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# State and Trends in Adaptation Report 2025

Small Island Developing States





# Executive Summary

## Increasing the Resilience of Small Island Developing States

### INTRODUCTION

#### Why Focus on Small Island Developing States

Previous reports in the State and Trends in Adaptation series from the Global Center of Adaptation (GCA) have focused on Africa, describing in detail the challenges countries face because of climate change, and the huge benefits that can be gained from measures to reduce carbon emissions, to better adapt to the impacts of climate change, and to improve resilience.

This report expands GCA's deep analysis to a group of nations that typically gets less attention from the global climate change and adaptation communities – the Small Island Developing States.

These 39 small island countries are enormously diverse. Home to 65 million people, they are found in oceans all across the globe, in the Caribbean; the Pacific; and the African, Indian Ocean, and South China Sea (see Box 1). Some are comprised of low-lying islands, formed by coral atolls that rise above the ocean waves, such as the 32 atolls that make up the Republic of Kiribati in the Central Pacific Ocean. Others contain towering peaks, such as the 3,101 m mountain Pico Duarte in the Dominican Republic in the Caribbean. These nations are home to diverse and unique cultures.

These countries are also biologically rich and varied, harboring 40% of the world's vital coral reef

ecosystems and 20% of total global biodiversity. Some countries are heavily dependent on tourism, such as Fiji, where visitors are responsible for more than 40% of the country's gross domestic product (GDP). Others produce valuable commodities for international markets. Off the coast of southeastern Africa, for example, the 800,000 people on Comoros grow vanilla, cloves, and a plant called ylang-ylang, which provides essential oils for perfumes, lotions, and soaps.

However, these diverse nations face many common challenges. The most urgent is their extreme vulnerability to the consequences of climate change. Even though the 39 nations have done virtually nothing to cause the climate crisis – their collective greenhouse gas emissions add up to less than 1% of the global total – they are disproportionately likely to suffer from its impacts. Rising seas threaten to submerge communities in the Maldives and Marshall Islands, among many others, while increasingly powerful storms are taking an enormous human and economic toll, destroying or damaging ports, roads, hotels, airports, and other critical infrastructure from Tuvalu to Grenada. In 2017, Tropical Cyclone Maria destroyed most of the infrastructure in Dominica, for example, causing estimated damages of nearly \$1.5 billion, 225% of the nation's annual GDP.

Overall, the analysis conducted for this report shows that, without immediate steps to build resilience and





Photo: Vlad Sokhin/Panos Pictures

adapt to the impacts of climate change, the total damages across all the countries could climb to as much as \$476 billion by 2050, creating a huge drag on the nations' economic development, reversing years if not decades of economic progress in these nations.

Moreover, this vulnerability to climate change is exacerbated by the challenging financial conditions in many of the nations. The financial indicators in more than 70% of them show impending or deepening debt crises. Seven countries are already nearing "debt distress," with debt-to-GDP ratios of more than 100% putting them on the verge of being unable to fulfill their financial obligations. Eight more are considered to be "highly indebted."

As a result, many small island nations are unable to make the investments in capacity-building, adaptation, and resilience that are necessary to protect their people and economies in an uncertain future. Nor have they been getting much help from the global finance community. Taken together, the

39 nations now receive barely \$2 billion per year in international public climate finance for adaptation. That is a miniscule share – only 0.2% – of total global climate finance. Moreover, two-thirds of that is going to only 10 of the 39 small island nations, leaving the others far behind.

### **The Opportunity to Build Resilience**

The challenges are daunting, but there are compelling reasons for hope. These island nations can significantly increase their resilience in the face of climate change, dramatically cutting losses from climate impacts while also laying stronger foundations for development and reducing greenhouse gas emissions.

Indeed, considerable progress has already been made, thanks to high-level leadership and commitment, remarkable innovation, and, in some cases, indigenous knowledge. Examples abound of successful efforts: creating innovative climate insurance models and installing solar-powered water pumps in Vanuatu; powering schools and community



**Box 1. List of Small Island Developing States Analyzed in this Report, by Region**

**Caribbean**

Antigua and Barbuda  
Bahamas  
Barbados  
Belize  
Cuba  
Dominica  
Dominican Republic  
Grenada  
Guyana  
Haiti  
Jamaica  
St Kitts and Nevis  
Saint Lucia  
St Vincent and the Grenadines  
Suriname  
Trinidad and Tobago

**Pacific**

Cook Islands  
Federated States  
of Micronesia  
Fiji  
Kiribati  
Nauru  
Niue  
Palau  
Papua New Guinea  
Marshall Islands  
Samoa  
Solomon Islands  
Tonga  
Tuvalu  
Vanuatu

**Atlantic, Indian Ocean,  
and South China Sea**

Cabo Verde  
Comoros  
Guinea Bissau  
Maldives  
Mauritius  
São Tomé and Príncipe  
Seychelles  
Timor-Leste



Photo: Jocelyn Carlin/Panos Pictures

centers in the Marshall Islands with solar arrays and battery back-ups; restoring mangrove forests in the Dominican Republic's Manglares del Bajo Yuna National Park; climate-proofing the vital West Coast Road in Samoa; cleaning plastic debris from marine sanctuaries in Palau as part of an educational curriculum; and cutting fuel costs by \$500,000 per year with 70 electric buses in Bermuda.

This report documents how increased investments in such adaptation measures, along with international efforts to reduce debt, will bring dividends many times higher than the costs. GCA conducted a detailed macroeconomic analysis of six island states, covering all three regions and different climate scenarios, using a Green Economy Model and multiple databases of assets and economic activities in these nations. That analysis shows that each dollar invested in adaptation and resilience measures has a multiplier effort, generating as much as \$6.50 in avoided damages and new growth opportunities.

In addition, the investments required are relatively modest when compared with the total global economy and development flows. They would add up to an annual average of \$12 billion across all 39 nations. That represents just 1.2% of current global climate finance.

In this report, GCA lays out a roadmap for increasing adaptation funding and local capacities, identifying and implementing adaptation and resilience opportunities, building stronger communities, reducing inequities, and empowering youth entrepreneurship. It describes in detail the climate risks faced by the Small Island Developing States, the opportunities to increase adaptation finance and reduce debt, and the measures needed to combat coastal erosion and improve the sustainability of two crucial parts of the "blue" economy: tourism and fisheries.

The report reinforces the fundamental truth that adaptation brings three forms of benefits. Not only does successful adaptation help avoid major losses from climate shocks, it also brings important economic benefits for communities and nations, financial benefits for businesses, and substantial environmental and social benefits, particularly for the most vulnerable. Adaptation

thus should not be seen as being separate from the development paths of small island nations, but rather as being integral and essential to economic growth and prosperity.

The report also takes a deep dive into four vital sectors: transport, energy, water, and agriculture. Finally, it examines issues that cut across multiple sectors, such as strategy, planning, and governance; institutional capacity; nature-based solutions; and the need to educate and empower young people.

Until now, international adaptation and mitigation efforts have paid insufficient attention to these vulnerable island nations. This report is an effort to redress that failure. It highlights the challenges these countries face as the planet warms, and provides concrete solutions.

### **Climate Risks: Large and Increasing**

Small island nations have always faced perils from tropical cyclones, storm surges, floods, and droughts that are greater than those in many other, less exposed, countries. But now, the danger is increasing even more because of climate change. Even if the world stays below the Paris Agreement target of 1.5°C warming above pre-industrial levels, the consequences for small island nations will be enormous, and indeed are already being felt.

Climate change is raising ocean temperatures, providing additional fuel for stronger and stronger cyclones and hurricanes (see Box 2). It is also causing

#### **Box 2. Destruction in Dominica Fueled by Climate Change**

In September 2017, Hurricane Maria became one of the most rapidly intensifying storms in recent history, strengthening from a tropical storm to a Category 5 hurricane in just 24 hours. Slamming into Dominica, the tempest killed more than 30 people and destroyed most of the island's infrastructure, with losses adding up to 226% of the country's 2016 GDP.

Climate change made a hurricane such as Maria nearly five times more likely to occur, one study showed. In response, Dominica has established the Climate Resilience Execution Agency for Dominica to build resilience.



sea levels to rise. Between 2030 and 2050, sea levels are expected to climb by 5–10 cm, doubling the frequency of floods in the Indian Ocean and Tropical Pacific nations. In the Caribbean, sea levels are projected to rise by 1 m by the end of this century, which could be catastrophic for many coastal communities.

Higher sea levels are already making storm surges more deadly, flooding communities, destroying shorelines and coastal infrastructure, and damaging the coastal ecosystems that provide both biodiversity and protection from storms. If the world fails to curb climate emissions (as in the Intergovernmental Panel on Climate Change high-emissions RCP8.5 scenario), some Pacific atoll islands are likely to be submerged under wave-driven flooding by the 2060s, threatening their very existence. One country, Kiribati, has bought 6,000 acres of property in Fiji as a possible new homeland for communities displaced by rising seas.

Higher ocean temperatures are also devastating coral reefs through a process called coral bleaching. Bleaching has already severely impacted Fiji, Palau, and Vanuatu in the Pacific; Comoros, Mauritius, and Seychelles in the Indian Ocean; and the Bahamas in the Caribbean. Now, climate change is making the problem worse. Models suggest that severe bleaching events could occur every year in parts of the Pacific by 2040, and a global temperature rise of 2°C could result in the loss of 99% of the world's corals. That would be a crippling blow not just to global biodiversity, but also to the key economic drivers of most small island nations: fisheries and tourism.

Another major climate-related threat to small island nations is the increasing severity (and perhaps frequency) of drought. Dependent on rainfall to recharge aquifers, streams, and other sources, they have some of the most threatened freshwater resources on the planet. In just one example, a drought in Vanuatu in 2015–2016 forced households to rely on tiny amounts of contaminated water left at the bottom of their domestic water tanks, increasing the incidence of disease. Climate models show that a 1°C increase in temperature (from 1.7°C to 2.7°C over pre-industrial levels) could put 60% more people in small island nations at risk of severe water shortages.

The inescapable impacts of climate change on these nations are already causing widespread death and destruction. Between January 2014 and August 2024, more than 34 million people were affected by disasters linked to storms, droughts, or floods. In just the first eight months of 2024, extreme weather events killed 58 people and harmed 707,000.

Climate change will make these impacts even more threatening, increasingly putting economies, livelihoods, health, ecosystems, cultural heritage, and indigenous knowledge at risk.

One crucial step for increasing the resilience is improving climate services, which provide the essential climate information needed for better decision-making in sectors vulnerable to climate variability and change. Those sectors include agriculture, water resources, disaster management, and public health. While small island nations have made notable progress in developing and implementing climate services, much work still lies ahead. Currently, only 62% of Small Island Developing States provide climate services at a basic or essential level, according to the World Meteorological Organization, and only 25% provide these services at a full or advanced level. All 24 of the Small Island Developing States for which information is currently available have considerable gaps in their meteorological observation networks.

In addition, only 39% report that they have multi-hazard early warning systems (MHEWS) in place. This proportion is considerably lower than the global average of 52%, and is also worse than that for the Least Developed Countries at 46%. While the historical trend is clearly positive, with only five having MHEWS in 2015, there is a clear need to expedite support to small island nations for these systems.

## INCREASING FINANCE FOR ADAPTATION

### Realizing Major Macroeconomic Benefits from Adaptation Investments

To quantify the level of investment in adaptation measures needed to reduce climate risks in small island nations and to estimate the resulting benefits, GCA undertook a rigorous macroeconomic analysis of six representative countries: the Comoros, Maldives, and Mauritius in the Indian Ocean; Fiji and the Marshall Islands in the Pacific; and Barbados in the Caribbean.

The analysis used a Green Economy Model and reliable, comprehensive, open source databases to calculate costs and benefits under different climate scenarios and socioeconomic pathways.

The results show that adaptation investments are remarkably cost effective. As detailed in the climate risks section, small island nations are particularly vulnerable to climate impacts, not just because of their geographic locations, but also because their economies are highly dependent on tourism and trade. A severe storm that destroys or damages such critical infrastructure and assets as ports, hotels, and pristine beaches can therefore cripple economies for months or years after the event. Even if the world limits the global temperature rise to 1.5°C, the GCA modeling shows that small island nations will suffer climate-related losses of more than \$200 billion by 2050. Overshooting that target, as seems increasingly likely, will more than double that economic toll, to up to \$476 billion. These costs will be especially onerous for small island nations because of their already high levels of debt (see Box 3).

Using a bottom-up approach to calculate adaptation needs and benefits, the modeling shows that an investment of between \$54 billion and \$127 billion will cut climate damage as a share of GDP for these countries by more than 50%. Even using a discount rate of 10%, the benefit-to-cost ratio is surprisingly high at 6.5 for the Maldives and 5.6 for Barbados.

Overall, the benefits are 3.53–15.73 times larger than the costs, depending on the climate scenario and specific adaptation investment. Constructing or retrofitting roads and buildings to withstand fiercer storms is expensive, for example, with a lower return on investment. In contrast, expanding renewable energy, such as distributed solar photovoltaic generation, is particularly cost-effective because of the multiple benefits it provides. In addition to improving climate resilience, renewable energy replaces expensive fossil fuel imports and cuts energy spending, slashes air pollution and greenhouse gas emissions, and improves health. Similarly, resilience measures that improve economic and labor productivity, such as climate-smart agriculture and air-conditioned workplaces, also have high returns.

The key message: GCA's macroeconomic analysis shows that adaptation investments in the 39 Small Island Developing States are enormously cost-

### **Box 3. Breaking the Cycle of Debt and Vulnerability**

Forty percent of small island nations are already highly indebted or nearing debt distress. More than 70% show evidence of impending or deepening debt crisis.

Now, climate change is making this problem even worse. Every new disaster not only brings immediate devastation, it also undermines each nation's future abilities to respond and pushes it further into debt.

It is crucial to break this deadly cycle of debt and vulnerability. This report recommends actively exploring ways to provide debt relief, including through debt-for-resilience swaps, with an aim to reduce the nations' total debt from the current level of \$153.75 billion to \$81.65 billion. That would also cut the annual cost of debt servicing from \$12.34 billion to \$9.39 billion. A comprehensive approach could include parametric insurance to cover immediate losses in a disaster, debt swaps to aid medium-term recovery, and blue and green bonds as an alternative to traditional loans. The bonds would be used to build more robust and resilient infrastructure, such as storm-resistant housing and sea walls, and to support sustainable efforts such as renewable energy projects, reforestation, and biodiversity conservation. The long-term goal is to reduce economic losses from disasters and enable recovery without resorting to debt.

One potential model for debt relief is the United States "Brady Plan" for Mexico in 1989, which offered debt restructuring options and led to stronger economic growth.

effective, highlighting the urgent need to begin making those investments now while also tackling the debt crisis.

### **Closing the Finance Gap**

Unfortunately, existing frameworks for climate and development finance are falling far short of the need in these highly vulnerable countries.

The 39 Small Island Developing States are receiving just over \$2 billion annually in international public climate finance, with 67% going to just 10 countries. The amount needs to be increased at least six-fold to \$12 billion and spread more widely among all the countries, based on their own estimates.

Moreover, too much – 44% – of the public international finance that small island nations receive is in the form of debt, adding to their already unsustainable debt levels.

Small Island Developing Nations are united in a vision of a more resilient future. In May 2024, the nations adopted the Antigua and Barbuda Action Plan, which highlights the importance of scaling up and enabling access to finance for adaptation. The amounts needed are relatively small – a total of \$12 billion per year – which represents only 1.2% of all current global climate finance.

However, substantial barriers stand in the way of providing this urgently needed support. Many climate finance mechanisms are not designed with small island nations in mind, nor do they take into account the unique situations and needs of the island nations.

In addition, many nations lack the institutional capacity to measure and report physical climate risks, track adaptation financing, and transparently report that financing. Further constraints include the long distances between island nations and major global markets, which hamper trade; high finance transition costs; and the lack of historical climate data.

The largest adaptation finance needs are in improving water resources and sanitation, improving food and economic security through more productive agriculture and sustainable fisheries and forestry, making infrastructure more resilient to climate impacts, providing insurance to cover rebuilding after disasters, and increasing the attractiveness of private sector investments in small island nations.

Some small efforts are underway. Given the importance of beautiful beaches and shorelines for the tourist industry, for example, a company called Reefscapers has been able to raise funds from both international hospitality businesses and small donors to restore coral reefs in the Maldives. In Fiji, a private sector company, Matanataki, has created an investment fund, supported by multilateral banks, conservation groups, and others, to provide finance and technical support to improve resilience in waste management, fisheries, agriculture, and tourism. And in Tonga, the World Bank has launched the Safe and Resilient Schools Project. Box 4 describes the African Adaptation Acceleration Program.

These examples show what is possible, but the effort needs to be ramped up dramatically. GCA recommends a six-fold increase in adaptation finance overall. In particular, since multilateral development finance institutions now provide most (60%) international public adaptation finance for small island nations, contributions from international governments and multilateral climate funds must increase. In addition, the opportunities for larger private investments in adaptation markets, goods, and services are enormous; such investments are indispensable for enhancing the resilience of island nations. The finance must be accompanied by support to island nations' governments to identify key gaps and barriers, and better track adaptation financing.

### Strengthening the Blue Economy

The small island nations are renowned for their spectacular beaches, lagoons, coral reefs, mangrove forests, and other natural resources. These resources not only support some of the world's richest and most biodiverse ecosystems, but also create a "blue economy", which is essential for the nations' economic health and future growth.

Climate change is a growing threat to this blue economy. In the Caribbean alone, island nations are

#### Box 4. Creating an Adaptation Acceleration Program

An Africa-owned and -led program called the African Adaptation Acceleration Program has successfully mobilized billions of dollars to support climate-smart agriculture, youth entrepreneurship, nature-based solutions, and many other adaptation measures in Africa.

GCA proposes a comparable initiative for the Small Island Developing Nations. The program would work with national and regional organizations to strengthen capacities and mainstream the best adaptation and resilience science into policies and practices. It would also aim to unleash the potential of the private sector to implement adaptation and resilience measures, such as developing and strengthening ports and roads, and growing the tourism economy. Such a program would provide more opportunities for adaptation interventions, which then could be supported by international climate finance.



projected to lose up to 3,900 km<sup>2</sup> of land to rising seas and erosion by 2050, with estimated economic losses of \$406 billion to \$624 billion. Higher ocean temperatures and ocean acidification are bleaching coral reefs and harming highly productive coastal and marine ecosystems, threatening economically valuable fisheries. Extreme storms damage hotels and resorts, keeping tourists from visiting for months afterward.

It is necessary, therefore, for small island nations to slow and prevent coastal erosion, and to better protect the two key industries in the blue economy: tourism and fisheries.

### **Combating Coastal Erosion**

Coastal ecosystems are being threatened by sea level rise, destructive practices such as poorly regulated sand mining, more powerful waves, and more extreme storms. The resulting losses are taking a huge human and economic toll. A World Bank study estimated that coastal degradation in Benin, Côte d'Ivoire, Senegal, and Togo adversely affected 1.4 million people in 2020. It also caused 13,000 deaths per year, the study estimated. In a worst-case scenario, the disappearance of sandy beaches in Mauritius could cost the nation \$100 million per year by 2060 in lost tourist revenue. And in Jamaica, the loss of mangrove forests, which protect coasts from storms and waves, would increase damages to residential and industrial property by nearly 24%, or more than \$33 million annually, the World Bank estimates.

There is an urgent need, therefore, for island nations to first understand and monitor the extent of coastal degradation, using such tools as citizen science monitoring and geospatial analysis. Then they must work to preserve or expand existing ecosystems, such as by restoring mangroves and coastal wetlands, and revegetating dunes. In some cases, it may be cost effective to counteract beach erosion with extensive beach nourishment projects and seawalls, as the Maldives has done to protect its tourism industry. In others, managed retreat may be the only viable long-term solution, which will require effective and collaborative planning by communities and governments.

### **Protecting and Growing Tourism**

Tourism-related revenues are central to the economic development and survival of small island nations.

In 2023, tourism was responsible for 12.6% of their GDP, about three times higher than the average in developed economies.

The extreme weather events exacerbated by climate change threaten this economic driver, causing both immediate and long-lasting effects. When Cyclone Pam hit Vanuatu in 2014, for example, the tourism sector suffered 26% of the total losses, and most major hotels were forced to close for three to six months to repair the damages. Moreover, storms can harm tourism even when there is no actual damage. After hurricanes Maria and Irma cut a destructive swath across one-third of Caribbean islands in 2017, the number of visitors to the remaining undamaged islands dropped by hundreds of thousands.

The tourism sector is also under threat from slow-onset climate impacts, such as sea level rise, heatwaves, coral bleaching, and ocean acidification.

The governments of Small Island Developing States can play a critical role in protecting this valuable industry. They can work to enhance the resilience of resorts and other supporting infrastructure, conserve and restore natural ecosystems, and improve disaster risk management and insurance. Top priorities include identifying disaster and climate risks, making sure that new developments and investments are more resilient, creating plans and actions for disaster recovery, and developing climate adaptation plans that will increase long-term sustainability.

Another effective strategy is diversifying tourism by offering opportunities away from the coasts, such as inland adventures and cultural heritage tours. In one successful example, Jamaica has leveraged its rich cultural and musical heritage to draw tourists to attractions such as the Bob Marley Museum, historical Maroon communities, and reggae festivals.

### **Making Fisheries Sustainable**

Fisheries are also essential for the economies of small island nations. They provide food, export revenue, and income, and contribute to the culture of both rural and urban communities. The total catch has grown significantly since the 1990s, peaking at nearly 2 million tons in 2019, more than half of which is tuna and tuna-like species taken from marine waters. About half of the fish are exported, with a value of about \$3 billion in 2022.

This industry is being threatened by both climate change and overfishing. Higher temperatures and ocean acidification are damaging coral reefs and other crucial habitats, for example. Under the high-emissions climate scenario (RCP8.5), fish harvests in the Pacific could drop by 20% by 2050 and up to 50% by 2010. Moreover, an estimated 75% of Pacific Island communities dependent on coastal fisheries will be unable to meet their food security needs by 2030.

To improve the resilience of the fishing industry, countries should set limits on fishing based on changes in the distribution and abundance of commercial species; diversify livelihoods; leverage Marine Protected Areas as an adaptation measure; integrate aquatic food systems in Nationally Determined Contributions (NDCs); and continue investing in research to better understand the impacts of climate change on fisheries. The commitment to protect 30% of the planet's oceans by 2030 will be an invaluable tool to adapt fisheries to a rapidly changing climate.

## INCREASING THE RESILIENCE OF KEY SECTORS

### Transport

Transportation networks in small island nations are highly vulnerable to natural hazards and the growing impacts of climate change. Hurricanes, floods, storm surges, and other disasters can destroy roads, most of which are built in the low-elevation coastal zones, and cause crippling damage to airports and seaports.

These impacts have enormous consequences, especially when maritime transport is disrupted. In the Pacific, for example, Kiribati imports 90% of its fuel through its seaports, and Fiji, Kiribati, the Marshall Islands, the Federated States of Micronesia, Nauru, Palau, Samoa, the Solomon Islands, Tonga, and Tuvalu are all heavily dependent on imported food.

However, the ports in many countries are not designed to withstand climate change impacts. Many also lack proper and timely maintenance, increasing their vulnerability. The damage to Vanuatu's main seaport from Tropical Cyclone Pam in 2015, for example, caused \$10.08 million in revenue losses from canceled departures of cargo and cruise ships.

Airports are also at risk. Tuvalu relies heavily on its Funafuti International Airport to deliver badly needed aid when disasters strike, but the runway does not meet climate-resilient design standards, leading to blistering and pavement heaving that prevents flights from landing safely.

Countries thus must not only upgrade roads, bridges, runways, ports, and other transport infrastructure, but also mainstream climate resilience into the design, maintenance, and operation of all transport projects. In some promising examples, Tuvalu is constructing safer and more resilient harbors on the outer islands of Nanumaga and Nukufetau in locations less exposed to climate events, and the Pacific Climate Resilient Transport Program aims to improve the climate resilience of 140 km of roads, 10 bridges, and 6 maritime ports in Fiji, Kiribati, the Federated States of Micronesia, Samoa, Tonga, Tuvalu, and Vanuatu.

### Energy

Small Island Developing States historically have had two serious energy challenges: high electricity costs and heavy dependence on imports of fossil fuels. Customers in Monserrat pay up to \$0.60/kWh, for example, more than three times the average price in the United States, and they spend 5–10% of their GDP on imported fuel, straining their economies and putting them at risk of volatility in global markets. The high energy costs have ripple effects throughout the economies, raising the costs of everything from providing tourism services to growing and processing crops.

Now, climate change is exacerbating these problems. The typical pattern of generating electricity at centralized fossil fuel powerplants and delivering that electricity with overhead transmission lines makes the island countries' energy systems particularly vulnerable to increasingly severe storms.

The best solution is replacing imported fossil fuels with clean, domestic, and cheaper sources of energy. The many benefits include greater resilience, lower levels of national debt, reduced pollution, and improved health, and more sustainable development.

Realizing these benefits will require both new policies, such as support for renewable generation, and changes in system planning, such as moving from Integrated Resource Plans to Integrated Resource and Resilience Plans. In Barbados, for example, feed-in



tariffs and tax incentives have spurred the installation of 100 MW of distributed energy resources, mostly solar photovoltaics. The Marshall Islands have identified solar mini-grids with battery backup as a key adaptation opportunity, installing them in schools, community centers, grocery stores, telecom facilities, and other key locations to provide power during emergencies, replacing backup diesel generators. And in Vanuatu, solar-powered water pumping systems have reduced water scarcity, improved water quality, and enhanced climate resilience, while electric buses in Bermuda are saving hundreds of thousands of dollars annually in fuel costs.

These nascent efforts are demonstrating the many benefits of a more resilient energy system; the challenge now is spurring a more widespread transformation of the energy sectors in all small island nations.

## Water

Small island nations typically rely on combinations of groundwater, surface water, rainwater harvesting, and, in a few cases, desalination. But nearly all are already experiencing some level of water stress, and some, such as Dominica, Grenada, and St Vincent and the Grenadines, face serious water shortages during the dry season. Climate change will make these shortages even more challenging, as more severe flooding and storm surges damage water storage tanks and reservoirs, water distribution pipelines, and treatment plants. Meanwhile, rising seas are causing saltwater intrusion into groundwater and aquifers.

Paradoxically, most island nations have sufficient water resources to meet their needs. But they face numerous problems delivering that water efficiently and sustainably. Deteriorating water infrastructure means that substantial amounts are lost in the distribution system, and additional large amounts are delivered but not paid for. The average proportion of so-called non-revenue water is 46% for the Small Island Developing States, compared to less than 30% for well-performing utilities. In some countries, the proportion reaches 75%.

Reducing levels of non-revenue water is thus one of the most cost-effective steps that island nations can take, but it is best done through a comprehensive policy framework that includes:

- Implementing integrated water resources management strategies that more precisely quantify water resources, then tailoring the system based on each country's unique characteristics and vulnerabilities to climate change. One promising example is the Pacific Integrated Water Resources Management Programme, which helps islands implement best practices.
- Exploring hybrid distribution water technologies and management systems, including expanding traditional rainwater harvesting.
- Investing in climate-resilient technologies, including upgrading water storage and distribution infrastructure.

Funding these efforts, however, is a serious problem, emphasizing the need to dramatically increase the available adaptation finance.

## Agriculture and Food

Despite the growth of urban areas in small island nations, most of their populations (61% in the Pacific, for example) still live in rural areas and depend on subsistence agriculture and fisheries. This predominance of small-scale, local food production, along with the limited investment in new technologies, makes these food systems highly vulnerable to climate change.

The resilience of smallholder farmers and agricultural communities can be increased by both reviving indigenous practices and implementing new approaches and technologies, such as drip irrigation or switching to crop varieties that are more resistant to drought. In the Maldives, for example, the Food and Agriculture Organization of the United Nations has funded a project to grow guava in raised beds, thus better protecting the crop from floods. Such measures can not only increase resilience to climate shocks, but also reduce food waste and losses and raise incomes, thereby improving livelihoods.

## INCREASING RESILIENCE ACROSS ALL SECTORS

### Improve Strategy, Planning, and Governance

To take advantage of the many opportunities to build resilience in individual sectors – and to make the best use of available adaptation finance – island nations need effective strategies and planning.

For this report, GCA conducted a review of the capabilities and progress of Small Island Developing States in developing their adaptation plans.

The review, entitled *Strategy and Planning to Redouble Adaptation in Small Island Developing States*, found that all countries have made good progress. All have at least one version of an NDC, and about one-third have submitted National Adaptation Plans (NAPs). Half show evidence of robust and effective governance, and five have established strategic frameworks specifically for adaptation initiatives. Papua New Guinea, for example, has a comprehensive framework of offices and committees that can carry out climate-related initiatives at both the national and provincial levels. Similarly, Suriname has created a monitoring and evaluation framework that makes it possible to evaluate the effectiveness of adaptation actions, while Vanuatu is helping people rebound after disasters (see Box 5).

However, more progress needs to be made. Based on the review, GCA recommends that small island nations:

- Outline their priority sectors, including adaptation finance, more clearly in their strategic adaptation documents, and develop sector plans.
- More precisely calculate the financial needs for adaptation measures to help attract finance.
- Strengthen monitoring and evaluation and disaster management.
- Modernize national data infrastructure.
- Improve cooperation between communities and governments, and integrate more local knowledge into national strategies and plans.
- Monitor progress toward implementation of their national strategies and plans for adaptation.

### Box 5. Building Resilience in Vanuatu

After suffering major losses from events such as Cyclone Harold in 2020, Vanuatu is implementing affordable microinsurance and “climate insurance” models to compensate for loss of income and damage to housing, infrastructure, crops, and other assets. The nation is also developing solutions for people affected by displacement. These actions demonstrate Vanuatu’s commitment to investing in adaptation and resilience.

As the planet warms and the impacts of climate change increase, the effects and burdens will fall most heavily over time on people who are young today, as they will live to see substantial changes unfold over many coming decades. Today’s youth face a future with greater environmental uncertainties and economic instabilities, with the potential loss of their environmental heritage and traditional employment.

This report thus recommends improving education and raising school enrollment rates in the small island nations to better prepare young people for a more uncertain future. GCA also notes, however, that many countries are already harnessing the power of youth for climate adaptation solutions through opportunities and employment in eco-tourism, sustainable fisheries, mangrove restoration projects, and ocean conservation efforts, among others.

One innovative project that combines education, adaptation, and sustainable business is the Eda Davara Marine Sanctuary at Kohua Beach in the Central Province of Papua New Guinea, which was established by a group of biology students. This sanctuary contains a mangrove forest 500 m wide, which shields the coastal community from storm impacts and is being protected, restored, and used for research by the students. The sanctuary offers eco-tourism adventures and brings in school children to learn about mangroves, seagrasses, and ecology. Deep in the heart of the mangrove forest is the Kohua Mangrove Nursery, a community initiative that sells mangrove seedlings for restoration projects elsewhere in the country.

### Increase Institutional Capacity

As the small island nations work to adapt to the impacts of climate change, one key barrier is the lack of institutional capacity. Governments need more detailed climate data, more information on areas and ecosystems at risk, stronger abilities to predict damaging events and provide early warnings, and greater capacity to explore and procure innovative financing instruments. Regional efforts are needed to meet these challenges.

One promising tool for increasing capacity is the Local Climate Adaptative Living Mechanism, which was piloted first in Tuvalu. The approach channels climate finance to local governments and communities but includes performance-based



measures to ensure that the grants are being used effectively. Localities that perform better receive larger grants, creating incentives to get the most cost effective results.

### **Implement Nature-based Solutions**

The most common traditional approach to protecting communities, ports, and other valuable assets from disasters such as floods has been to build hard structures, such as levees, breakwaters, or sea walls. In many cases, however, natural resources and ecosystems are much more cost-effective than “hard” solutions. They also offer multiple additional benefits, such as supporting fisheries and tourism, protecting freshwater supplies, increasing biodiversity, reducing heat island effects, providing new recreational opportunities, and helping to preserve cultural practices.

For small island nations, such “nature-based solutions” include restoring mangrove forests, protecting coral reefs, maintaining or restoring wetlands and forests, and adding more green spaces to urban areas. The more mountainous small island

nations can also use a “ridge-to-reef” approach that looks for opportunities at all levels of key watersheds. For example, restoring degraded forests or constructing wetlands far inland can reduce downstream flooding and land degradation, and even help protect valuable coastal ecosystems.

The Global Program on Nature-Based Solutions has created a geospatial “Opportunity Scan” methodology to spot promising locations for these natural solutions. In one example, a scan of the coastal zones of Viti Levu and Vanua Levu in Fiji identified 48,000 hectares that would be suitable for nearshore reefs, along with 150 hectares of beaches and 67,000 hectares of mangroves that could be protected or restored. The analysis calculated that these nature-based solutions could reduce damage from flooding by more than \$47 million per year by 2050, while also improving fisheries in the area. The total benefits were more than five times the estimated restoration costs, highlighting yet again the cost effectiveness of adaptation measures in Small Island Developing States.