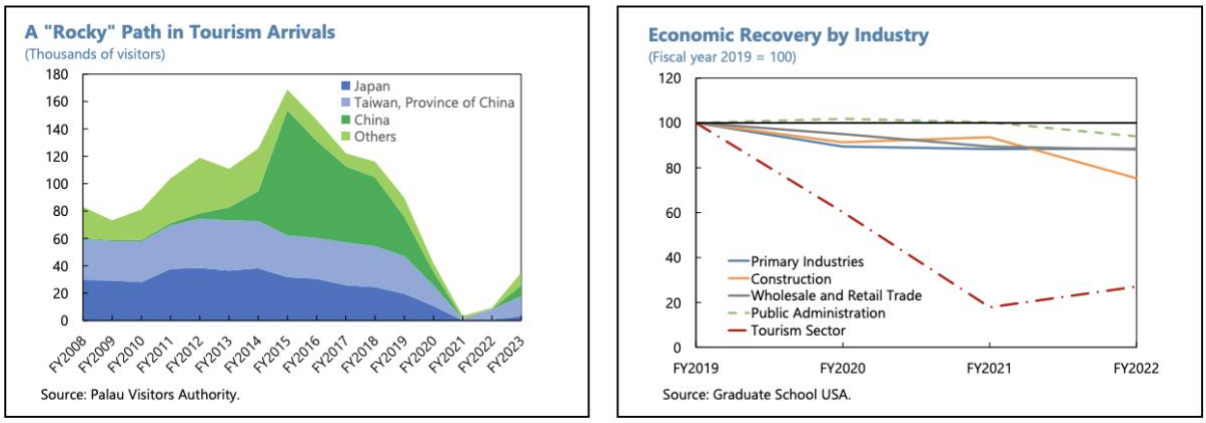


Source: World Bank Open Data. "Age Dependency Ratio (% of Working-Age Population) - Palau," March 28, 2024. https://data.worldbank.org.

COVID-19's impacts only amplified Palau's outward migration pressures by limiting tourism and thus employment opportunities, as well as by increasing the cost of imported food and fuel. **If lackluster economic growth continues, Palau's outbound migration rates will only exacerbate skilled labor shortages.** Palau's 2020 National Master Development Plan highlights the need for more technical expertise with regard to land-use planning and the construction of upland housing divisions.[100] Technical expertise and more skilled labor would be helpful in meeting the adaptation needs identified towards research and development, particularly in avoiding maladaptation pitfalls such as ineffective and dangerous seawalls.

[100] Palau Environment Data Portal. "Palau National Master Development Plan," June 24, 2021. https://palau-data.sprep.org/resource/palau-national-master-development-strategy-2020-executive-summary.

Figure 12: Palau's tourism industry has rapidly declined since the onset of the global pandemic.



Source: IMF. "Republic of Palau: 2023 Article IV Consultation-Press Release; Staff Report; and Statement by the Executive Director for Republic of Palau," December 21, 2023. https://www.imf.org/en/Publications/CR/Issues/2023/12/21/Republic-of-Palau-2023-Article-IV-Consultation-Press-Release-Staff-Report-and-Statement-by-542638, p. 9.

Palau also requires intellectual capital in the form of healthcare and educational expertise. Belau National Hospital is Palau's only hospital; two additional Community Health Centers and three private medical clinics constitute the entirety of the medical infrastructure across the islands.

Palau's limited human/intellectual capital is reflected in rates of hospital staffing, with only **6.5 nurses and 1.8 doctors per 1,000 people** (World Bank).

The lack of healthcare access, coupled with a high proportion of vulnerable residents (the elderly and children) and the rising threat of vector-borne diseases, imperils population security. The limited capacity of Palau's healthcare system could prove to be a factor influencing families' decisions to migrate out of the country, further exacerbating labor shortages.

Financial Capital

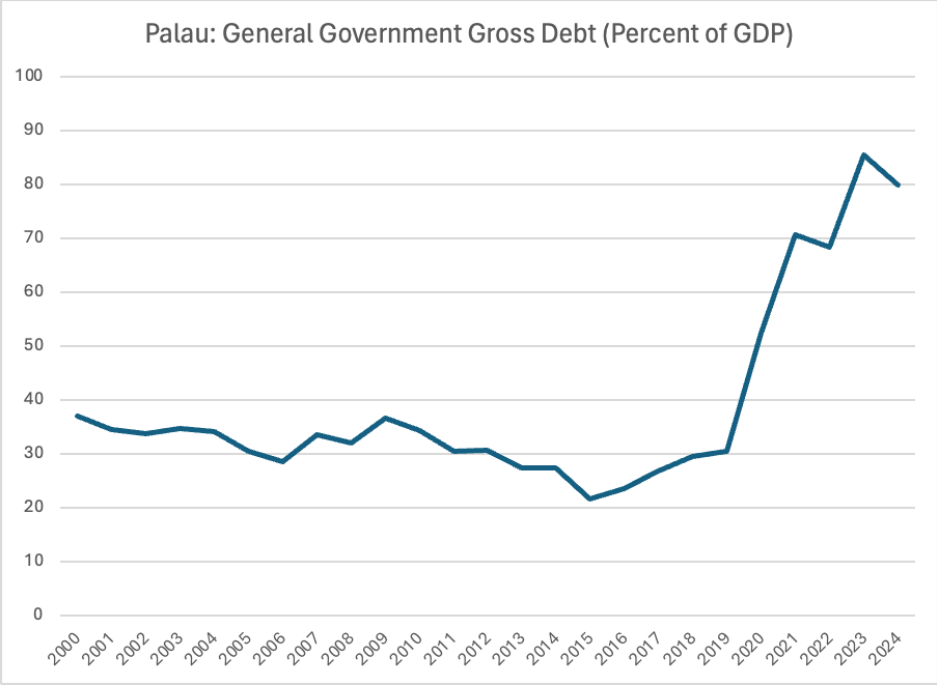
Palau, like many Pacific Island nations, has limited financial capital due to its small population, geographic isolation, and minimal resource base. Furthermore, Palau's dependence on tourism continues to expose it to a precarious financial future. The rising cost of long-distance travel could erode the nation's tourist economy.[101] Additionally, Palau has experienced immense growth in public debt, with debt levels reaching 80 percent of GDP in 2024.[102] The nation's economic

[101] Abiad, Hatem, Ganesh Navaratnam, and Kaustubh Kukde. "Palau - Disaster Management Reference Handbook." Center for Excellence in Disaster Management and Humanitarian Assistance (CFE-DM), January 2023. https://www.cfe-dmha.org/LinkClick.aspx?fileticket=GEzceMcF7Q8%3d&portalid=0.

[102] IMF. "Republic of Palau: 2023 Article IV Consultation-Press Release; Staff Report; and Statement by the Executive Director for Republic of Palau," December 21, 2023.

vulnerability is further exacerbated by their large trade imbalance; most notably, Palau's reliance on imported oil and gas subjects the nation to price volatility from global market disruptions.

Figure 13: Palau's public debt has increased by about 167% since 2018.



Source IMF: "Palau IMF DataMapper" World Economic Outlook, April 2024
https://www.imf.org/external/datamapper/profile/PLW

Furthermore, it is likely that Palau's climate adaptation needs – including ecosystem rehabilitation, infrastructure retrofits and relocations, and improved water filtration – will far exceed the nation's fiscal capacity**. In 2015, it was estimated that Palau would require $500 million USD to meet climate change-related adoption costs, roughly double the nation's 2022 GDP.[103] The widening gap between Palau's financial capacity and adaptation needs presents an ongoing challenge to the nation, exacerbated by the precarious nature of the country's tourism-based economy.** It is likely that Palau will need to rely on foreign assistance and investment to achieve its climate adaptation goals. Increased dependence on foreign aid poses additional challenges that Palau will need to address. These challenges include insufficient administrative capacity to satisfy reporting requirements, plan long-term projects, and disperse funds equitably and efficiently, which can impede the country's ability to successfully implement adaptation programs.

https://www.imf.org/en/Publications/CR/Issues/2023/12/21/Republic-of-Palau-2023-Article-IV-Consultation-Press-Release-Staff-Report-and-Statement-by-542638.

[103] Ibid.

Physical Capital

Infrastructure: Palau's coastal environment complicates the upkeep and maintenance of physical infrastructure, from water storage tanks that are at risk of damage from windstorms, to water distribution systems at risk of contamination from flooding, to transformers and switchgear subject to corrosive ocean spray. According to Palau's 2021 National Infrastructure Investment Plan (PNIIP), which is prepared by Palau's Ministry of Finance and outlines the country's priorities and plans for infrastructure development, the likelihood of damage from natural disasters across water, energy, and building infrastructure is overall high.

According to the 2021 PNIIP, every pump at the Airai water filtration plant, which supplies freshwater resources to 75 percent of the population, is in need of general repair or maintenance.[104] [105] This single water source becomes particularly vulnerable to shortages during periods of low rainfall, increasing the likelihood of drought even as Palau experiences the most precipitation of any nation in the world.[106] The PNIIP reports even more maintenance and upkeep requirements for water pumping stations on more rural islands. Meanwhile, riverine reservoirs and coastal aquifers–two potential relief systems–are increasingly stressed due to saltwater intrusion and over-extraction.

Transportation**:** Roads across Palau vary dramatically in terms of condition and safety. The main roads across Koror are generally well-maintained.[107] On the outer, rural islands, most roads are not sealed or paved and are in poor condition. During the rainy season, driving can be very hazardous, and the PNIIP reports that roads are highly vulnerable to damage during flooding.[108]

Renewable Energy: Babeldoab, the largest island in Palau, is building a solar plus storage farm that represents the first and largest power plant of its kind in the Western Pacific. This grid-scale generator meets 20 percent of island energy demand, creates long-term price security for Palau residents, and galvanizes employment through operations and maintenance (O&M) contracting but requires skilled labor for upkeep.[109] This energy project also requires large up-front capital expenditure to construct. Future projects may face similar up-front financing constraints and delay the launch of expensive energy projects. Additionally, the construction of renewable energy

[104] Palau Ministry of Finance. "Palau National Infrastructure Investment Plan 2021-2030." Pacific Region Infrastructure Facility, September 2021. https://www.theprif.org/sites/default/files/documents/PRIF_PalauNIIP-2021_Web_0.pdf.

[105] "Republic of Palau Water Treatment Plants – Preliminary Assessment." U.S. Department of the Interior, Bureau of Reclamation, Office of Insular Affairs, July 2020. https://www.doi.gov/sites/doi.gov/files/uploads/oia-palauwatertreatmentplants-preliminaryassessment-july2020.pdf.

[106] Encyclopedia Britannica. "Climate of Palau." Accessed April 28, 2024. https://www.britannica.com/place/Palau/Climate.

[107] Ibid, p. 81.

[108] Ibid, p. 81.

[109] Colthorpe, Andy. "Western Pacific's Biggest Solar-plus-Storage Project Inaugurated in Palau." Energy-Storage.News, June 22, 2023. https://www.energy-storage.news/western-pacifics-biggest-solar-plus-storage-project-inaugurated-in-palau/.

projects requires complex supply chains and the transportation of materials across large distances, including solar photo-voltaic panels from China, inverters, and battery storage components. These supply chains complicate the timeline for implementing energy and infrastructure development projects.

Disaster Management Infrastructure and Telecommunications: Palau needs to improve its telecommunications infrastructure to communicate effectively in the event of a natural disaster. Palau's only mobile phone carrier –Palau National Communications Corporation (PNCC) – offers phone subscriptions through pre-paid and post-paid sim card subscriptions. Given the high cost of service in Palau, the pre-paid subscriptions are often not renewed until more money is available throughout the month. Additionally, at present, their mobile phone access is concentrated across their main islands of Koror-Airai and Babeldoab with limited 3G or 2G connectivity in the outer islands.[110] In 2023, PNCC partnered with Lynk Global to create the world's first satellite-to-cell service, improving communications capabilities in remote regions that previously lacked a stable telecom infrastructure. However, this service still only provides mobile phone access for the times of day that satellites are positioned over Palau, providing text messaging services for a few minutes each day throughout the archipelago.[111]

Political Capital

Despite Palau's relatively strong political and judicial system, the country lacks a cohesive policy framework for addressing the nation's adaptation needs. Furthermore, the identified needs for adaptation far exceed immediately available funding, and hence careful planning is necessary to address the growing climate threats. In its 2020 National Infrastructure Investment Plan (a component of the National Development Plan), the government identified outdated and cumbersome regulatory frameworks, conflicting mandates, insufficient funding for evaluation, review, and monitoring activities, as well tensions between state and national governments with regards to land and resources management as key impediments to the government's ability to address environmental concerns.[112]

Natural Capital

Coral reefs are the lifeblood of archipelago island chains such as Palau, where the reefs weaken wave energy from thrashing storms, provide abundant fish for food, and opportunities for economic development through tourism or fishing. Despite their strong resilience compared to

[110] Jewett, Rachel. "Lynk Starts Initial Satellite-to-Cell Service in Palau With Local MNO." Via Satellite, June 23, 2023. https://www.satellitetoday.com/connectivity/2023/06/23/lynk-starts-initial-satellite-to-cell-service-in-palau-with-local-mno/.

[111] Ibid.

[112] Palau Ministry of Finance. "Palau National Infrastructure Investment Plan 2021-2030." Pacific Region Infrastructure Facility, September 2021. https://www.theprif.org/sites/default/files/documents/PRIF_PalauNIIP-2021_Web_0.pdf.

other reefs around the world, Palau is expected to see widespread coral bleaching by 2040 due to global ocean acidification and stronger storm damage.[113]

In 2015, Palau made significant strides towards protecting marine ecosystems through the establishment of the Palau National Marine Sanctuary, which prohibited fishing in roughly 80 percent of the country's Exclusive Economic Zone (EEZ). While this policy made Palau a global leader in ocean protections, the country is currently considering shrinking the sanctuary and reintroducing industrial fishing. Shrinking the marine sanctuary is a contentious topic in Palau. With sufficient regulations and policies to support sustainable fishing practices, the nation may be able to open parts of the sanctuary to raise fishing revenues, while minimizing environmental harm. That being said, maintaining the sanctuary has benefits for the country's ecotourism industry; as a result, the tradeoff associated with redrawing the sanctuary boundaries remains unclear.[114]

As another consideration, Palau's already strained freshwater resources are under persistent threat due to climate change. Sea level rise and over wash events create saltwater intrusion into coastal aquifers. Furthermore, rising temperatures result in water loss from the country's soil through both evaporation from the soil surface and transpiration from the leaves of plants growing in the soil, known as evapotranspiration, which negatively impacts Palau's groundwater supply. These issues play into the physical capital constraints around current water storage and sewage infrastructure.

WHAT HAS BEEN TRIED BEFORE?

Key Climate Adaptation Projects (2014-2024)

The majority of external funding for Palau is provided by the U.S. through the COFA. Recent amendments to the Compact will shore up $889 million USD for Palau, to be dispersed over the span of 20 years (2023-2043). The assistance will provide funding for public service delivery, including healthcare and education, and help improve public infrastructure, including transportation, communications, and sewage infrastructure. In addition to this robust funding package, Palau also receives loans and assistance from several other governments and multilaterals. Some of the largest externally financed projects in Palau of the last decade are presented in the table below.

[113] Miles, Wendy, Zena Grecni, Erbai Xavier Matsutaro, Patrick Colin, Victoria Keener, and Yimnang Golbuu. "Climate Change in Palau: Indicators and Considerations for Key Sectors." East-West Center, October 27, 2020. https://www.eastwestcenter.org/publications/climate-change-in-palau-indicators-and-considerations-key-sectors.
[114] Woody, Todd. "The US Environmental Group Behind Palau's Plan to Shrink Its Massive Marine Sanctuary." Bloomberg, January 18, 2024. https://www.bloomberg.com/news/features/2024-01-18/the-environmental-ngo-behind-palau-s-plan-to-shrink-its-ocean-reserve.

Project Title and Donor	Category	Objective	Timeline and Status (Ongoing/ Completed)	Lifetime Budget (USD)
North Pacific Regional Connectivity Investment Project (The Asian Development Bank)	Communications Infrastructure	Bolster access to affordable ICT infrastructure	2014-2016	$22.5 million
Koror-Airai Water Supply System Improvement Project (The Japanese Government)	Water Storage and Supply	Construct a new 250,000 gallon water tank, and improve water transmission and distribution infrastructure.	2016-2018	$17 million
Koror-Airai Sanitation Project (The Asian Development Bank)	Sanitation	Improve delivery of sanitation services by upgrading sewage pump infrastructure.	2019 - Present	$30 million
Disaster Resilience Program (The Asian Development Bank)	Disaster preparedness	Strengthen disaster risk management policies and infrastructure.	2018-2020	$15 million
Palau Disaster Preparedness and Improved Infrastructure (United Nations Development Programme)	Disaster preparedness	Develop early warning systems, improve radio broadcasting, improve access to evacuation and educational facilities	2019-2023	$7.5 million
Ecosystem-based Adaptation for Reducing Community Vulnerability to Climate Change in Northern Pacific Small Island Developing States (Green Climate Fund)	Environment and Conservation	Establish small-grant facilities to finance and scale conservation and ecosystem-based adaptation	2023 - Present	$9.9 million
Enhancing Climate Information and Knowledge Services for resilience in 5 island countries of the Pacific Ocean (Green Climate Fund)	Governance and Awareness	Promote use of climate information in decision making, strengthen awareness, adaptive capacity.	2021-2026	$49.9 million

POLICY RECOMMENDATIONS

Analysis: *Assessing Priority Areas of Need*

The government of Palau is well aware of the existential threat of climate change facing their island country, and they are taking active measures to meet the challenge by investing in adaptive resilience. Given their unique capital constraints, particularly their lack of skilled labor and human capital, in meeting their climate adaptation challenges, we recommend prioritizing their preparation and response for climate change across these three buckets of policy priorities.

Workforce Development and Training

- **Invest** in human capital development by expanding trade school pathways for high school students, and building educational programs in technical skills.

- **Create** new jobs by passing resilient infrastructure building code improvements (hurricane retrofits for high winds, raising roads, homes for sea-level rise, etc.), creating demand for contractors.
- **Scale** contractor capacity by investing in reskilling programs (i.e., initiatives to develop new skills to transition into emerging industries) and incentivizing workers from different industries to enroll.[115]
- **Target** employment opportunities within the Public Utilities Commission, Climate Change Office, and Planning and Permitting groups to improve planning, prioritization, and implementation of climate adaptation strategies
- **Advance research and development** for crop resilience, natural infrastructure conservation, and other actionable opportunities to protect natural capital.

Infrastructure (Natural and Physical)

- **Protect** coral reefs and mangrove infrastructure to buttress short-term resilience to storms and coastal flooding and create the capacity for longer-term disaster planning and management.
- **Install** rooftop solar and at-home, behind-the-meter battery storage to support local electricity demand, particularly in post-disaster scenarios where additional battery storage could provide essential backup power.
- **Increase** renewable energy capacity to reduce vulnerability to economic shocks from volatile energy markets. Enhance energy security by strengthening long-term investment planning and building financial security.

Partnerships

- **Collaborate** with private entities to address public communications issues such as the Lynk Global Satellite-to-Cell program that builds connectivity across remote islands within Palau and is essential in case of disaster.
- **Facilitate** the distribution of at-home life-saving disaster management tools such as water filtration tablets in the event of drought or physical infrastructure deterioration. Scalable and inexpensive filtration options include MadiDrops, Life Straws, and FoliaWater Filters that can provide clean water for families during periodic bouts of water insecurity.

[115] "Palau Development Plan 2023-2026." Government of Palau, November 17, 2022. https://www.palaugov.pw/wp-content/uploads/Palau-Development-Plan-PDP-2023-2026.pdf.

THE REPUBLIC OF THE MARSHALL ISLANDS (RMI)

COUNTRY OVERVIEW

Population and Population Density	- Total population is under 50,000 with a density of approximately 603.5 persons per square mile. - Around 70 percent reside in Majuro, the capital, and Ebeye. - Ebeye, on Kwajalein Atoll, is extremely dense, housing 15,000 people in just 0.36 square kilometers as of 2016. - The remainder of the population lives in sparsely populated traditional villages on the outer islands.[116] - Marshallese also still grapple with the aftermath of mid-20th century nuclear testing on the islands.
Geography	RMI comprises 29 atolls (24 inhabited) and five islands just north of the equator.
Governance System	RMI is a mixed parliamentary-presidential republic in which the president is both the head of state and government. The parliament, Nitijela, is unicameral; it consists of 33 members (senators), all of whom sit for four-year terms. Of the senators, 19 are directly elected in single-member districts, and 14 are elected from five multi-member districts (two to five seats each). The president is elected by the legislature from among sitting Nitijela members, and the presidential term also runs for four years. The president nominates fellow lawmakers to serve as cabinet ministers, and they are formally appointed by the Nitijela speaker.[117] In other words, the President can only choose from the other 32 elected Nitijela for leadership roles.
Sources of Economic Revenue	The public sector (national and local governments, state enterprises, and the national development bank) is the country's largest employer (53 percent of the labor force). The private sector accounts for approximately 32 percent of employment, and U.S. Army Garrison – Kwajalein Atoll (USAG-KA) – accounts for another nine percent.[118]
Dietary Staples	Approximately 90 percent of food is imported, processed and packaged.[119] Traditional local foods include breadfruit, papaya, pandanus, banana, coconut, taro, and arrowroot, skipjack tuna.

[116] Abiad, Hatem, Mara Langevin, Tiare Eastmond, and Andrea Cecchi. "Republic of the Marshall Islands - Disaster Management Reference Handbook." Center for Excellence in Disaster Management and Humanitarian Assistance (CFE-DM), December 2022. https://www.cfe-dmha.org/LinkClick.aspx?fileticket=GEzceMcF7Q8%3d&portalid=0.
[117] Abiad, Hatem, Mara Langevin, Tiare Eastmond, and Andrea Cecchi. "Republic of the Marshall Islands - Disaster Management Reference Handbook." Center for Excellence in Disaster Management and Humanitarian Assistance (CFE-DM), December 2022. https://www.cfe-dmha.org/LinkClick.aspx?fileticket=GEzceMcF7Q8%3d&portalid=0.
[118] PITI-VITI. "RMI FY22 Economic Statistics (Preliminary)," December 7, 2023. https://pitiviti.org/marshall-islands.
[119] Rasmussen, Eric, Gregg Nakano, Senator Kitlang Kabua, and Alex Hatoum. "Climate-Focused Field Research within the Kwajalein Atoll Sustainability Laboratory." In *2022 IEEE Global Humanitarian Technology Conference (GHTC)*, 465–68, 2022. https://doi.org/10.1109/GHTC55712.2022.9911040.

Figure 14: RMI risks becoming the first nation in the world lost to climate change. Ninety-nine percent of RMI's population lives in coastal areas, placing them in immediate danger of sea-level rise and coastal flooding. [120]

Source: RMI National Adaptation Plan

In 2023, RMI assembled a comprehensive, 200-page National Adaptation Plan, for which it interviewed three percent of its population (1,362 people). This plan details strategies for infrastructure adaptation as well as approaches to mitigating outward migration. By as early as 2040, RMI will decide which atolls and islands can be saved and how to consolidate islands by rebuilding Majuro and Ebeye at their designated new locations.[121] By as early as 2070, RMI plans to weigh permanent relocation due to projections of a half-meter rise in the sea level. Of the Marshallese surveyed, however, 99 percent reject plans to migrate away from their home islands.[122]

CLIMATE-RELATED THREATS AND ASSOCIATED IMPACTS

RMI has already seen the impacts of climate change, with primary climate threats including **sea level rise, coastal flooding**, **drought, and rising ocean temperatures**. The average elevation in RMI is two meters above sea level. If sea levels rise by one meter, up to 40 percent of infrastructure on the capital island of Majuro could be submerged.[123] Coastal flooding damages aquifers,

[120] "PREP II (RMI) - Annual Performance Report." Green Climate Fund, February 28, 2021. https://www.greenclimate.fund/sites/default/files/document/fp066-annual-performance-report-cy2020-disclosable.pdf.

[121] "National Adaptation Plan: Responding to the Impact of Climate Change." World Bank PREP II Project, October 20, 2023. https://rmigov.com/RMI-NAP-2023.pdf.

[122] Magazine, Hakai. "The Marshall Islands Aren't Giving In to Sea Level Rise." Hakai Magazine. Accessed April 28, 2024. https://hakaimagazine.com/news/the-marshall-islands-arent-giving-in-to-sea-level-rise/.

[123] ReliefWeb. "Sea Level Rise Threatens The Existence Of The Marshall Islands," July 11, 2023. https://reliefweb.int/report/marshall-islands/sea-level-rise-threatens-existence-marshall-islands

contaminates the groundwater fresh lens, and renders limited freshwater non-potable, increasing the risk of waterborne illnesses. Droughts in RMI have directly impacted the nearly 80 percent of Marshallese who depend on rainfall for their water supply. Rising ocean temperatures impact tuna school movements, which affect fishermen's yields in the RMI. Extreme heat and drought have forced the Marshallese to turn to unhealthy food alternatives, prevented exercise and farming, and increased rates of obesity. (See Appendix 8 for additional information on the climate-related threats and associated impacts in RMI.)

ADAPTATION NEEDS

Adaptive Resilience

As the reality of the climate crisis in RMI looms, the Marshallese must be prepared for life as environmentally displaced persons. A difficult transition is imminent. The Marshallese government and international community must prioritize efforts to ensure the transition is least traumatic as possible for the Marshallese.

"For too long, adaptations and investments have focused on infrastructure and neglected the human element." - Environmental Security Expert

English is a mandatory subject in the RMI national curriculum, taught from kindergarten through the 12th grade and gradually introduced as a language of instruction for STEM courses beginning in the 7th grade. However, English proficiency, as measured by annual national learning assessment exams, remains low. In 2019, the College of the Marshall Islands required that 83 percent of incoming students take additional developmental English coursework before enrollment.[124] Outer-island students lack educational access and score lower than their peers on the main island. Secondary education is only offered on a few islands, so outer-island students must relocate to continue their education at increased transportation and accommodation expense to their families, often living in precarious conditions not conducive to studying.[125]

Indigenous and environmentally displaced persons face unique mental health challenges stemming from loss of homeland, pride, culture, and identity. Many Marshallese turn to substances like betel nut, drugs, and alcohol, contributing to the area's high suicide rates, although data on these rates is frequently unavailable.[126] There is a pressing need for enhanced mental health services and counseling in the Marshall Islands.[127]

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124 "Project Information Document - RMI Education and Skills Strengthening Project." World Bank, March 24, 2020. https://documents1.worldbank.org/curated/en/687221585114558147/pdf/Concept-Project-Information-Document-PID-RMI-Education-and-Skills-Strengthening-Project-P171924.pdf.

125 Ibid.

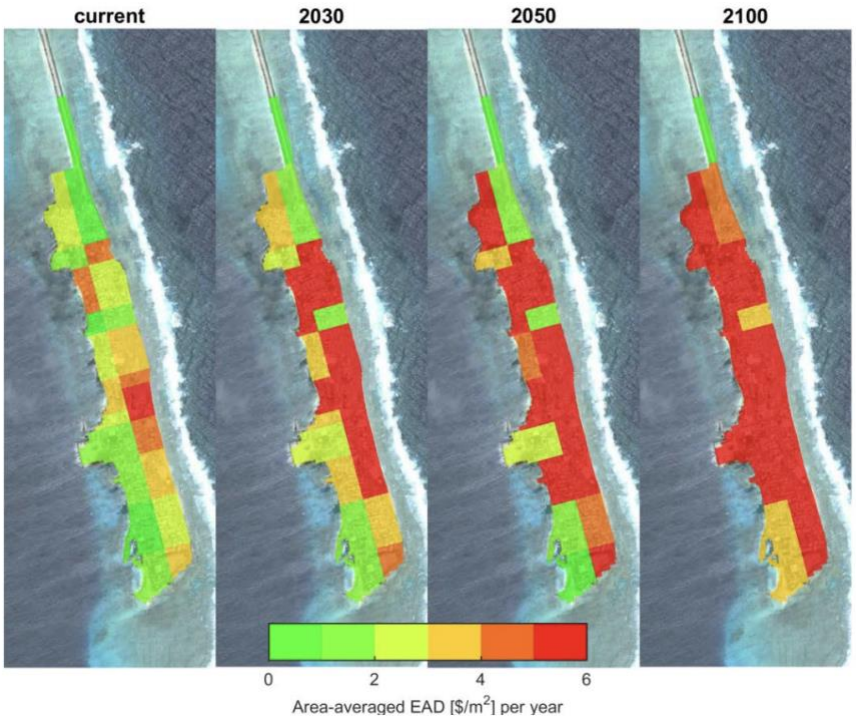
126 Devlin, Michelle. SIPA Capstone Team Interview, March 28, 2024.

127 Devlin, Michelle. SIPA Capstone Team Interview, March 28, 2024.

Seawalls and Revetments

Given the short time horizon of habitability on RMI, seawalls are a necessary stop-gap measure. Long term solutions such as conserving mangrove forests and constructing other natural barriers are not as feasible on RMI given the pace of sea-level rise. Albon Ishoda, RMI Ambassador to Fiji and the Pacific Islands, stated, "**Many times, people think we have options lined up. The reality is we don't, unless some benefactors are able to commit hundreds of millions of dollars for some hard adaptation that includes relocating people and raising islands, then perhaps seawalls will be the last option."**[128]

Figure 15: The Estimated Annual Damages (EAD) for Ebeye are projected to increase dramatically between 2024 and 2100 (evidenced in red).



This graphic shows the estimated annual damages for Ebeye under RCP 8.5, the most severe projected rise in emissions. Source: Giardino, Alessio, Kees Nederhoff, Michalis Vousdoukas, "Coastal hazard risk assessment for small islands: assessing the impact of climate change and disaster reduction measures on Ebeye (Marshall Islands)," Regional Environmental Change, Vol 18, 2237-2248, 2023 https://www.gfdrr.org/sites/default/files/publication/Coastal_risk_assessment_Ebeye_1.pdf.

[128] Lo, Joe. "Scientists Warn Seawalls Can Make Rising Waters Worse in the Long Run." Climate Home News, March 3, 2022. https://www.climatechangenews.com/2022/03/03/scientists-warn-seawalls-can-make-rising-waters-worse-in-the-long-run/.

With so many residents living in such close proximity to the coast, seawalls are needed to protect homes and save lives. Seawalls create time while the government strategizes long-term relocation planning. Although seawalls do deteriorate, this does not mean they are ineffective for the solution they are reaching for; they do, however, require periodic maintenance and repair.

In 2015, the out-of-season tropical storm Nangka destroyed seawalls and caused $4.2 million USD in damages to RMI.[129] In 2016 and 2019, king tides flooded several hundred homes in Majuro. On Ebeye alone, the expected annual damage from flooding is $2.1 million USD.[130]

RMI requires oceanside seawalls to protect Majuro and Ebeye. In Ebeye, coastal risk assessments have shown the oceanside to present greater risks than the lagoon side.[131] Currently, the World Bank, International Development Association, and the Green Climate Fund are building seawalls along the oceanside of Ebeye under the Pacific Resilience Project Phase II (PREP II) (see section on "What's Been Tried Before?"), which will cost an estimated $63.97 million USD. This initiative is projected to protect against sea level rise of up to 20 inches between now and 2070.[132] Additional oceanside seawall construction, however, is still needed. A 2021 estimate found seawalls would cost $28,250 USD per meter of length, or $45.5 million USD per mile.[133] The exorbitant up-front costs often result in inadequate half-measures or attempted shortcuts, such as backfilling with cheap materials. In many cases, individual citizens have resorted to constructing protective barriers outside their homes.

Clean Water Access

There are two main sources of water in RMI: rainwater catchment systems (maintained by communities and in individual homes) and freshwater wells tapping into the limited groundwater lens, a convex body of freshwater floating on top of the saltwater from the ocean. Clean water access is most important on Ebeye and Majuro given their high population density and rates of infectious diseases. On these islands, reverse osmosis desalination water treatment plants convert saltwater into potable drinking water, but they are not connected to the water grid. Residents on Majuro and Ebeye must instead walk to the community filling station to fill personal water containers. **Nearly 80 percent of residents on Majuro and Ebeye remain disconnected from**

[129] "Marshall Islands Weathers Climate Storm, Prevents Foreign Minister to Attend Key Climate Talks in Morroco - Marshall Islands | ReliefWeb," October 17, 2015. https://reliefweb.int/report/marshall-islands/marshall-islands-weathers-climate-storm-prevents-foreign-minister-attend-key.
[130] Giardino, Alessio, Kees Nederhoff, Matthijs Gawehn, Ellen Quataert, and Alex Capel. "Coastal Risk Assessment for Ebeye." *Deltares*, 2017. https://www.gfdrr.org/sites/default/files/publication/Coastal_risk_assessment_Ebeye_1.pdf.
[131] Ibid.
[132] The Pacific Resilience Program (PREP). "The Ebeye Seawall - Inclusive Resilience Newsletter," 2023. https://mailchi.mp/65d2d1e1e11b/7l5g8xafs4.
[133] Thompson, Doug. "Rising Seas and Worsening Conditions Unfold in the Marshalls, Driving Islanders to NWA." The Arkansas Democrat-Gazette, December 12, 2021. https://www.arkansasonline.com/news/2021/dec/12/rising-seas-and-worsening-conditions-unfolds-in/.

the water grid and still rely on rainwater for their clean water.[134] For those connected to the water grid, water is only available for 45-minute periods each day, and service interruptions are common. The Majuro Water and Sewer Company, which provides water to Majuro Island, has a 40 percent failure rate.[135]

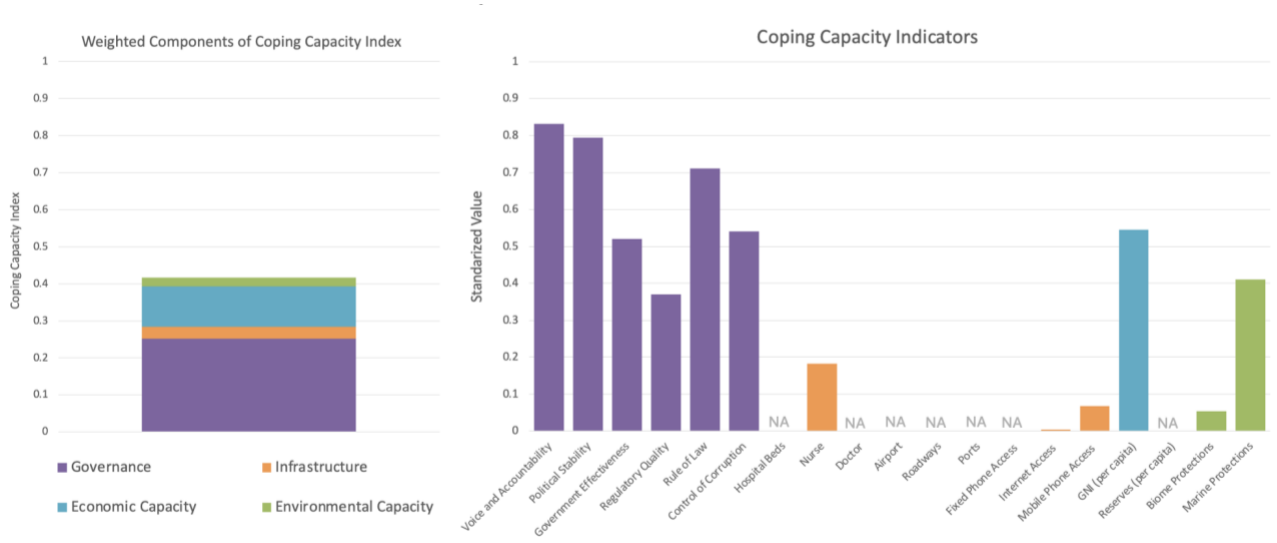
Water storage silos remain under-utilized; greater pumping capacity is needed to store freshwater and recover from an overwash event. There are several options for improving existing pumping systems, including low-power desalination units, small aquifers, and large freshwater storage tanks. Additionally, RMI can work to create levees, dikes, and subsurface impermeable walls below the levee to protect thin freshwater lens.

CAPACITY CONSTRAINTS

What are the underlying impediments to investing in, implementing, and scaling sustainable adaptation efforts in FSM? What capital constraints can be identified

Quantitative Analysis: Data Findings

Figure 16: Coping Capacity Breakdown in the RMI



134 "Majuro Water Supply and Distribution System Analysis." U.S. Department of the Interior, Bureau of Reclamation, Office of Insular Affairs, September 2020. https://www.doi.gov/sites/doi.gov/files/majuro-water-system-hydraulic-analysis-report-10-05-2020-final-508-compliant.pdf.

135 "National Adaptation Plan: Responding to the Impact of Climate Change." World Bank PREP II Project, October 20, 2023. https://rmigov.com/RMI-NAP-2023.pdf.

Interpretation: The height of the figure on the left represents the RMI's Coping Capacity Index value (~0.41), and the color-coded components reflect the contribution of each subindex (Governance, Infrastructure, Economic Capacity, and Environmental Capacity) to the overall Coping Capacity value, where the height of each component corresponds to the sub-index value. The figure on the right presents the standardized values for the indicators included in each of the four sub-indices, and are color-coded as such.

Indicators relating to governance (in purple) are relatively high in RMI, with the exception of *regulatory quality*. To a lesser degree, *government effectiveness* and *control of corruption* also appear to be lacking. Low *regulatory quality* suggests limited governmental success in supporting and sustaining private sector growth. Low *government effectiveness* suggests that the perceived quality of public services is lacking. Finally, low *control of corruption* is associated with the perception that exploitation and the abuse of public funds for personal gain are endemic to the political system.

Economic capacity (in blue) is an additional source of weakness in RMI, with a moderately low indicator value for the *gross national income (GNI) per capita*. The country's constrained economic capacity significantly limits its ability to address climate change and requires the nation to rely on foreign assistance for its adaptation needs.

Weak infrastructure also limits RMI's coping capacity. The available health care inputs, that is the indicator for the *number of nurses (per capita)*, is a clear vulnerability for RMI. Additionally, RMI has incredibly low indicator values for *internet service*, and *mobile phone access*, indicating weak communication infrastructure. Environmental capacity (in green) is somewhat lacking as well, with a very low indicator value for *biome protections*, and a moderately low value for *marine protections*.

Qualitative Analysis of Capacity Constraints: Five Forms of Capital

Human and Intellectual Capital

Out-migration to the U.S. significantly inhibits the development of a skilled labor force in RMI. **Since the signing of the first Compact Agreement in 1982, nearly half of all Marshallese have migrated to the U.S. for better economic opportunities.**[136] Between 2003 and 2013, 7,228 RMI residents – about 14 percent of RMI's population – migrated to the U.S. Many U.S. firms in search of cheap, unskilled labor–such as warehouses and meatpacking companies–recruit Marshallese

[136] Jetnil-Kijiner, Kathy, and Hilda Heine. "Displacement and Out-Migration: The Marshall Islands Experience | Wilson Center." Wilson Center, September 30, 2020. https://www.wilsoncenter.org/article/displacement-and-out-migration-marshall-islands-experience.

with pay three to four times greater than what they would receive in RMI.[137] The promise of higher wages in the U.S. leaves RMI without the technical capacity to install and maintain key infrastructure projects.

> The lack of skilled labor leaves the RMI with a shortage of healthcare workers, with **only 4.2 nurses per 1,000 residents.**

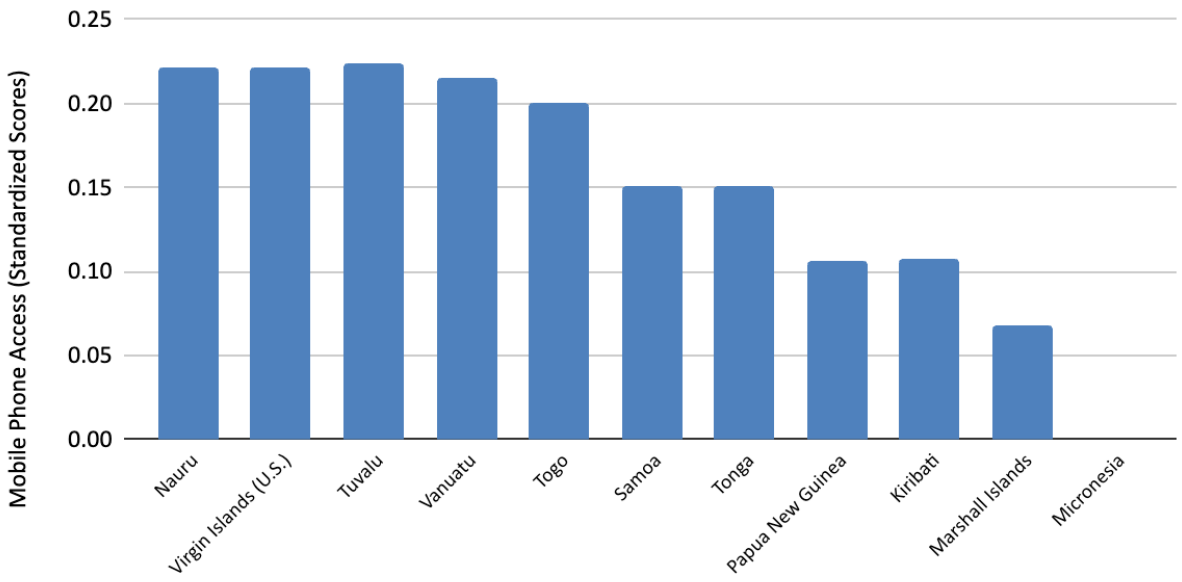
RMI ranks in the 42nd percentile on the World Bank's Human Capacity Index, indicating that workforce productivity is constrained by weak education and healthcare services.[138] Rates of primary school completion and secondary school enrollment remain lower than regional averages, and well below those of other upper middle-income countries.[139]

Physical Capital

RMI faces unique infrastructure challenges, particularly in emergency response and disaster management. While RMI maintains one airport and several ports, other islands like Ebeye rely on the functionality of a single pier. Access to remote islands without ports complicates the logistics of emergency and disaster response efforts. Most roads are unpaved and suffer from inadequate maintenance and drainage. RMI's single-lane road network is limited to Majuro, Kwajalein, and Ebeye.

[137] Brown, April. "Marshallese in Arkansas." Marshallese Educational Initiative. Accessed April 28, 2024. https://www.mei.ngo/marshallese-in-arkansas.
[138] "Marshall Islands." Human Capital Country Brief. Human Capital Project. World Bank, October 2022. https://thedocs.worldbank.org/en/doc/7c9b64c34a8833378194a026ebe4e247-0140022022/related/HCI-AM22-MHL.pdf, p. 1.
[139] Ibid, p. 2.

Figure 17: The RMI's mobile phone access is ranked the second lowest among other Pacific Island Countries.



Source: World Bank Open Data. "Mobile Phone Subscriptions (per 100 People)," March 28, 2024. https://data.worldbank.org.

RMI also suffers from a lack of telecommunications infrastructure, scoring poorly in terms of mobile phone access compared to other Pacific Island Countries. The remote outer islands experience the worst connectivity in RMI, which inhibits the timely and meaningful dissemination of information to at-risk individuals to prepare for impending natural disasters. RMI listed obtaining an early warning system as a priority in its 2020-2030 National Strategic Plan. Increasingly severe and unpredictable weather systems make an impact-based and risk-informed multi-hazard early warning system even more crucial. Although bulk wave and static sea level statistics are sufficient to identify an inundation event, RMI cannot issue timely warnings due to gaps in its national alert system.[140] It is also unable to advise citizens to store water before a drought, or stay cool during extreme heat. Countries in the Pacific region with multi-hazard warning systems increased from 25 percent in 2015 to 60 percent in 2022, yet RMI lags behind.[141]

Financial Capital

Enormous gaps exist between the financing RMI needs for climate adaptations and the financing it has access to. **RMI's 2023 National Adaptation Plan estimates that they need $35 billion**

[140] Smith, Grant, and Nover Juria. "Diagnosis of Historical Inundation Events in the Marshall Islands to Assist Early Warning Systems." *Natural Hazards* 99, no. 1 (October 1, 2019): 189–216. https://doi.org/10.1007/s11069-019-03735-9.

[141] Baker, Temily, Sanjay Srivastava, Sapna Dubey, Soomi Hang, and Madhurima Sarkar-Swaissggod. "Early Warning for All: Saving Lives in Asia and the Pacific." United Nations Economic and Social Commission for Asia and the Pacific (UN-ESCAP), October 14, 2022. https://www.preventionweb.net/news/early-warning-all-saving-lives-asia-and-pacific.

USD[142]–a figure 135 times the size of their annual output[143] and equivalent to around $800,000 USD for every current resident of RMI[144]– to protect its atolls against rising sea levels. This dwarfs the $998 million USD RMI received during the second Compact term (FY2004-FY2023) from the U.S. through grant assistance and trust fund contributions.[145]

RMI's macroeconomic outlook is subdued and highly volatile, with real GDP growth averaging 2.15 percent since 2010[146] due to significant uncertainty and risks related to the country's geographic isolation, vulnerability to climate change, volatility in fishing revenues, and fragile financial and trade links.[147]

Political Capital

Despite its status as a stable democracy featuring regular competitive elections and a free press, RMI faces significant corruption challenges relating to the allocation of foreign aid, government procurement, and financial transactions. Although senior officials rarely face prosecution, fraud cases brought by the auditor general increased in 2019 and 2020, possibly due to increased World Bank funding.[148] From 2018 to 2022, a Chinese couple bribed several Marshallese officials with bribes up to $22,000 USD in an attempt to create a Chinese Special Administrative Region in Rongelap.[149]

RMI also struggles to enforce legal frameworks robust enough to ensure government transparency; obtaining government documents may require court orders. Auditors have frequently reported questionable expenditures across various government departments, ministries, and state-controlled enterprises, underlining the persistent issues in financial governance.[150]

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142 "National Adaptation Plan: Responding to the Impact of Climate Change." World Bank PREP II Project, October 20, 2023. https://rmigov.com/RMI-NAP-2023.pdf.

143 World Bank Open Data. "GDP (Current US$) - Marshall Islands," March 28, 2024. https://data.worldbank.org.

144 Bittle, Jake. "Inside the Marshall Islands' Life-or-Death Plan to Survive Climate Change." Grist, December 5, 2023. https://grist.org/extreme-weather/marshall-islands-national-adaptation-plan-sea-level-rise-cop28/.

145 Lum, Thomas. "The Compacts of Free Association." In Focus. Washington, DC: Congressional Research Service, November 13, 2023. https://crsreports.congress.gov/product/pdf/IF/IF12194.

146 World Bank Open Data. "GDP Growth (Annual %) - Marshall Islands," March 28, 2024. https://data.worldbank.org.

147 IMF. "Republic of the Marshall Islands: 2023 Article IV Consultation-Press Release; Staff Report; and Statement by the Executive Director for Republic of the Marshall Islands," October 16, 2023. https://www.imf.org/en/Publications/CR/Issues/2023/10/16/Republic-of-the-Marshall-Islands-2023-Article-IV-Consultation-Press-Release-Staff-Report-540607, p. 1-2.

148 Freedom House. 'Marshall Islands: Freedom in the World 2021.' Accessed April 14, 2024. https://freedomhouse.org/country/marshall-islands/freedom-world/2021.

149 McKenzie, Pete. "Bribes, Booze and Bombs: The Brazen Plan to Create a Pacific Tax Haven." *Washington Post*, February 16, 2023. https://www.washingtonpost.com/world/2023/02/14/china-united-states-marshall-islands-rongelap/.

150 Freedom House. 'Marshall Islands: Freedom in the World 2021.' Accessed April 14, 2024. https://freedomhouse.org/country/marshall-islands/freedom-world/2021.

"It is key to understand two parallel governments in RMI: the elected government in Majuro and the local indigenous government." - Regional expert

Aside from the elected government, one must gain approval from the local paramount chief or *iroojlaplap* before breaking ground on a new development project in RMI; moreover, the *iroojlaplap* are distinct in the Ralik and Ratak Island chains.[151] This divided governance system blurs lines of accountability and authority, often delaying or complicating long-term climate adaptation programming by adding bureaucratic red tape.

Natural Capital

RMI faces much of the same natural capital constraints as the FSM and Palau, including pressure on tuna fisheries stocks, limited freshwater resources, and the degradation of natural infrastructure of coral reefs that help mitigate coastal inundation and overwash events. However, unlike Palau and the FSM, RMI's islands are exclusively low-lying atolls, placing them at higher risk for all of these constraints.[152]

[151] Islands Business. "Marshall Islands Celebrates New Iroojlaplap," July 25, 2022. https://islandsbusiness.com/news-break/marshall-islands-celebrates-new-iroojlaplap/.

[152] Chapman, Alex, Denyse Dookie, William Davies, and Ciaran Downey. "Climate Risk Country Profile - Marshall Islands." World Bank Group, Asian Development Bank, 2021. https://climateknowledgeportal.worldbank.org/sites/default/files/2021-06/15817-WB_Marshall%20Islands%20Country%20Profile-WEB.pdf.

WHAT HAS BEEN TRIED BEFORE?

Key Climate Adaptation Projects (2016-2024)

U.S. funding through the COFA plays a crucial role in RMI's national budget, particularly in the health, education, and infrastructure sectors. Through the Compact and other federal services and grants, the U.S. provides RMI approximately $80 million USD in assistance every year,[153] which is used for everything from drought relief assistance to solar energy system installation to water management systems. Under the new Compact approved in 2024, RMI's Compact funding from the U.S. will see a 54 percent increase over 20 years from the previous Compact period.[154] Approximately 75 percent of RMI's national education budget is from Compact Education Sector Grants.[155] Foreign grants in total account for about 37 percent of national GDP.[156]

In addressing climate-induced emergencies, the National Disaster Management Office (NDMO) in Majuro plays a pivotal role at the local level in orchestrating disaster management endeavors. Moreover, since 2008, USAID has stepped in as the key American entity offering critical humanitarian assistance and disaster relief.[157]

Project Title and Donor	Category	Objective	Timeline	Funding (USD)
Pacific Resilience Project Phase II (Green Climate Fund)	Infrastructure	Enhance resilience of coastal infrastructure in sections of Majuro and Ebeye	2018 - Present	$59.9 million
RMI Education and Skills Strengthening Project (The World Bank)	Education	Improve access to secondary education and vocational skills	2021 - Present	$10 million
FP112 Addressing Climate Vulnerability in the Water Sector (ACWA) in the Marshall Islands (Green Climate Fund)	Infrastructure	Increase resilience of water resources	2020 - Present	$24.7 million
Kwajalein Atoll Sustainability Lab (Office of Naval Research)	Environment	Conduct research, document climate change, build partnerships and capacity of local authorities to implement climate adaptations, and create jobs.	2023 - Present	N/A

[153] United States Department of State. "U.S. Relations With Marshall Islands," December 9, 2021. https://www.state.gov/u-s-relations-with-marshall-islands/.

[154] Goldmeier Green, Karen, Ileana Ros-Lehtinen, Geoffrey K. Verhoff, and Jeffrey L. Farrow. "Compacts Renewal Ushers in New Era of Relations Between the U.S. and Freely Associated States." Akin Gump Strauss Hauer & Feld LLP - Compacts Renewal Ushers in New Era of Relations Between the U.S. and Freely Associated States, March 21, 2024. https://www.akingump.com/en/insights/alerts/compacts-renewal-ushers-in-new-era-of-relations-between-the-us-and-freely-associated-states.

[155] U.S. Department of the Interior, Office of Insular Affairs. SIPA Capstone Team Interview, March 13, 2024.

[156] "Project Information Document - Federated States of Micronesia Climate Resilient Road Project." World Bank, April 3, 2020. https://documents1.worldbank.org/curated/en/791101578622391269/pdf/Project-Information-Document-Digital-Federated-States-of-Micronesia-P170718.pdf.

[157] Eastmond, Tiare. SIPA Capstone Team Interview, March 14, 2024.

Enhancing the Resilience of Health Systems to Climate Change and Emerging Pandemics in the RMI (World Health Organization, Green Climate Fund)	Health	Improved climate resilient health systems, improved health readiness on remote outer islands.	2022-Present	$399,802
Pacific Island Tuna Provisions LLC (Walmart, The Nature Conservancy)	Economy	Create jobs and exported 20 million cans of tuna to date, renewed contract in July, 2023.[158]	2021 - Present	N/A
Pacific ALLIES	Capacity Building	Form lasting relationships between US military officers and Marshallese peers through climate work.[159]	2022 - Present	N/A
Rikitak Program (US Army Garrison Kwajalein)	Education	Educating Marshallese students at DoD school.	1988 - Present	N/A
Osmoflo Reverse Osmosis Water Plants (USA, Australia, Asian Development Bank)	Water Security, Sanitation	Provide clean water access, creating 650,000 liters of clean water per day, and sanitation upgrades.[160]	2016-2017	$19.02 million

POLICY RECOMMENDATIONS

Analysis: *Assessing Priority Areas of Need*

The RMI government is realistic about the existential threat of climate change and the likely relocation within this century. Given the identified capital constraints, climate adaptations should both improve livability on the islands and prepare Marshallese for life elsewhere. Beyond infrastructure improvements, there is a unique opportunity to both prepare for and treat generational trauma and build human capacity with the Marshallese.

158 Johnson, Giff. "Marshall Islands-Walmart Deal Continues Historic Development of Tuna Supply." Marianas Business Journal, September 4, 2023. https://www.mbjguam.com/marshall-islands-walmart-deal-continues-historic-development-tuna-supply.

159 Nakano, Gregg. SIPA Capstone Team Interview, March 10, 2024.

160 Asian Development Bank. "With Australian-ADB Investment, Clean Water Is Flowing in Marshall Islands' Ebeye." Text, January 27, 2020. Marshall Islands. https://www.adb.org/results/australian-adb-investment-clean-water-flowing-marshall-islands-ebeye.

Infrastructure

- **Enhance health capacity**. Many Marshallese do not seek healthcare until diseases reach a critical stage.[161] Innovative and secure telehealth technologies will allow Marshallese to seek care via the internet and access heart rate monitors, pulse oximeters, and blood pressure cuffs onsite instead of traveling to Hawaii.[162] Continued collaboration between U.S. Naval Ship hospitals and RMI population centers to screen for tuberculosis and provide vaccinations, optometry care, and dental care is essential.
- **Invest in water systems**. Improve clean water access by expanding the water grid and pumping capacity, and by implementing redundant water generation and catchment systems. Bring a sewage treatment system into operational status.
- **Improve early warning systems**. Ensure all remote islands have a chatty-beetle outfitted with an alarm to notify of an incoming message and repeaters to improve network connectivity. Invest in multi-hazard siren systems, tidal buoys, satellite phones, and trained technical expertise and support. Joining the Regional Integrated Multi-Hazard Early Warning System for Africa and Asia International (RIMES), an intergovernmental institution, would also help improve a national early warning system. RIMES works to enhance data availability, improve modeling and forecasting, and transform data into actionable information.[163] RMI is not yet a member state of RIMES and would benefit greatly from elevating to this level, like other island states such as Timor Leste and Papua New Guinea.
- **Invest in seawalls and natural barriers.** Continue to construct and repair seawalls as necessary to combat the sea level rise and bide time on Majuro and Ebeye. Ensure seawalls and barriers are not the responsibility of individual families to construct. Construct higher and stronger barriers of higher quality material. Evaluate raising structures where appropriate.

Workforce Development and Training

- **Strengthen English language teaching support**. Improved English proficiency would help Marshallese prepare for life as environmentally displaced persons. As RMI looks toward the eventual relocation of its residents to the United States, the Philippines, or other Pacific Islands, English skills are paramount. The Rikitak program has yielded overwhelmingly positive results.[164] Additionally, it helps the U.S. build trust and long-term partnerships with RMI. English skills would also prepare Marshallese for better jobs in

[161] McElfish, Pearl Anna, Emily Hallgren, and Seiji Yamada. "Effect of US Health Policies on Health Care Access for Marshallese Migrants." *American Journal of Public Health* 105, no. 4 (April 2015): 637–43. https://doi.org/10.2105/AJPH.2014.302452.
[162] Rasmussen, Eric. SIPA Capstone Team Interview, February 25, 2024.
[163] RIMES. "Overview - Regional Integrated Multi-Hazard Early Warning System (RIMES) for Africa and Asia," 2024. https://www.rimes.int/aboutus/overview.
[164] Hepler, Douglas S. "Post-High School Outcomes of the Marshallese Graduates of the Kwajalein Jr-Sr High School Kwajalein, Marshall Islands." *ETD Collection for University of Nebraska-Lincoln*, January 1, 2016, 1–123.

the U.S. military, in which more Marshallese serve per capita than residents of many states in the U.S., by helping to raise Armed Services Vocational Aptitude Battery (ASVAB) test scores.

- **Advance vocational training**. Encourage firms to create joint job ventures and provide training in RMI. This helps Marshallese to gain access to better paying jobs. Otherwise, many Marshallese will be subjected to cheap and unskilled manual labor in the United States. Continue to tailor school curriculum toward unfilled jobs in RMI: STEM, construction, entry-level medical careers, etc.
- **Increase mental health support**. Seek innovative ways to celebrate and maintain cultural identity and prepare for generational trauma associated with an inevitable diaspora and loss of a homeland, which was inhabited for 4,000 years. Collaborate with medical nonprofits, U.S. Chaplain Corps, and Civil Affairs Commands to provide mental health counseling and therapy services.

Partnerships

"The key to fighting climate change is long-standing relationships." - Climate Security Expert for RMI

- **Scale collaboration with American universities**. Many Marshallese students travel to the U.S. for secondary education at accredited universities. Increase opportunities at U.S. universities to work with Marshallese students to find practical solutions in engineering (sea walls, flooding resistant structures) and agriculture (drought resistant and salt resistant seeds). There is no comprehensive list of ongoing research projects at U.S. universities relating to RMI. Create a database detailing what each private university has done for RMI so that many solutions can be tested, evaluated, and scaled in RMI.
- **Augment U.S. Coast Guard (USGC) presence to stop illegal fishing.** Bring assets into the region to surveil RMI's waters, enforce fishing laws, and deter efforts for illegal fishing. This will strengthen RMI's economy and build capacity between Marshallese and USCG personnel. Create a multinational coalition, Joint Interagency Task Force, expand ship-rider programs, and leverage intelligence capabilities of partner nations to secure the waters of RMI.[165]

[165] Dehnz, Arthur M. "Securing the Seas: Fishery Security Is Maritime Security in the Indo-Pacific Command Area of Responsibility." *Journal of Indo-Pacific Affairs*, April 2024, 150–61.

CONCLUSION

In conclusion, this paper has investigated the challenges confronting the Freely Associated States as they attempt to adapt to the risks and associated threats presented by climate change. These challenges are multi-faceted, as governments face a series of interrelated capital constraints that inhibit effective governance at the national and local level. Among these, the most crucial include a dearth of skilled labor, weak public financial management, rapidly deteriorating physical infrastructure, underdeveloped private sectors, and donor fragmentation.

The report closely examined the hurdles that Compact countries face in implementing climate adaptation solutions to bolster their coping capacity and adaptive resilience. The multi-layered nature of these challenges underscores the need for a systems thinking approach, and for recognizing the interlinkages between socio-economic development and climate adaptation. In other words, **improving a country's coping capacity requires shifting from a short-term, incremental, projectized approach toward long-term planning that targets holistic transformations at the systemic level.** Thus, capacity building activities in the Freely Associated States should do more than minimize capacity gaps; it should include forward-looking, anticipatory planning activities that empower faculties across the capital spectrum.

The policy recommendations set forth in this paper, and the analysis of priority areas of need, therefore propose cross-cutting options that seek to improve workforce availability, reinforce fragile infrastructure, and strengthen partnerships to advance climate adaptation initiatives that not only drive investments but also bolster human security and socio-economic development.

The aim of this report is to provide insights into how bilateral and multilateral partners can help Compact countries reap the benefits of a systems-level approach in developing adaptive resilience and coping capacity towards a climate-ready future.

APPENDIX

Appendix 1: Composite Index Creation

Pros and Cons of Composite Indices

Composite indices can be used to reflect complex topics that cannot be captured by a single indicator or data series, such as environmental status, economic performance, or technological development. They serve as a mix of individual indicators combined to reflect an abstraction of reality, allowing policymakers to benchmark country performance on elusive concepts over time. However, as the Organization for Economic Co-operation and Development's *Handbook on Constructing Composite Indicators* warns, "composite [indices] must be seen as a starting point for initiating discussion and attracting public interest. Their relevance should be gauged with respect to constituencies affected by the composite index."[166] It is important that composite indices do not replace location-, time-, and context-specific issues and policy proposals; they should serve to supplement those more granular understandings of issues.

Below are some pros and cons of composite indices identified by the OECD in their *Handbook on Constructing Composite Indicators*:

Pros and Cons of Composite Indices

Pros	Cons
• Can summarize complex or multi-dimensional issues in view of supporting decision-makers • Easier to interpret than trying to find a trend in many separate indicators • Facilitate the task of ranking countries on complex issues in a benchmarking exercise • Can assess programs of countries over time on complex issues • Reduce the size of a set of indicators or include more information within the existing size limit • Place issues of country performance and progress at the center of the policy arena • Facilitate communication with general public (i.e. citizens, media, etc) and promote accountability	• May send misleading policy messages if they are poorly constructed or misinterpreted • May invite simplistic policy conclusions • May be misused, e.g. to support a desired policy, if the construction process is not transparent and lacks sound statistical or conceptual principles • The selection of indicators and weights could be the target of political challenge • May disguise serious failings in some dimensions and increase the difficulty of identifying proper remedial action • May lead to inappropriate policies if dimensions of performance that are difficult to measure are ignored

Source: Nardo, Michela, Michaela Saisana, Andrea Saltelli, Stefano Tarantola, Anders Hoffman, and Enrico Giovannini. "Handbook on Constructing Composite Indicators: Methodology and User Guide." Organisation for Economic Co-operation and Development, August 9, 2005. https://www.oecd-ilibrary.org/docserver/533411815016.pdf?expires=1711138623&id=id&accname=ocid177456&checksum=9D929CFF533B6C03DB0AB48E37262057, p. 8.

[166] Nardo, Michela, Michaela Saisana, Andrea Saltelli, Stefano Tarantola, Anders Hoffman, and Enrico Giovannini. "Handbook on Constructing Composite Indicators: Methodology and User Guide." Organisation for Economic Co-operation and Development, August 9, 2005. https://www.oecd-ilibrary.org/docserver/533411815016.pdf?expires=1711138623&id=id&accname=ocid177456&checksum=9D929CFF533B6C03DB0AB48E37262057, p. 8.

Standardization Process

To standardize the indicator values on a zero to one scale and turn them into indices, the methodology employs a max-min standardization using the following formula:

$$standardized\ output\ = \frac{value - min}{max - min}$$

where max and min are the highest and lowest individual values of the indicator in the data set.

Utilizing this standardization method measures how closely each individual country performs relative to the leading country in each indicator. For example, Hong Kong ranks highest on the World Bank's "mobile cellular subscriptions (per 100 people)" indicator, with a value of 292 mobile cellular subscriptions per 100 people. Micronesia ranks the lowest on the indicator, with a value of 19 mobile cellular subscriptions per 100 people. To find the index value for a country like Belgium, which has 102 mobile cellular subscriptions per 100 people, the formula would look as follows:

$$standardized\ output\ = \frac{102 - 19}{292 - 19}$$

$$standardized\ output\ = \frac{83}{273}$$

$$standardized\ output\ = 0.30$$

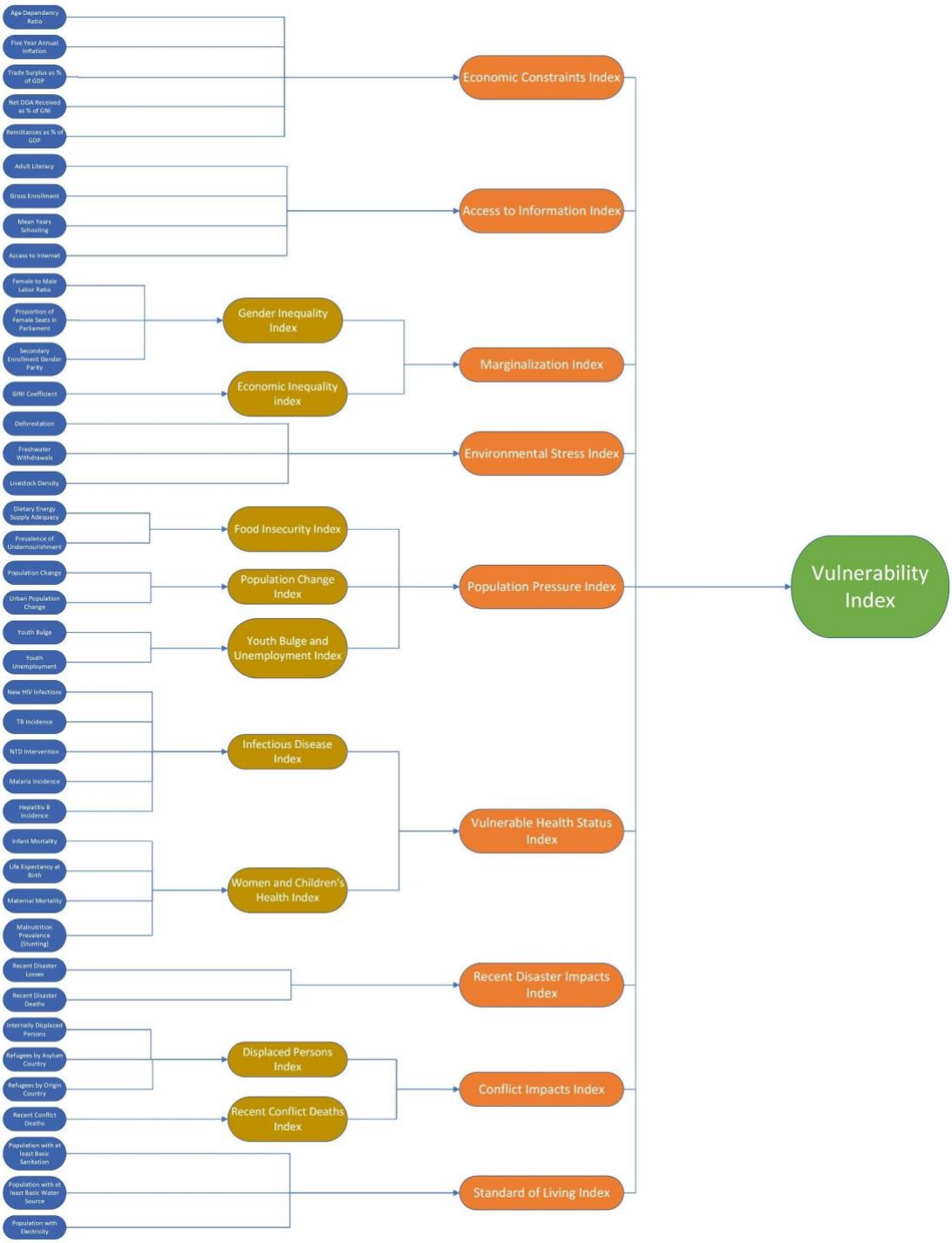
For indicators that were skewed in one direction, the analysis performs transformations to ensure the data was more evenly distributed and better reflects a country's relative position to the global maximum. For example, the GNI per capita data demonstrated a strong positive skew, owing to the exponential growth of income. To control for this, the analysis performed a natural logarithmic transformation on the data before standardizing.

Index Construction

The Vulnerability Index is calculated as the average of nine sub-indices: the Vulnerable Health Status Index, the Standard of Living Index, the Access to Information Index, the Economic Constraints Index, the Marginalization Index, the Population Pressures Index, the Recent Disaster Impacts Index, the Conflict Impacts Index, and the Environmental Stress Index. Four of these nine sub-indices have intermediate sub-indices feeding into them. The Marginalization Index is composed of the Gender Inequality Index and the Economic Inequality Index; the Population Pressures Index is composed of the Population Change Index, the Food Insecurity Index, and the Youth Bulge and Unemployment Index; the Vulnerable Health Status Index is composed of the Women and Children's Health Index; and the Conflict Impacts Index is composed of the Recent Conflict Deaths Index and the Displaced Persons Index. Each index is an average of the inputs feeding into them. Values range from 0 to 1, with 1 representing higher vulnerability to climate shocks. See the flowchart below for a detailed breakdown of which indicators feed into each index.

The process of filtering each indicator through multiple sub-indices with different indicators changes the relative weighting of each indicator's impact on the final Vulnerability Index output. For a breakdown of the relative weight of each indicator on the final Vulnerability Index output, see below

Appendix 2: Vulnerability Index Breakdown.

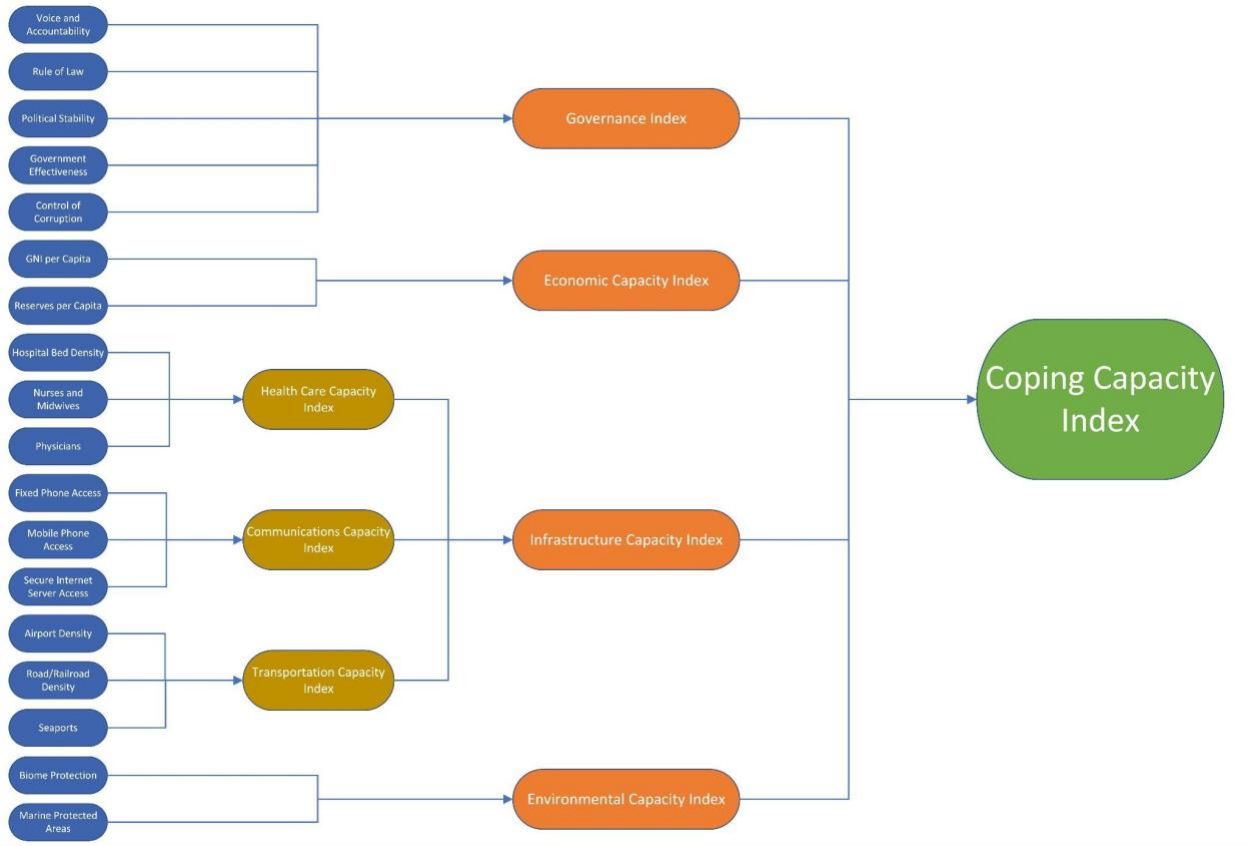


The Coping Capacity Index is calculated as the weighted average of four sub-indices, using the following weights: Governance Index (40%), Infrastructure Index (30%), Economic Capacity Index (20%), and Environmental Capacity Index (10%). The Infrastructure Index has three intermediate sub-indices feeding into it: the Health Care Capacity Index, the

Communications Capacity Index, and the Transportation Capacity Index. The Infrastructure Index is calculated as the average of the three intermediate sub-indices. Values range from 0 to 1, with 1 indicating higher coping capacity to climate shocks. See the flowchart below for a detailed breakdown of which indicators feed into each index.

The process of filtering each indicator through multiple sub-indices with different indicators and different weights changes the relative weighting of each indicator's impact on the final Coping Capacity Index output. For a breakdown of the relative weight of each indicator on the final Coping Capacity Index output, see below:

Appendix 3: Coping Capacity Index Breakdown.



Indicator List and Sources

Appendix 4: Vulnerability Index Weighting

Indicator	Source	High Value Coded as Good or Bad in Index	Relative Weight to Overall Vulnerability Index	Notes
Age Dependency Ratio	World Bank	Bad	0.022	
Five Year Annual Inflation	World Bank and IMF	Bad	0.022	World Bank data used first, if value was missing, then IMF data was used
Exports minus Imports (trade surplus as % of GDP)	World Bank	Good	0.022	
Net ODA Received as Percent of GNI	World Bank	Bad	0.022	
Remittances as Percent of GDP	World Bank	Bad	0.022	
Adult Literacy	World Bank	Good	0.028	
Gross Enrollment	World Bank	Good	0.028	
Mean Years Schooling	UNDP	Good	0.028	
Access to Internet	World Bank	Good	0.028	

Female to Male Labor Ratio	World Bank	Good	0.019	
Proportion of Female Seats in Parliament	World Bank	Good	0.019	
Secondary Enrollment Gender Parity	World Bank	Good	0.019	
GINI Coefficient	World Bank	Bad	0.056	
Deforestation	World Bank	Bad	0.037	Calculated as percent change in 5 years
Freshwater Withdrawals	UN Statistics	Bad	0.037	
Livestock Density	UN FAO	Bad	0.037	Sheep and goats; buffalo and cattle grouped together, total sum used as indicator
Dietary Energy Supply Adequacy	UN FAO	Good	0.019	
Prevalence of Undernourishment	UN FAO	Bad	0.019	
Population Change	World Bank	Bad	0.019	
Urban Population Change	World Bank	Bad	0.019	
Youth Bulge	UN	Bad	0.019	
Youth Unemployment	World Bank	Bad	0.019	
New HIV Infections	UN SDG	Bad	0.011	
TB Incidence	UN SDG	Bad	0.011	
NTD Intervention	UN SDG	Bad	0.011	
Malaria Incidence	UN SDG	Bad	0.011	
Hepatitis B Incidence	UN SDG	Bad	0.011	
Infant Mortality	World Bank	Bad	0.014	
Life Expectancy at Birth	World Bank	Good	0.014	
Maternal Mortality	World Bank	Bad	0.014	
Malnutrition Prevalence (Stunting)	World Bank	Bad	0.014	
Recent Disaster Losses	World Bank and EM-DAT	Bad	0.056	Loss figures multiplied by 1,000 to obtain actual numbers for total losses. Total losses for each five-year period were multiplied by 100, then divided by latest available GNI figures
Recent Disaster Deaths	World Bank and EM-DAT	Bad	0.056	For each country, the total number of deaths for each five-year period were multiplied by 10,000, then divided by population figures to obtain deaths per 10,000 persons. Recent Disaster Deaths per 10,000 Persons refers to data for the period 2016 to 2020.
Internally Displaced Persons	UNHCR and IDMC	Bad	0.019	UNHCR data first, if missing used IDMC
Refugees by Asylum Country	UNHCR	Bad	0.019	Sum totals were then multiplied by 100 and divided by corresponding population values ranging from 2000 to 2020 to obtain Refugees by Country of Origin as a Percent of the Population.
Refugees by Origin Country	UNHCR	Bad	0.019	Sum totals were then multiplied by 100 and divided by corresponding population values ranging from 2000 to

				2020 to obtain Refugees by Country of Origin as a Percent of the Population.
Recent Conflict Deaths	UCDP	Bad	0.056	Conflict-related deaths were summed for each five-year period and normalized using population figures for selected years to obtain Recent Conflict Deaths per Million Population
Population with at least Basic Sanitation	WHO	Good	0.037	
Population with at least Basic Water Source	WHO	Good	0.037	
Population with Electricity	World Bank	Good	0.037	

Appendix 5: Coping Capacity Index Weighting

Indicator	Source	Relative Weight to Overall Coping Capacity Index	Notes
Control of Corruption	World Bank	0.08	
Government Effectiveness	World Bank	0.08	
Political Stability	World Bank	0.08	
Rule of Law	World Bank	0.08	
Voice and Accountability	World Bank	0.08	
GNI per Capita	World Bank	0.15	
Reserves per Capita	World Bank	0.15	
Hospital Bed Density	World Bank and WHO	0.022	
Nurses and Midwives per 10,000 People	World Bank	0.022	
Physicians per 10,000 People	World Bank	0.022	
Fixed Phone Access	World Bank	0.022	
Internet Server Access	World Bank	0.022	
Mobile Phone Access	World Bank	0.022	
Airports	Geospatial analysis by PDC	0.022	Couldn't replicate PDC's methodology, so did not include in final Coping Capacity Index calculation
Railroads	USGS Database	0.022	Couldn't replicate PDC's methodology, so did not include in final Coping Capacity Index calculation
Seaports	Geospatial analysis by PDC	0.022	Couldn't replicate PDC's methodology, so did not include in final Coping Capacity Index calculation
Biome Protection	NGA	0.05	
Marine Protected Area	NGA	0.05	

Appendix 6: World Bank Governance Indicators Definitions

Indicator	Definition (World Bank)
Control of Corruption	The degree to which the public power is exercised for private gain, including both petty and grand forms of corruption, as well as "capture" of the state by elites and private interests.
Government Effectiveness	The perceived quality of public and civil services, the degree of services are independent from political pressures, the quality of policy formulation and implementation, and the credibility of the government's commitment to such policies.
Political Stability	The perceived likelihood of political instability and/or politically motivated violence, including terrorism.
Regulatory Quality	The degree to which the government is able to formulate and implement sound policies and regulations that permit and promote private sector development.
Rule of Law	The extent to which agents have confidence in and abide by the rules of society, and in particular the quality of contract enforcement, property rights, the police, and the courts, as well as the likelihood of crime and violence.
Voice and Accountability	The extent to which a country's citizens are able to participate in selecting their government, as well as freedom of expression, freedom of association, and a free media

Source: Daniel Kaufmann and Aart Kraay (2023). Worldwide Governance Indicators, 2023 Update (www.govindicators.org)

Appendix 7: List of Interviewees

Name	Position Title
Dr. Michele Devlin	Professor of Environmental Security, U.S. Army War College
Tiare Eastmond	Regional Advisor at USAID, Office of U.S. Foreign Disaster Assistance
Dr. Joseph Green	Director of Applied Science, Pacific Disaster Center
Rev. Francis X. Hezel, S.J.	Director, Micronesian Seminar, former Jesuit Superior for Micronesia and President of Xavier High School (Chuuk, FSM)
Joslyn Howard	Director, We Are Oceania
Dr. Gregg Nakano	Climate Security Advisor, Kwajalein Atoll Government
Dr. Eric Rasmussen	CEO, Infinitum Humanitarian Systems, and Chair of Board of Directors, InSTEDD
USCG Personnel	Illegal Unreported, Unregulated Fisheries Center for Expertise, Joint Interagency Task Force West
U.S. Department of Interior Office of Insular and International Affairs	Honolulu Field Office, Compact Sector Grants
Ethan Allen	Asia Pacific Center for Security Studies
Elizabeth Kunce	Asia Pacific Center for Security Studies
Makenna Coffman	University of Hawai'i at Manoa
Shanty Asher	Pacific Islander Liaison, Honolulu Office of Economic Revitalization
Samantha Happ	Local 2030 Islands Network; East-West Center
IOM Official	International Organization for Migration
Dr. Victoria Keener	Co-Lead Investigator for Pacific RISA: Pacific Research on Island Solutions for Adaptation, a NOAA and East-West Center Partnership

Appendix 8: Climate Related Risks and Threats

Federated States of Micronesia

Sea Level Rise and Coastal Inundation

The impacts of climate change are already evident in FSM. **Saltwater intrusion** from extreme king tides and sea level rise contaminates freshwater supplies and damages soil, agroforestry resources, and critical infrastructure along the coast. Sea levels in the region are anticipated to rise by approximately seven to 18 centimeters by 2030, and by as many as 35 centimeters by 2050 (depending on emission reduction scenarios). In the high islands, where most of the population and infrastructure is located near the coastline, this increase is accelerating erosion of coastal properties and damaging them through periodic flooding. **Extreme king tides** and **sea level rise** have an even greater impact on the low-lying atoll islands of the FSM, which are usually less developed and more remote than the high islands. **Coastal inundation** in the atolls damages agricultural techniques like maintaining patches for taro, a traditional backup food to more seasonal crops such as breadfruit. Formerly self-sustaining outer island atoll communities, which still rely on these traditional crops, instead must import food and water, which require cash and increases reliance on a tenuous supply chain.

Extreme Weather Events and Food Insecurity

Increases in sea level, strong winds, ocean temperature rises, and ocean acidification also impact fisheries that depend on coral reef ecosystems, mangroves, and wetlands that protect villages and communities from storms and flooding. Extreme weather events damage maritime, air, and telecommunications infrastructure upon which FSM depends for food, water, energy, and emergency services. Since 1981, there have been at least 212 tropical cyclones in the FSM, with 37 being Category 3 or higher. In 2015, Typhoon Maysak wiped out 90 percent of the key agricultural stock of Chuuk and Yap, affecting 29,000 people and causing $8.5 million USD in damages. Direct damage from tropical storms and typhoons is often accompanied by damage from ensuing landslides in the high islands and saltwater contamination of land and water. Climate projections for the North Pacific region where the FSM is located anticipate a decrease in frequency of tropical cyclones (low confidence) and an increase in storm intensity.

Drought

Despite typically frequent and intense rainfall, drought is a pressing climate risk in FSM in part due to limited rainwater catchment capacity and groundwater resources. FSM's rainfall is influenced by the El Nino-Southern Oscillation (ENSO), with historical data showing that ENSO events are commonly associated with subsequent droughts, particularly in the western regions such as Yap and Chuuk state. Droughts threaten both water and food security, harming traditional crops such as taro, breadfruit, bananas, and coconuts. Increasingly, longer than usual droughts of higher intensity are followed by heavier than usual rainfall events, accelerating erosion and the deterioration of critical infrastructure. The frequency of extreme hot weather days is anticipated to increase in line with average temperature levels, a challenge in a place where air conditioning is often a luxury not available to many.

Republic of Palau

Severe Typhoons, Sea Level Rise and Coastal Flooding

Sea-level rise and coastal flooding create significant challenges for Palau, particularly in the low-lying islands, in the past decade, typhoons and storms have increased the frequency of overwash events and storm surges that have shut down electricity, sewage, and water access, amongst other consequences. Even in a low emissions case, by 2090, Palau is projected to see sea levels rise by between 15 and 46 centimeters. As other island nations do, Palau relies on their coastline for their way of life.[167]

A December 2008 coastal flooding disaster in Palau is emblematic of future climate-related disruptions. Residents awoke to damaged infrastructure, flooded communities, and freshwater aquifers filled with salt. That coastal flood destroyed approximately 60 percent of the island's crops, and food systems took years to rebuild.[168]

Despite climate science predicting a slight decline in the frequency of storms, cyclones, and typhoons near Palau, the cyclones that will strike are expected to be stronger in terms of wind, storm surge, and rainfall. Rising sea levels and diminished coral cover weaken Palau's protection from intense storms. In 2021, Typhoon Surigae caused over $4.8 million USD worth of damage to Palau, with 100 percent of outer island residents affected by the storm.[169] Water and telecommunications access were lost for days during the immediate aftermath, complicating government communications and disaster awareness alerts for civilian response.[170]

Sea-level rise also exacerbates the risks of saltwater intrusion into freshwater sources, as well as agricultural productivity. Palau's locally grown agriculture accounts for $9.3 million USD annually, 3.2 percent of national GDP, and 3.8 percent of the nation's workforce.[171] The flooding, soil erosion, and salination wrought by climate change on agricultural lands has outsized impacts on the local economy, workforce, and food security. Local crops such as taro patches also provide natural barriers to climate change; in addition to their cultural significance,they protect sedimentation from contaminating coral reefs. The increased frequency

[167] Mulhern, Pwen. "Sea Level Rise Projection Map - Palau." Earth.Org, August 4, 2020. https://earth.org/data_visualization/sea-level-rise-by-2100-palau/.
[168] Ibid.
[169] Woody, Todd. "How an Ancient Island Culture Copes With Climate Change." Bloomberg, November 17, 2022. https://www.bloomberg.com/features/2022-palau-pacific-islands-sea-level-cop27/.
[170] Carreon, Bernadette. "The Typhoon That Hit My Island Didn't Make the News. This Is What the Climate Crisis Looks Like." The Guardian, April 23, 2021, sec. World news. https://www.theguardian.com/world/2021/apr/23/the-typhoon-that-hit-my-island-didnt-make-the-news-this-is-what-the-climate-crisis-looks-like.
[171] "What Do Extreme Weather and Climate Change Mean for Palau's Key Sectors?" Climate Change in Palau. East-West Center, 2020. https://www.jstor.org/stable/resrep28813.8.

and severity of sea level rise and its impacts poses a significant threat to local agriculture, food security, and the economy as a whole.[172]

Drought

Sea-level rise begets drought risk in Palau, as changing precipitation patterns and higher temperatures exacerbate water scarcity and stress freshwater supplies. Droughts –more frequent and severe in recent years due to reduced rainfall and increased evaporation– heighten threats to agriculture, livelihoods, and public health.

Climate change's rising temperatures will also put pressure on demand, even as supplies become scarcer and the freshwater lens across Palau requires more time to recharge from precipitation opportunities. Sea-level rise is also impacting sedimentation patterns, as poor erosion control and saline overwash put freshwater lenses at risk. Currently, the islands of Angaur, Peleliu, and Kayangel already require salination filtration systems due to the high levels of salinity within their freshwater aquifers.

Droughts also have significant public health implications. In 2016, the Palau Ministry of Health and Human Services reported increased cases of diarrhea, pink eye, and other water-borne diseases.[173] Limited freshwater availability during drought makes it challenging for communities to access potable water, amplifying the risks of malnutrition, food insecurity, and illnesses associated with contaminated water sources. Additionally, mosquitos and other disease vectors thrive in drought conditions, increasing the risk of dengue, malaria, and other illnesses. These diseases strain hospital resources already struggling to meet patient needs due to other water-driven health vulnerabilities.

Republic of the Marshall Islands

Sea Level Rise

Sea-level rise in the RMI presents a danger of both heightened water insecurity and severe land loss. The average elevation in RMI is two meters above sea level. If sea levels rise by one meter, up to 40 percent of infrastructure on Majuro could be submerged.[174] The threat to housing is most imminent on Majuro, and Ebeye, the most densely populated island in the Pacific. Sea level rise has also reduced the available groundwater supply by increasing salinization in the freshwater lenses, as well as destroyed crops and threatened housing and infrastructure.

[172] Woody, Todd. "How an Ancient Island Culture Copes With Climate Change." Bloomberg, November 17, 2022. https://www.bloomberg.com/features/2022-palau-pacific-islands-sea-level-cop27/.
[173] "Drought Report." Republic of Palau, June 2016. https://www.palaugov.pw/wp-content/uploads/2017/06/Drought-Report-Final.pdf.
[174] ReliefWeb. "Sea Level Rise Threatens The Existence Of The Marshall Islands," July 11, 2023. https://reliefweb.int/report/marshall-islands/sea-level-rise-threatens-existence-marshall-islands.

Flooding

Typhoons and tsunamis threaten population security and cause damage to infrastructure and housing. Although typhoons and tsunamis are projected to occur less frequently, they are expected to occur with greater intensity and unpredictability. Overwash events also threaten lives, given the proximity of houses to the coastline.[175] On January 20, 2024, a rogue wave on Roi Namur caused the evacuation of 80 of Roi Namur's 120 residents.[176] The wave destroyed the chapel, and damaged living quarters, a cafeteria, movie theater and an automotive repair shop. It also temporarily rendered the runway on Roi Namur unusable and interrupted fuel and water service to the small island of Enniburr. Additionally, flooding incapacitates aquifers, contaminates the groundwater fresh lens, and renders limited freshwater non-potable. A 2018 DoD Strategic Environmental Research and Development Program Report found flooding would destroy Kwajalein's aquifers, make potable groundwater unavailable, and render the islands uninhabitable between 2035 and 2065. Lack of clean water access causes increased rates of diarrhea, waterborne illness, and deficient hygiene. Flooding and saltwater intrusion destroy crops and amplify food insecurity. Although agriculture is not a large GDP contributor, it is essential to residents of remote outer islands.

Drought and Extreme Heat

Drought limits potable water supplies and endangers crop vitality. Although El Niño has reached its zenith, its consequences, notably the exacerbation of drought conditions, are expected to persist in the ensuing months.[177] Drought has directly impacted the nearly 80 percent of Marshallese who depend on rainfall for water supply. The Drought Monitoring Report released on February 27, 2024, has stated RMI has experienced a "deteriorating drought condition" since January 2024.[178] Majuro and Jaluit have been characterized as abnormally dry.[179] Kwajalein Atoll and Wotje Atolls have been characterized as severe.[180]

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[175] Devlin, Michelle. SIPA Capstone Team Interview, March 28, 2024.

[176] Brantley, James. "Operation Roi Recovery Assesses Damages to Roi-Namur Infrastructure in Kwajalein Atoll." U.S. Indo-Pacific Command, January 23, 2024. https://www.pacom.mil/Media/News/News-Article-View/Article/3654035/operation-roi-recovery-assesses-damages-to-roi-namur-infrastructure-in-kwajalei/https%3A%2F%2Fwww.pacom.mil%2FMedia%2FNews%2FNews-Article-View%2FArticle%2F3654035%2Foperation-roi-recovery-assesses-damages-to-roi-namur-infrastructure-in-kwajalei%2F.

[177] Climate Centre. "'No Rain for Three Months in Some of the Marshall Islands' – Red Cross Red Crescent Climate Centre," March 12, 2024. https://www.climatecentre.org/13422/no-rain-for-three-months-in-some-marshall-islands/.

[178] ReliefWeb. "Drought in Republic of Marshall Islands 2024 - DREF Operation MDRMH004," March 11, 2024. https://reliefweb.int/report/marshall-islands/drought-republic-marshall-islands-2024-dref-operation-mdrmh004.

[179] Pacific Island Times. "Severe Drought Causing Water Contamination and Health Concerns in Marshall Islands," March 13, 2024. https://www.pacificislandtimes.com/post/severe-drought-causing-water-contamination-and-health-concerns-in-marshall-islands.

[180] ReliefWeb. "Drought in Republic of Marshall Islands 2024 - DREF Operation MDRMH004," March 11, 2024. https://reliefweb.int/report/marshall-islands/drought-republic-marshall-islands-2024-dref-operation-mdrmh004.

A combination of drought, extreme heat, irregular rainfall and increasing soil salinity has heightened food insecurity. Yields and nutritional values of bananas, breadfruit, coconuts, limes, pandanus, swamp taro, tomatoes and watermelon have fallen. Tapioca can no longer be grown on Ailuk, and breadfruit in Wotho is ripening two months early and rotting quickly in dry years.[181] This creates a secondary driver of increased health problems. To replace such staples, people have turned to less nutritious imported food. Over 90 percent of Ebeye's nutrition is imported, and processed. In Majuro, 53 percent of men and 70 percent of women are obese.[182] Marshallese rely on regular shipping to deliver the vast majority of its calories. In Ebeye, the population's diet depends on the operability of a single pier. Drought has also contributed to rising cases of dengue fever, Zika virus and cholera.[183] Extreme heat negatively impacts health by preventing exercise, and there is a high risk of heat-related illnesses, especially to elderly and children.[184]

Rising Ocean Temperatures

Water is warming faster in western Pacific than anywhere else in the world. Rising ocean temperatures have forced tuna schools to migrate farther away from RMI. Coral bleaching has destroyed fish habitats, and ocean acidification has killed off smaller sea animals that larger fish feed on. Fishers on all atolls in RMI have reported declining catches and increased difficulty catching fish. Venturing farther offshore is more costly and more dangerous given unpredictable weather patterns.

The loss of tuna as a dietary staple has dire consequences for health. Tuna, once the lone lean protein in the diet, has been replaced with canned meat and cheap carbohydrates. Fishing is integral to the economy, as a primary source of GDP in RMI. It has also come under attack from China's illegal distant water fishing fleet, which in 2020 mustered 2,701 ships, the largest in the world. From 2015 to 2019, China committed more illegal, unreported, and unregulated fishing incidents than any other country in the world.[185] If the global temperature rises 1.5 degrees, the Intergovernmental Panel on Climate Change estimates between 70 and 90 percent of coral reefs will be lost due to subsequent ocean warming. This would further exacerbate erosion and flooding in the RMI.[186]

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[181] International Organisation for Migration, Jo-Jikum, Marshall Islands Conservation Society. My Heritage Is Here: Report on Consultations with Communities in the Marshall Islands in Support of the Development of the National Adaptation Plan. The University of Melbourne and Women United Together Marshall Islands, 2023. https://www.iom.int/sites/g/files/tmzbdl486/files/documents/2023-11/nap_marshallislandsresearch_report_v1.pdf.

[182] Ahlgren, Ingrid, Seiji Yamada, and Allen Wong. "Rising Oceans, Climate Change, Food Aid, and Human Rights in the Marshall Islands." Health and Human Rights Journal 16, no. 1 (2014): 69–80.

[183] "National Adaptation Plan: Responding to the Impact of Climate Change." World Bank PREP II Project, October 20, 2023. https://rmigov.com/RMI-NAP-2023.pdf.

[184] Devlin, Michelle. SIPA Capstone Team Interview, March 28, 2024.

[185] Grossman, Derek. Chinese Strategy in the Freely Associated States and American Territories in the Pacific: Implications for the United States. Before the Committee on Natural Resources, Subcommittee on Indian and Insular Affairs, U.S. House of Representatives: RAND Corporation, 2023. https://doi.org/10.7249/CTA2768-1.

[186] IPCC. "Summary for Policymakers." In Global Warming of 1.5 oC. An IPCC Special Report on the Impacts of Global Warming of 1.5 oC Above Pre-Industrial Levels and Related Global Greenhouse Gas Emission Pathways, in

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Abiad, Hatem, Mara Langevin, Tiare Eastmond, and Andrea Cecchi. "Republic of the Marshall Islands - Disaster Management Reference Handbook." Center for Excellence in Disaster Management and Humanitarian Assistance (CFE-DM), December 2022. https://www.cfe-dmha.org/LinkClick.aspx?fileticket=GEzceMcF7Q8%3d&portalid=0.

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After Fully Passing U.S. Congress, President Biden Has Just Signed the Amended Compact Act of 2023 into Law. H.E. President Wesley W. Simina Addresses the Nation with the Official Announcement - Providing Important Updates and next Steps. Facebook, 2024. https://www.facebook.com/piofsm/videos/after-fully-passing-us-congress-president-biden-has-just-signed-the-amended-comp/758847759721035/.

Ahlgren, Ingrid, Seiji Yamada, and Allen Wong. "Rising Oceans, Climate Change, Food Aid, and Human Rights in the Marshall Islands." *Health and Human Rights Journal* 16, no. 1 (June 2014): 69–80.

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