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STRENGHTENING DISASTER RISK MANAGEMENT IN CLIMATE RESILIENCE ACTION:

A Learning Review of CIF-Supported Projects

// June 2023

KNOWLEDGE FOR RESILIENCE SERIES//

Case Study

CIF Programs: **PPCR, TAF**

TOPICS

- Disaster Risk Management
- Climate Resilience Action
- Nature-based Solutions
- Integrated Solutions

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LIST OF ABBREVIATIONS

ADB	Asian Development Bank
AfDB	African Development Bank
AFOLU	Agriculture, Forestry, and Other Land Uses
AMIS	Agriculture Management Information System (Nepal)
AWS	Automatic Weather Station(s)
BAT	Bathymetric Model
BWDB	Bangladesh Water Development Board
CAFF	Climate Adaptation Financing Facility
CAHMP	Central Asia Hydrometeorology Modernization Project
CBA	Cost-Benefit Analysis
CBDRM	Community-Based Disaster Risk Management
CCA	Climate Change Adaptation
CCORAL	Caribbean Climate Online Risk and Adaptation Tool
CCRIF SPC	Caribbean Catastrophe Risk Insurance Facility Segregated Portfolio Company
CCTF	Climate Change Trust Fund
CCVAP	Climate Change Vulnerability Assessment and Adaptation Plan
CEIP-I	Coastal Embankment Improvement Project Phase I
CERC	Contingent Emergency Response Component
CIF	Climate Investment Funds
CIF-TAF	CIF Technical Assistance Facility
CIM	Community Integrated Management (initially Coastal Infrastructure Management)
CoE	Centre of Excellence for Climate and Disaster Resilience
COP	Conference of Parties
CSO	Civil Society Organizations
CZM	Coastal Zone Management
DEM	Digital Elevation Model
DHM	Department of Hydrology and Meteorology
DRM	Disaster Risk Management
DRR	Disaster Risk Reduction
DVRP	Disaster Vulnerability Reduction Project
EWS	Early Warning System(s)

FGE	Farmer Group Educator
FWUC	Farmer Water User Committee
GBF	Global Biodiversity Framework
GIS	Geographic Information System(s)
ha	Hectares
HF	High Frequency
HVCA	Hazard and Vulnerability Capacity Assessment
IBRD	International Bank for Reconstruction and Development
IDB	Inter-American Development Bank
IFC	International Finance Corporation
IPCC	Intergovernmental Panel on Climate Change
IWRM	Integrated Water Resource Management
JNAP	Joint National Action Plan
km	Kilometers
LDCF	Least Development Countries Fund
LiDAR	Light Detection and Ranging
MDB	Multilateral Development Bank
MDUR	Municipal Development and Urban Resilience Project
MET	Tonga Meteorological Services
m	Meters
MHEWS	Multi-Hazard Early Warning Systems
MOI	Ministry of Infrastructure
MoU	Memoranda of Understanding
MRC	Mekong River Commission
NbS	Nature-Based Solutions
NDCs	Nationally determined contributions
NCDM	National Committee on Disaster Management
NEMO	National Emergency Management Organization
NFFC	National Flood Forecast Center
NPC	Nature People Climate
PEDRR	Partnership for Environment and Disaster Risk Reduction
PNG	Papua New Guinea
PPCR	Pilot Program for Climate Resilience
PREP	Pacific Resilience Project
PWD	Person with Disability
RTSM	Regional Technical Support Mechanism
RWH	Rainwater Harvesting
SDG	Sustainable Development Goal
SFM	Sustainable Forestry Management
SLDB	Saint Lucia Development Bank
SMS	Short Messaging Service

SPC	Pacific Community
SPCR	Strategic Program for Climate Resilience
TA	Technical Assistance
TAF	Technical Assistance Facility
UNDRR	United Nations Office for Disaster Risk Reduction
UNEP	United Nations Environment Programme
USAID	United States Agency for International Development
VDMG	Village Disaster Management Group
VFMP	Village Fisheries Management Plan
VHF	Very High Frequency
WCIS	Weather and Climate Information Service(s)
WMA	Water Management Association
WMO	Bangladesh Water Management Organisation
WMO	World Meteorological Organization

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1. INTRODUCTION

Climate change and disasters are inextricably linked (see **Figure 1**). Disasters triggered by weather and climate events, such as floods, storms, heat waves, droughts, and wildfires, have almost doubled in the last 20 years.[1] The need for humanitarian aid is extremely high: one in 33 people globally is in need of assistance and protection.[2] With every increment in global warming, adverse impacts, along with related losses and damages will only escalate. According to the Intergovernmental Panel on Climate Change (IPCC), global warming of 1.5°C in the near term would cause unavoidable increases in multiple climate hazards.[3] And unless this trend is countered by reductions in vulnerability and exposure, an increase in climate hazards will inevitably and directly lead to an increased risk of disaster, including both rapid and slow onset events, with the potential for further escalation in humanitarian crises.

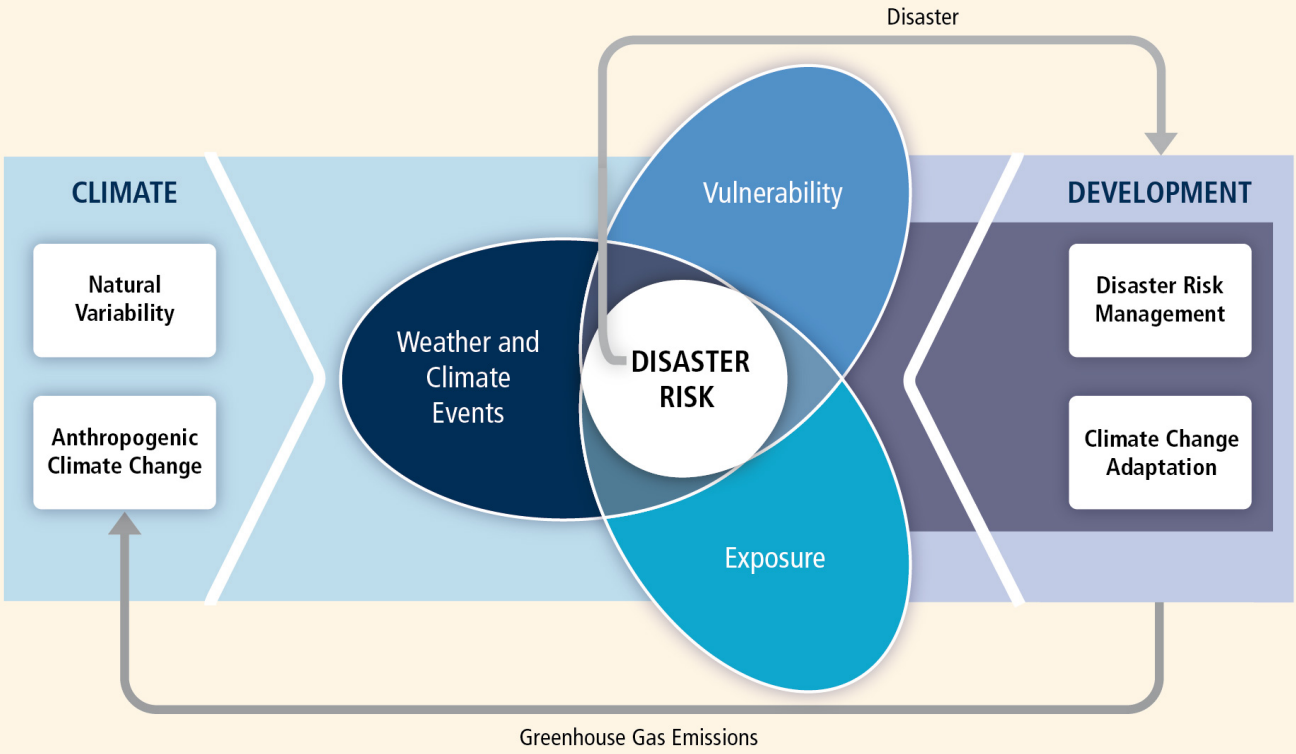
What is a disaster? [4]

According to United Nations Office for Disaster Risk Reduction (UNDRR), a disaster can be described as a serious disruption of the functioning of a community or a society at any scale, due to hazardous events interacting with conditions of exposure, vulnerability, and capacity, leading to one or more of the following: human, material, economic, and environmental losses and impacts.

Furthermore, **climate change aggravates underlying risk factors.** Adverse impacts of climate change, such as shifts in vector-borne disease patterns, reductions in agricultural yield, and pressure on ecosystems, affect people's health, nutrition, and livelihoods, amongst other ways. These multiplier pressures have serious implications, especially for

the poor, marginalized, and vulnerable populations. In particular, in times of hardship and disaster, the existence of gender inequalities and harmful gender norms exert an additional disproportionately negative impact on women and girls, who are often more dependent on natural resources, bear extra domestic and care responsibilities, and face an increased threat of gender-based violence. Potentially, this complex mix of stresses, imposed by climate change upon people's lives and livelihoods, can trigger a conflict over resources, further widen inequalities, and reverse hard-earned development gains. Therefore, by exacerbating underlying risk factors, climate change affects people's exposure and vulnerability to all hazards and disaster risks, thereby undermining resilience more broadly.

FIGURE 1. Links Between Climate Change and Disaster Risk



Source: IPCC, 2012. *Managing the Risks of Extreme Events and Disasters to Advance Climate Change Adaptation*

This figure is an illustration depicted in the IPCC's Special Report on Managing the Risks of Extreme Events and Disasters to Advance Climate Change Adaptation (SREX) and is consistent with this study's focus. The SREX report "assesses how exposure and vulnerability to weather and climate events determine impacts and the likelihood of disasters (disaster risk). It evaluates the influence of natural climate variability and anthropogenic climate change on climate extremes and other weather and climate events that can contribute to disasters, as well as the exposure and vulnerability of human society and natural ecosystems. It also considers the role of development in trends in exposure and vulnerability, implications for disaster risk, and interactions between disasters and development". As for this study, the SREX report "examines how disaster risk management and adaptation to climate change can reduce exposure and vulnerability to weather and climate events and thus reduce disaster risk, as well as increase resilience to the risks that cannot be eliminated".

COVID-19 brought into sharp focus awareness and discussion about the interconnectedness of human health, environmental degradation, and climate change, given that zoonotic diseases are linked with unsustainable, exploitative, and unsafe practices. The pandemic also revealed how risks and challenges that appear to be confined to a specific context or region can reverberate across the globe, and how disasters of different types can co-occur and exacerbate one another (see **Box 1**).

Moreover, the current state of affairs has shown us how the recovery from a health crisis can be compounded by armed conflicts. The war in Ukraine has led to an ensuing energy crisis, financial instability, and supply chain disruptions, which have, in turn, exacerbated food insecurity and disproportionately affected the most vulnerable groups, such as smallholder farmers. The complex mix of pressures and challenges is reversing years of development gains and pushing food prices to all-time highs. Seventy-five million more people were expected to be pushed into extreme poverty by the end of 2022 relative to pre-pandemic projections.[5]

BOX 1. Co-occurring Crises

In the border region of India and Bangladesh, where almost 50 percent of the population lives under the poverty line, the COVID-19 pandemic and subsequent lockdowns left many people without income options. This population included migrant workers, who were forced to return to their home areas where they were then quarantined in cyclone shelters.

On May 20, 2020, Super Cyclone Amphan hit the region causing over 100 fatalities, incurring damages exceeding USD13 billion, and displacing 4.9 million people. Many people, concerned over social distancing, hygiene, and privacy, chose not to evacuate from their homes and seek refuge at the shelters. While the pandemic made it more difficult to prepare for the cyclone, the cyclone, in turn, worsened the conditions for a pandemic response due to the destruction of health centers. As a consequence, COVID-19 cases spiked.[6]

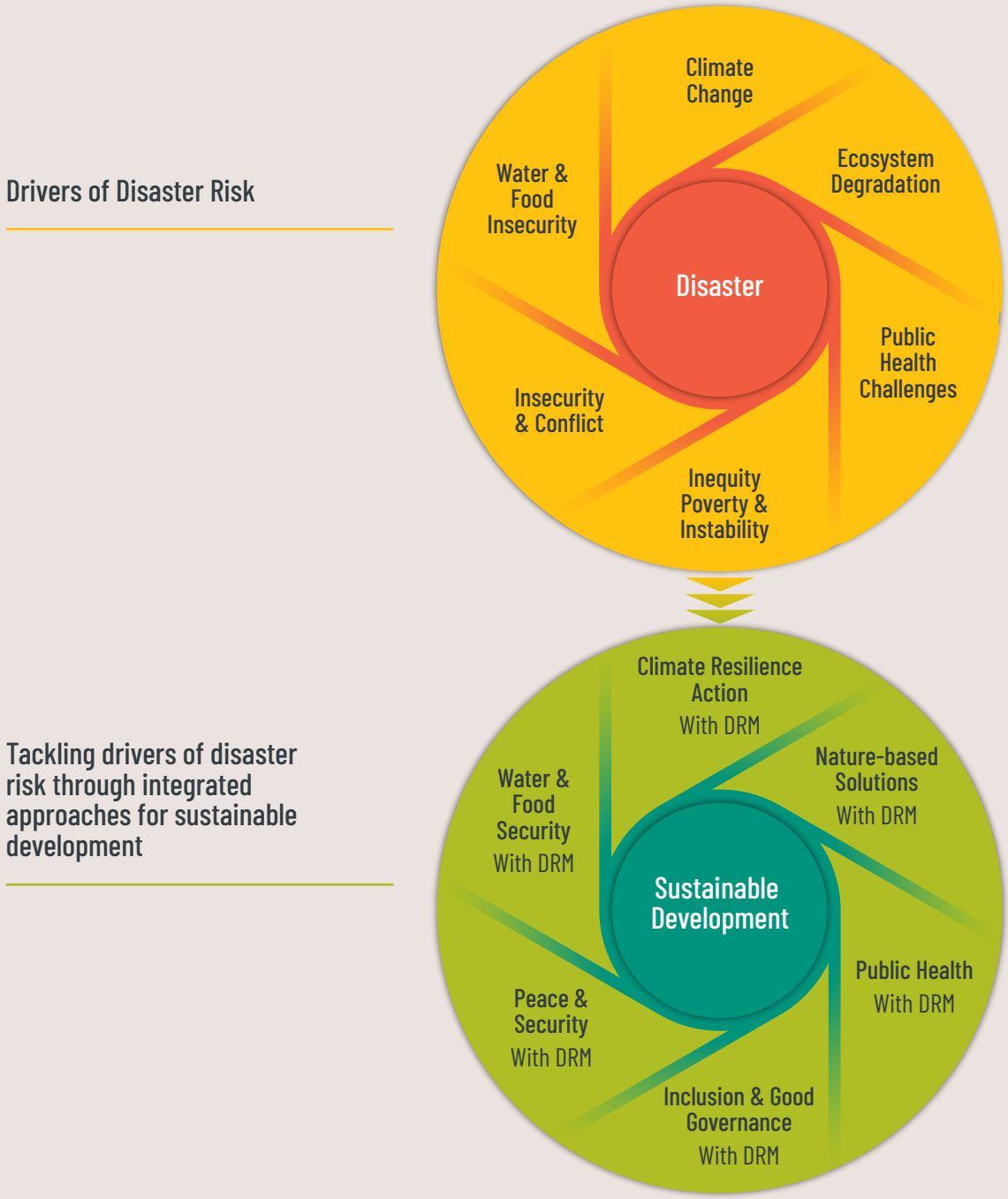
The co-occurrences of climate change, public health crises, ecosystem degradation, insecurity and conflict, social inequities and poverty, and water and food insecurity, drive risk. The interconnectedness of the challenges we face is clearly illuminated when these conditions combine with specific hazard events to create disastrous outcomes. Instead of treating isolated symptoms that manifest themselves in different disaster events, we have an opportunity to work in integrated ways to treat their underlying causes (see **Figure 2**).

Success in building resilience must be sought through interconnected thinking and solutions befitting the interconnected causes that are impinging on sustainable development and resulting in all types of disastrous events.

The Paris Agreement, the Sendai Framework for Disaster Risk Reduction 2015–2030, and the Sustainable Development Goals (SDGs)[7] provide the grounds for coherent action on reducing exposure and vulnerability, as well as enhancing resilience. Given this review's focus on disaster risk management (DRM) within climate resilience action, we note that the Paris Agreement's global goal on adaptation provides an umbrella for integrated actions in its call for "enhancing adaptive capacity, strengthening resilience and reducing vulnerability to climate change, with a view to contributing to sustainable development"[8].

As will be seen in this study, there is a lot of mutually reinforcing synergy between the Paris Agreement and the Sendai Framework in relation to the notion of reducing vulnerability and enhancing resilience. At the same time, they have differences in focus, approach, concepts, and terms, which go beyond the scope of this learning brief (see **Annex 1**).

FIGURE 2. An Integrated Disaster Risk Management Approach to Sustainable Development



Source: Developed by Dr. Paul Venton (lead author of the study)

Disasters, as shown in the top part of this Figure, can be slow-onset or rapid-onset and can be triggered by different hazard events. They can be isolated events in specific locations or much more complex with cascading impacts. Additionally, disasters of different types can co-occur.

It is the drivers of disaster risk that create and sustain conditions of vulnerability and exposure to different hazard events. The drivers of disaster risk are most responsible for disaster event occurrence. Examples of these drivers of disaster risk are shown in the top part of the Figure.

The bottom half of the Figure shows how each of the respective drivers of disaster risk are countered. Incorporating disaster risk management in an integrated approach to address these interconnected challenges reduces the risk of disaster and supports a context of sustainable development.

Through its portfolio of projects with a funding of USD1.2 billion under the **Pilot Program for Climate Resilience (PPCR),** CIF has been supporting countries via a wide range of activities and approaches. The program aims to reduce climate vulnerability and disaster risks, promote climate adaptation, as well as mainstream and build climate resilience in key economic sectors, institutions, and local communities, with a particular focus on the most vulnerable and marginalized groups.

At the same time, CIF strives to stay relevant, agile, and responsive to new challenges, client country demands, and continuously evolving circumstances. This approach is exemplified through its **COVID-19 Technical Assistance (TA) Response Initiative** — launched by late 2020 in the wake of COVID-19 to support green and resilient COVID-19 recoveries in developing regions — under its **Technical Assistance Facility (TAF).** Through this initiative, CIF aims to help client countries respond to the social, economic, and health crises in relation to COVID-19 and build their resilience against current and future risks, including that of climate change.[9] Building a green and resilient recovery from the COVID-19 health crisis in ways that recognize and support links with the climate emergency also provides opportunities for strengthening DRM.

This learning review draws upon CIF's PPCR and TAF COVID-19 TA Response Initiative[10] (hereafter referred to as TAF) experience across an extensive portfolio of **28 projects in 16 countries and three regions** to demonstrate how CIF has been contributing to crucially important DRM through climate resilience action. In doing so, it highlights opportunities and entry points for advancing the DRM agenda through climate resilience action and makes the case for integrated approaches to address interconnected challenges.

This study on DRM is part of the PPCR's Knowledge for Resilience series, and it is informed, in its design and layout, by previously published studies. The study is based on a desk review of PPCR and TAF project documents and other literature. Task team leaders who were consulted provided validation, feedback, and additional inputs. This learning review does not seek to draw lessons regarding the extent to which individual projects and activities have been successful in their objectives. Furthermore, it is not within the scope of the review to elaborate on the conceptual synergies and differences between DRM and adaptation to climate change. Rather, **the study seeks to collect, synthesize, and highlight key results and lessons from CIF experience, and consider how to advance and further strengthen DRM through climate resilience action and as part of a more integrated approach to the world's complex risk landscape.**

Reflections distilled in this study may be of great value to the countries and regions featured; to CIF, in terms of its existing and new programs, such as the Nature, People & Climate (NPC) Investment Program; as well as to other climate funds, multilateral development banks (MDBs), and development practitioners.

2. APPLYING A DISASTER RISK MANAGEMENT LENS TO CLIMATE RESILIENCE ACTION

Looking at climate resilience through a disaster risk management (DRM) lens provides a means of identifying how the Climate Investment Funds' (CIF) climate resilience action may contribute to the DRM agenda. For the purpose of this study, **the *Sendai Framework for Disaster Risk Reduction 2015–2030* is the DRM lens adopted as a basis for analyzing how featured Pilot Program for Climate Resilience (PPCR) and Technical Assistance (TA) Response Initiative projects can simultaneously address aspects of the climate emergency *and* DRM priorities.** More specifically, the experiences and analyses are structured around the four Sendai Framework Priorities for Action (from here onward, referred to as Priorities for Action): (a) understanding disaster risk; (b) strengthening disaster risk governance to manage disaster risk; (c) investing in disaster risk reduction for resilience, and (d) enhancing disaster preparedness for effective response and to "Build Back Better"[11] in recovery, rehabilitation, and reconstruction. In addition, capacity-building support and gender are important considerations across these different priorities; therefore, they are included as cross-cutting themes.

Activities, results, and lessons learned were analyzed for PPCR and TAF projects with respect to these Priorities for Action, and key themes common to both climate resilience and DRM agendas were identified. The elements of individual projects — with a clear bearing on DRM — were captured according to the identified themes. Details on how the themes were identified and how the specific PPCR and TAF examples were allocated to the different themes are provided in **Annex 2.**

FIGURE 3. Sendai Framework Priorities for Action and Identified Themes

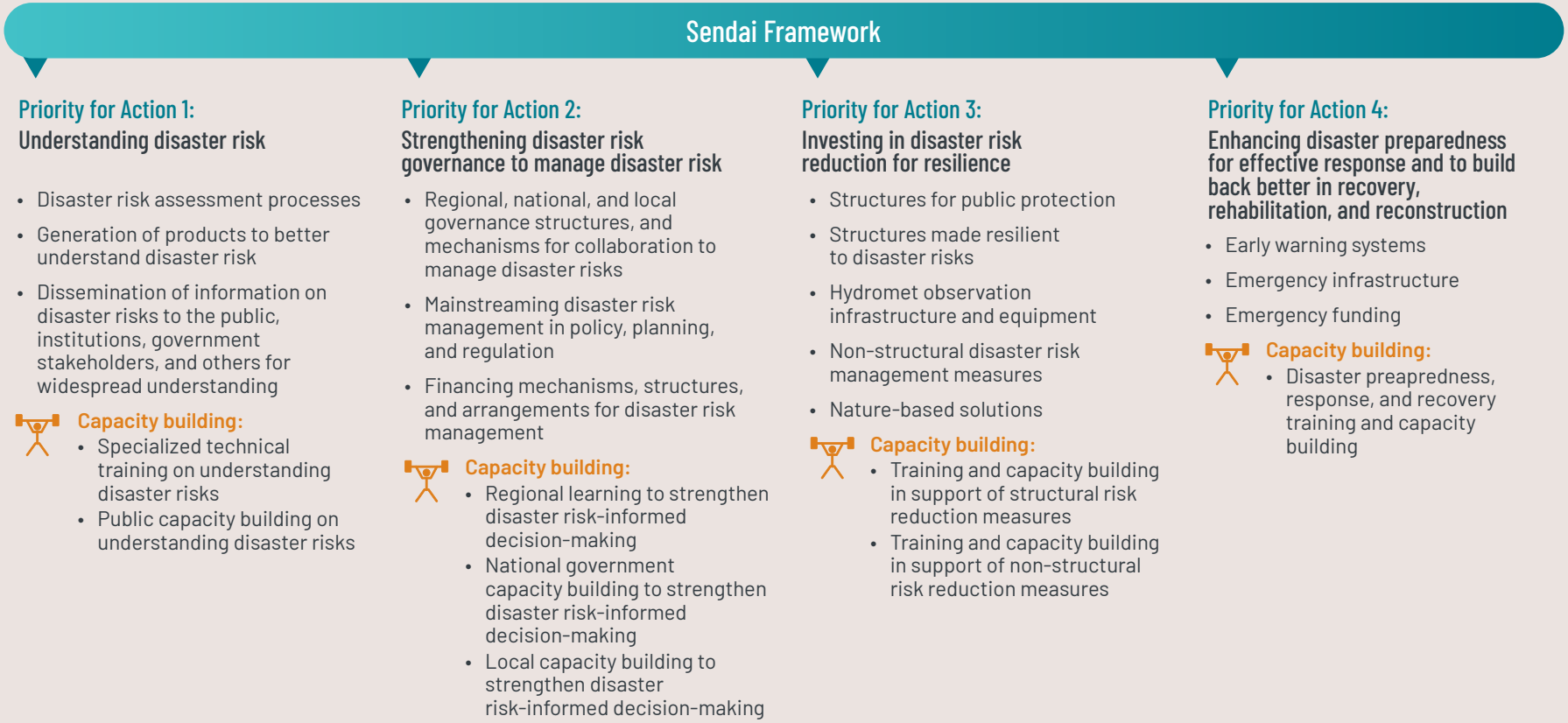


Figure 3 presents an overview of the study framework, including the four Priorities for Action and the specific themes related to each of these priorities identified in this study.

The tables below (one for each priority area) provide short descriptions of the DRM theme, how the DRM elements can be integrated in climate resilience efforts, and examples of how climate resilience and DRM can work hand-in-hand. Section 3 presents the specific real-life experiences of PPCR and TAF projects within the context of these DRM themes.

2.1. Priority for Action 1: Understanding Disaster Risk

The prerequisite knowledge that informs deep-rooted risk reduction, emergency planning, and avoidance of creating new risk

Sendai Framework's statement: *Policies and practices for DRM should be based on an understanding of disaster risk in all its dimensions of vulnerability, capacity, exposure of persons and assets, hazard characteristics and the environment. Such knowledge can be leveraged for the purpose of pre-disaster risk assessment, prevention and mitigation, and for the development and implementation of appropriate preparedness and effective response to disasters.*[12]

What is the connection between understanding disaster risk and climate change?

Given that climate change is a key driver of disaster risks, understanding climate risks in the short, medium, and longer terms is critical for DRM, as well as for avoiding the creation of future risks through short-sighted interventions (See **Figure 2**). For example, many actions envisaged under the Paris Agreement (Article 7.9), assessments of climate change impacts and vulnerability, as well as monitoring and evaluating adaptation plans and policies, are aligned with those for promoting an understanding of disaster risks.[13] **Table 1** below describes the themes under this Priority for Action.

TABLE 1. Priority for Action 1: Understanding Disaster Risk

THEMES	DESCRIPTION OF THEMES AND HOW THEY RELATE TO CLIMATE RESILIENCE	EXAMPLES OF DRM AND CLIMATE RESILIENCE WORKING HAND-IN-HAND
Disaster risk assessment processes	Disaster risks arise due to compounding and cascading hazards combined with exposure and underlying drivers of vulnerability such as poverty, gender inequalities, and social marginalization, environmental degradation, and insecurity, among others. Capacities offset such weaknesses and fragility. Climate change not only affects the frequency and intensity of climate-related hazard events and exposure to them but also aggravates all these underlying vulnerability factors. Defining iterative modalities that engage relevant stakeholders in the risk identification and assessment process — by adopting a sound participatory basis involving stakeholders, including local communities, and utilizing gender-responsive planning approaches — helps to ensure that the results of risk assessments are beneficial and tailored to the needs of end-users.	Comprehensive multi-hazard risk assessments to help avoid shortsighted planning, such as building a coastal embankment to withstand a 25-year return period coastal flood inundation event that encourages the establishment of new settlements, businesses, and industry on newly "protected" land, when this may turn out to be inadequate under a changing climate and with respect to geophysical hazards such as an earthquake and a tsunami.
Generation of products to better understand disaster risk	Visually representing disaster risks that account for climate conditions today and into the future can help display risks in ways that are more readily useful to decision-makers and end-users, especially when these products are interactive.	Products that blend Indigenous local knowledge with data and information derived from highly sophisticated technology and tools, such as earth observation and satellite imagery, light detection and ranging (LiDAR), drones, and geographic information systems (GIS), to visually represent and better understand risks.
Dissemination of information on disaster risks to the public, institutions, government stakeholders, and others for widespread understanding	Accessibility to disaster risk information among the public, government stakeholders, and others ensures that those affected by risk outcomes but unable to participate directly in risk assessments can benefit from improved information for decision-making. Risk communication is very important in the context of long-term climate risks. Dissemination processes should enable everyone to provide feedback for improvement.	The transmission of improved hydrometeorological (referred to as hydromet) and climate information through centralized platforms to help decision-makers better understand risks. Public awareness-raising activities through the media and arts.
Cross cutting theme: Capacity building		
Specialized technical training on understanding disaster risks	Technical capacity building is an ongoing need to ensure that relevant stakeholders can improve their understanding of disaster risks within the context of climate change and allow for the production of updated information.	Skills development is an important prerequisite for mastering GIS, LiDAR, and risk models, as well as managing data. Also important are the skills to ensure information, products, and services benefit from Indigenous local knowledge.
Public capacity building on understanding disaster risks	Building the capacity of the public and communities to engage effectively in the process of better understanding the different hazards, exposures, vulnerabilities, and capacities, and how these components interact with one another to form changing patterns of disaster risks ensures that information is relevant and usable.	Equipping local community members to understand disaster risks, including new scientific knowledge on climate change, will improve decision-making. Building local capacity among farmers, fishing groups, and grassroots women's groups, for example, to incite meaningful engagement in the co-design of climate information services.

2.2. Priority for Action 2: Strengthening Disaster Risk Governance to Manage Disaster Risk

The architecture and mechanisms for risk-informed developmental decision-making

Sendai Framework's statement: *Disaster risk governance at the national, regional, and global levels is of great importance for an effective and efficient management of disaster risk. Clear vision, plans, competence, guidance, and coordination within and across sectors, as well as participation of relevant stakeholders, are needed. Strengthening disaster risk governance for prevention, mitigation, preparedness, response, recovery, and rehabilitation is therefore necessary, and fosters collaboration and partnership across mechanisms and institutions for the implementation of instruments relevant to disaster risk reduction and sustainable development.*[14]

What is the connection between strengthening disaster risk governance for managing disaster risks and climate change?

Strengthening governance for risk-informed decision-making is also important for climate resilience action. Similar to the structures, mechanisms, and systems that need to be in place for DRM, the failure to enhance governance as a prerequisite for managing climate change risks will do little to reduce vulnerability to those risks.[15] **Table 2** below describes the themes under this Priority for Action.

TABLE 2. Priority for Action 2: Disaster Risk Governance

THEMES	DESCRIPTION OF THEMES AND HOW THEY RELATE TO CLIMATE RESILIENCE	EXAMPLES OF DRM AND CLIMATE RESILIENCE WORKING HAND-IN-HAND
Regional, national, and local governance structures, and mechanisms for collaboration to manage disaster risks	Inclusive DRM and climate resilience governance entail engaging and partnering with multiple stakeholders and adopting a whole-of-government and a whole-of-society approach, including the public and private sectors; communities; knowledge centers; and media. Strengthening the involvement of decision-makers and populations at risk is also essential to increase buy-in and facilitate implementation.	Strengthened international collaboration structures and processes conducive to the management and reduction of transboundary disaster and climate risks. National high-level authorities with clear roles and responsibilities to enable collaborations among a broad range of stakeholders, including marginalized and at-risk populations,[16] for the reduction of climate and disaster risks. Local community structures with meaningful opportunities and capabilities to influence risk outcomes within the context of sustainable development goals.
Mainstreaming disaster risk management in policy, planning, and regulation	All sectors and disciplines provide entry points and opportunities for contributing to DRM and climate resilience, as they are both achieved through mainstreaming risk-informed developmental actions across national and local sector plans; strategies; budgets; multi-level governance and administration; regulations; and policies.	In public health, a combined climate and disaster risk-informed approach to help strengthen systems to mitigate against current and anticipated health impacts under a changing climate, reduce the burden of suffering, and maintain the continuity of health care — during and after disaster events. In infrastructure investments, building codes and standards, encompassing an all-hazards approach that factors in changing hazard patterns to protect against structural damage and help maintain functions in extreme conditions. Other examples of entry points for mainstreaming climate-informed DRM include recognizing climate and disaster risks within land-use planning, integrated water resource management (IWRM), and coastal zone management (CZM), among many more.
Financing mechanisms, structures, and arrangements for disaster risk management	The setting up of mechanisms, structures, and arrangements for financing is needed for both DRM and climate resilience action at national, local, and individual levels. While it has been demonstrated that risk reduction is highly cost-effective and beneficial,[17] alleviating the soaring costs of avoidable emergency responses and recovery by investing in areas, such as early warning systems (EWS), resilient infrastructure, the improvement of dryland agricultural production, the protection of mangroves, and resilient water resources management, remains a major need.	Mainstreaming DRM and climate resilience in national, municipal, and local budgets. Insurance schemes. Cross-ministerial coordination agreements or memoranda of understanding for emergency preparedness, response, and recovery. Contingent emergency response components (CERC) and emergency funding for effective responses, social protection, and recovery and rehabilitation.

THEMES	DESCRIPTION OF THEMES AND HOW THEY RELATE TO CLIMATE RESILIENCE	EXAMPLES OF DRM AND CLIMATE RESILIENCE WORKING HAND-IN-HAND
Cross cutting theme: Capacity building		
Regional learning to strengthen disaster risk-informed decision-making	Disaster and climate-related risks and impacts can transcend boundaries and be of regional and widespread concern. Therefore, the means to address these risks and impacts can be aided by the pooling of knowledge and resources.	Regional learning through exchange visits, South-South learning, regional in-person and online training forums, and tailored capacity building.
National government capacity building to strengthen disaster risk-informed decision-making	Country ownership of DRM and climate resilience is imperative for sustained and relevant action. Therefore, considerable effort is necessary to maintain and strengthen the national structures, mechanisms, and capacity for climate and disaster risk-informed decision-making. Strengthening ministries with the convening power to address multisectoral crises can help in orchestrating effective integrated strategies.	Strengthening cross-sectoral and institutional coordination and planning to help break down silos. Building emergency and disaster response and climate-informed post-disaster recovery and rehabilitation systems, mechanisms, and approaches to reduce climate and disaster risks. Conducting national in-person and online training forums to build tailored capacity to address specific disaster and climate risk needs and challenges faced by national stakeholders.
Local capacity building to strengthen disaster risk-informed decision-making	Helping to ensure that local communities and other local stakeholders have a voice and can influence risk reduction within developmental priorities and agendas is among the most fundamental principles of DRM and climate resilience.	Developing community plans, especially those that are linked with local governments plans and budgets, will benefit from capacity building and knowledge-sharing across and within groups.

2.3. Priority for Action 3: Investing in Disaster Risk Reduction for Resilience

Investment through various financing mechanisms in the practical structural and non-structural measures taken as informed by Priority for Action 1 and utilizing Priority for Action 2

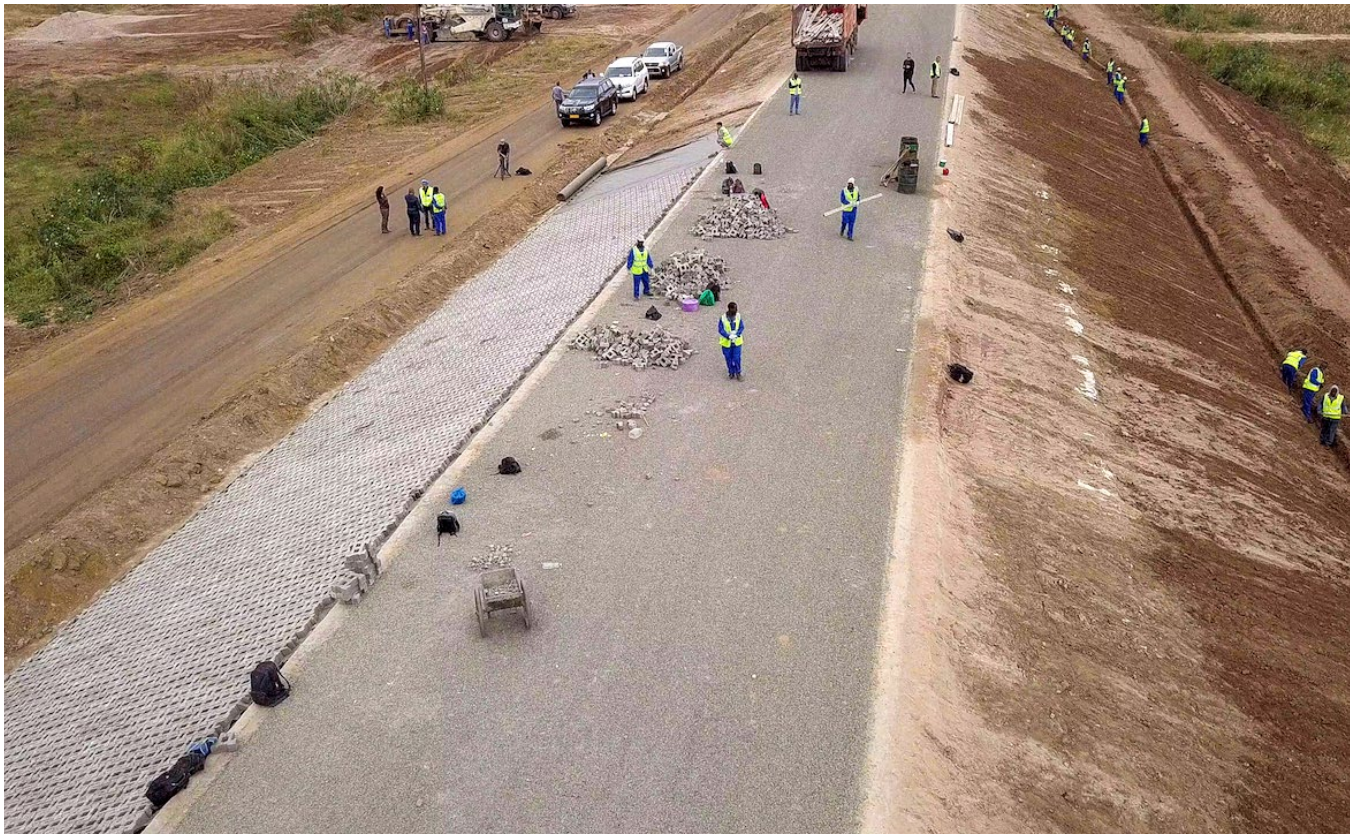
Sendai Framework's statement: *Public and private investment in disaster risk prevention and reduction through structural and non-structural measures are essential to enhance the economic, social, health, and cultural resilience of persons, communities, countries, and their assets, as well as the environment.*

What is the connection between investing in disaster risk reduction for resilience and climate change?

Investing in disaster risk reduction (DRR) can also be important for climate resilience and adaptation. Many underlying drivers of risk are shared, regardless of whether the risk is considered through a climate or a disaster lens. For example, weaknesses and injustices surrounding social and economic conditions render certain groups more exposed and vulnerable to experiencing losses and hardships from climate and disaster-related challenges alike. Therefore, DRM investments tackling such risk drivers can also address exposures to climate hazards, vulnerabilities, and risks, as well as build community resilience and adaptive capacity, thereby contributing to climate change goals laid out in the Paris Agreement. Concomitantly, investments in climate mitigation and adaptation can reduce disaster risks and enhance community resilience, thus advancing the Sendai Framework agenda. **Table 3** below describes the themes under this Priority for Action.

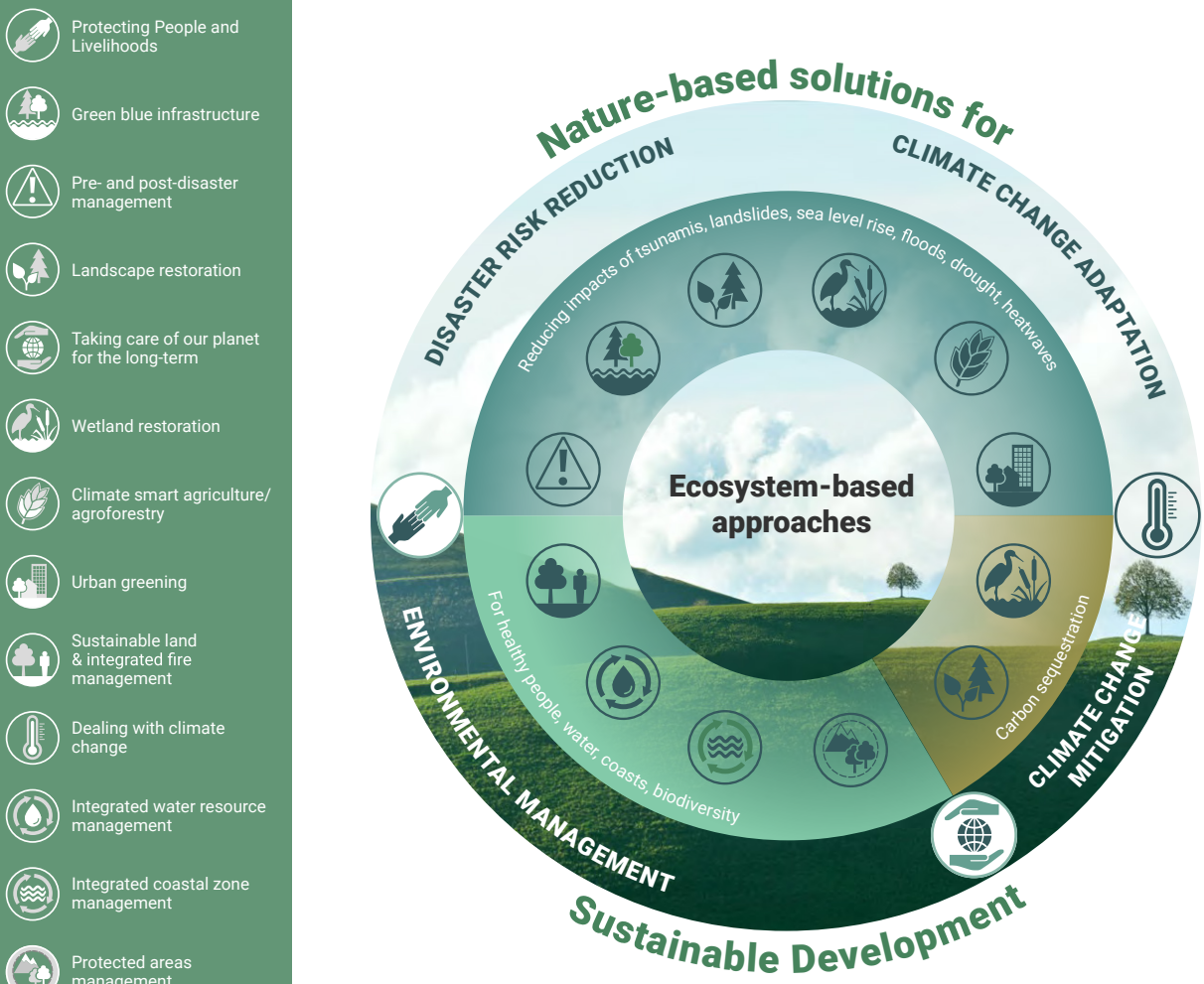
TABLE 3. Priority for Action 3: Disaster Risk Reduction

THEMES	DESCRIPTION OF THEMES AND HOW THEY RELATE TO CLIMATE RESILIENCE	EXAMPLES OF DRM AND CLIMATE RESILIENCE WORKING HAND-IN-HAND
Structural measures: Structures for public protection	Structural and engineering measures are commonly deployed as a means of reducing the exposure of the public and assets to hazards, such as floods, waves, storm surges, and droughts.	Engineering structures, such as flood barriers, embankments, sea walls, storm drains, slope stabilization technologies, water retention structures, and others.
Structural measures: Structures made resilient to disaster risks	The infrastructure that society relies on needs to continue functioning and providing services in the event of hazards and disasters under current and future climatic conditions. This is especially vital in the case of critical infrastructure.	Hospitals and schools in safe locations that can withstand storms, heatwaves, and other hazards. Safe water supply in the case of floods and droughts. Roads with storm drains so they remain open during heavy rain and flood conditions. Bridges capable of maintaining their structural integrity.
Structural measures: Hydromet observation infrastructure and equipment	The hydromet and climate services observation infrastructure and equipment provide an example of "hard" investment that caters to a specialist need while having broader utility for the public. They allow for data to be collected from stations and other measuring technologies, thus providing the backbone for the early warning of extreme and dangerous events. At the same time, they can be used for climate modeling and risk-informed planning and decision-making.	Radar, automatic weather stations (AWS), river gauges, ocean data buoys, radiosonde, satellite, and computing for data collection and management.



THEMES	DESCRIPTION OF THEMES AND HOW THEY RELATE TO CLIMATE RESILIENCE	EXAMPLES OF DRM AND CLIMATE RESILIENCE WORKING HAND-IN-HAND
Non-structural disaster risk management measures	Non-structural measures for DRM and climate resilience do not include physical "hard" construction; they refer to measures that use knowledge, practices, systems, and techniques to reduce and manage risks, and strengthen resilience. Even though capacity building is an example of a non-structural DRM measure, in this study, it is considered a cross-cutting theme that fits into all Priorities for Action "See Section 2.5".	Building resilient livelihoods by transitioning away from activities that are susceptible to climate and disaster shocks and stresses, such as rainfed agriculture, or by improving productivity despite changing conditions. Social protection and safety net programs that help poor households weather hard times, such as during and after emergencies or crises. Investments in resilient public health services. Maintaining and strengthening public health within the context of hazardous and changing conditions (e.g., extreme heat, bad air quality, changing vector patterns, water-borne diseases), will contribute significantly to DRM and climate resilience.
Nature-based solutions	Nature-based solutions (NbS) refer to actions for protecting, sustainably managing, and restoring natural or modified ecosystems that also address societal challenges, such as climate change and disaster risks, while catering to human well-being and generating biodiversity benefits (see Figure 4).[18] Averting the dramatic decline in the natural world, which is leading to increased disaster and climate risks, NbS can directly alleviate these risks by regulating and mitigating hazards, such as floods, droughts, and storms; and reducing vulnerability. NbS also mitigate climate change and enhance ecosystems by improving their vitality and health, with multiple benefits for people.	Green and blue infrastructure, such as restoring mangroves and coral reefs as a defense against erosion and storms. Landscape restoration, such as engaging in sustainable forestry to mitigate floods, landslides, and drought risks. Wetland restoration, such as salt marshes and flood plains, which absorb inundation. Climate-smart agriculture and agroforestry to maintain soil quality under weather extremes. Urban greening to reduce heat stress and buffer flooding. Other NbS for DRM and climate resilience can be achieved through sustainable land and integrated fire management, IWRM, integrated CZM, and protected areas management.
Cross-cutting theme: Capacity building		
Training and capacity building in support of structural risk reduction measures	Capacity building is needed for the design and implementation of the specific physical infrastructure investments to ensure suitability in the context of climate and disaster risks.	Training on the operability and maintenance of infrastructure and equipment, such as hydromet data collection, management, and processing, and on the design, monitoring, and maintenance of embankments and drainage channels.
Training and capacity building in support of non-structural risk reduction measures	Learning to adapt to changing risk contexts is an ongoing underpinning to ensure that local communities, governments, businesses, and all other stakeholders have the necessary skills for building climate and disaster resilience and can apply them in the face of uncertainty and risk.	Training on new farming techniques to counter drier, wetter, and less predictable seasons. Developing systems to scale safety net mechanisms and deploy forecast-based insurance payouts.

FIGURE 4. Nature-Based Solutions (NbS) for Sustainable Development



Source: UNEP/PEDRR (2020) in UNDRR 2021. Words into Action: Nature-based Solutions for Disaster Risk Reduction

The multi-faceted way in which nature and ecosystem-based approaches address societal challenges, including through contributions to disaster risk reduction and climate change adaptation.

2.4. Priority for Action 4: Enhancing Disaster Preparedness for Effective Response and to "Build Back Better" in Recovery, Rehabilitation, and Reconstruction

Building on Priority for Action 1 to 3, the actions necessary when other efforts are insufficient to prevent disaster and hazard impact

Sendai Framework's statement: *The steady growth of disaster risk... indicates the need to further strengthen disaster preparedness for response, take action in anticipation of events, integrate disaster risk reduction in response preparedness and ensure that capacities are in place for effective response and recovery at all levels... Disasters have demonstrated that the recovery, rehabilitation and reconstruction phase, which needs to be prepared ahead of disaster, is a critical opportunity to "Build Back Better", including through integrating disaster risk reduction into development measures, making nations and communities resilient to disasters.*[19]

What is the connection between enhancing disaster preparedness, response, recovery, rehabilitation, and reconstruction and climate change?

Strong evidence suggests that the probability and/or magnitude of many individual extreme events have already changed due to climate change, and as the climate continues to warm, the observed changes will continue.[20] With the linkages between climate and disasters becoming more apparent, integrated DRM approaches can significantly reduce disasters and climate impacts through enhanced preparedness, response, and recovery. For example, both the Paris Agreement (Article 7.7[c]) and the Sendai Framework call for a strengthening of early warning systems (EWS). **Table 4** below describes the themes under this Priority for Action.

TABLE 4. Priority for Action 4: Disaster Preparedness and "Building Back Better"

THEMES	DESCRIPTION OF THEMES AND HOW THEY RELATE TO CLIMATE RESILIENCE	EXAMPLES OF DRM AND CLIMATE RESILIENCE WORKING HAND-IN-HAND
Early warning systems	With the rise in climate-related disaster risk, there is an increased demand and need for effective early warning of extreme events and increased risk. An effective EWS requires four elements.[21] In this study, the elements are spread across the Priorities for Action, with dissemination, communication, and response capabilities being the most relevant in relation to this Priority for Action.	Floods and storm warnings of sufficient accuracy and usability provided from trusted and well-established sources for targeted government and non-government users to enable beneficial actions, such as timely evacuations and the protection of assets.
Emergency infrastructure	Emergency infrastructure is designed to provide safety in the event of an emergency, which is a growing threat in a changing climate (see Annex 2 to understand why emergency infrastructure is considered under this Priority for Action rather than Priority for Action 3, which discusses structural measures).	Community buildings that double as emergency shelters with facilities to serve the needs of women and other vulnerable populations. Escape roads in places, such as the coast, where communities are at risk of storm-surge inundation and hazards, such as tsunamis. Water storage designed to ensure access is maintained during extreme conditions.
Emergency funding	In an emergency, local capacities are typically very stretched or overwhelmed. In the immediate and short term, there may be a critical requirement for emergency funding to meet basic needs. Later, support is needed to recover and reconstruct losses in a more resilient way. In the absence of the provision of aid by state and non-state actors (e.g., remittances from families), those affected will do whatever is needed to survive and cope. This may include selling assets, migrating for work, and being forced to pursue negative coping mechanisms, such as transactional sex and early child marriage. A rise in gender-based violence is also apparent in disasters.[22] Beyond the needs at the household level, the region that has suffered loss and damage also needs rapid support to recover and minimize the slide into deeper poverty and debt that will make it harder to "Build Back Better". As climate-related disaster impacts accrue, so does the need for emergency funding.	Tapping into pre-agreed financial arrangements and coordination agreements for access to emergency funding, such as contingent emergency response mechanisms and cash transfers.
Cross-cutting theme: Capacity building		
Disaster preparedness, response, and recovery training and capacity building	Capacity building for the full array of government and non-government stakeholders is important to help ensure that investments in disaster preparedness, response, recovery, and rehabilitation are effective. These strengths and capacities are important for securing a more resilient future.	Developing contingency plans and emergency protocols can help maintain access to essential services and needs, such as healthcare, food, safe water, shelter, emergency communications and telecom systems. Scheduling rigorous evacuation drills and trainings can prevent physical harm and save lives. Building trust in and understanding of early warning alerts in support of actions that can be taken in an emergency, such as through co-design, can help achieve safety.

2.5. Cross-Cutting Themes

Capacity-building and gender are important considerations across all the Priorities for Action. Therefore, they are included in this study as cross-cutting themes.

Cross-cutting area — Capacity building

Capacity-building support across the Sendai Framework Priorities for Action and the various themes described above can empower and enable governments, businesses, and communities to anticipate, plan and prepare for, respond to, recover from, and mitigate crises. As described earlier, capacity building is necessary for understanding disaster risks, strengthening disaster risk governance, investing in disaster risk reduction, and enhancing disaster preparedness for an effective response and for building back better. **Capacity-building support is, therefore, included as a cross-cutting theme and an enabler for achieving results across these areas.** Building adaptive capacity to adjust to climate change is linked to capacity building for DRM, when it includes efforts to alleviate and cope with the impacts of both slow and rapid onset climate and weather-related events on lives, livelihoods, and the economy.

Cross-cutting area — Gender[23]

Disasters and climate change often affect women and girls disproportionately, as compared with men and boys, due to gender inequalities caused by socioeconomic conditions, cultural beliefs, and traditional practices. For example, gender inequalities can trigger more negative climate and disaster impacts on women because they typically assume the primary caregiving role in the household and suffer disproportionate losses due to the status and type of their employment. For instance, disasters can impact women more severely, as they are more likely to stay behind during a disaster event to care for children and relatives due to structural inequalities and social norms, as well as lack of access to disaster-related information and warnings. In addition, in many developing countries, women make up the majority of the agricultural labor force and are the primary producers of food. They also play a central role in the water sector, with the collection and managing of water, for domestic consumption, chores, and agricultural and irrigation purposes, falling largely on the shoulders of women and girls.[24] These sectors are particularly vulnerable to climate-related disasters and impacts, significantly increasing women's water-related time poverty and burden. Additionally, women's exposure to increased gender-based violence rises dramatically during emergencies and times of hardship.[25]

Significant evidence shows that, despite gender-differentiated vulnerabilities, women and girls are powerful agents of positive change before, during, and after the occurrences of disasters. To better understand how to support women and girls as advocates and agents of change, it is important to understand the different gender roles, responsibilities, needs, and capacities. This is critical for identifying and reducing the barriers that women face for climate and disaster resilience action and leadership, as well as for designing and implementing interventions that address these barriers, enhance women's capacity to prepare for, respond to, and recover from climate-related disasters, and increase their resilience and well-being.

CIF understands that a gender-responsive approach requires not just identifying target groups and specific programming needs but also instituting inclusive and embedded processes and approaches that promote women's participation and leadership in climate, disaster, and development planning and implementation across different scales. **Where relevant, activities, results, and lessons with a specific gender focus are highlighted in this study.**

3. CIF'S SUPPORT FOR DISASTER RISK MANAGEMENT

This section explores CIF's support for disaster risk management (DRM) through the Pilot Program for Climate Resilience (PPCR) and Technical Assistance Facility (TAF) portfolios. It provides key results and lessons learned based on the PPCR experience over the past several years. TAF examples are at an early stage of implementation, and, therefore, currently, they only highlight intended outcomes. The examples provided in this section are, by no means, exhaustive; rather, the intent is to give a taste of how CIF has been investing in DRM. **A full list of PPCR and TAF project experiences and examples across the four Priorities of Action and their respective themes is provided in the accompanying document, entitled "Portfolio of CIF's Disaster Risk Management Experience."**

To complement the examples provided in the study, a series of boxes were also developed, divided into two types: one type focuses on **project highlights** and interesting features, the other type on **learning**.

Insights and reflections emerging across CIF's resilience, adaptation, and TA portfolios, as they relate to the Sendai Framework, are included with respect to each of the Priorities for Action. At the end of each Priority for Action section, special focus is placed on how synergies and integrated solutions can be further strengthened through climate resilience action.

Table 5 below provides an overview of CIF's contributions to DRM by mapping the full scope of selected PPCR and TAF projects in relation to the four Priorities for Action and relevant themes.[26]

TABLE 5. Scope of PPCR and TAF Support for Disaster Risk Management

* Capacity building

COUNTRY / REGION	PROJECT	LEAD MULTILATERAL DEVELOPMENT BANK	EXAMPLES OF PPCR AND TAF SUPPORT FOR DISASTER RISK MANAGEMENT																					
			Priority for Action 1: Understanding disaster risk					Priority for Action 2: Strengthening disaster risk governance to manage disaster risk						Priority for Action 3: Investing in disaster risk reduction for resilience							Priority for Action 4: Enhancing disaster preparedness for effective response and to build back better in recovery, rehabilitation, and reconstruction			
			Disaster risk assessment processes	Generation of products to better understand disaster risk	Dissemination of information on disaster risks to the public, institutions, government stakeholders, and others for widespread understanding	* Specialized technical training on understanding disaster risks	* Public capacity building on understanding disaster risks	Regional, national, and local governance structures, and mechanisms for collaboration to manage disaster risks	Mainstreaming disaster risk management in policy, planning, and regulation	Financing mechanisms, structures, and arrangements for disaster risk management	* Regional learning to strengthen disaster risk-informed decision-making	* National government capacity building to strengthen disaster risk-informed decision-making	Local capacity building to strengthen disaster risk-informed decision-making	Structural measures: Structures for public protection	Structural measures: Structures made resilient to disaster risks	Structural measures: Hydromet observation infrastructure and equipment	Non-structural disaster risk management measures	Nature-based solutions	* Training and capacity building in support of structural risk reduction measures	* Training and capacity building in support of non-structural risk reduction measures	Early warning systems	Emergency infrastructure	Emergency funding	* Disaster preapredness, response, and recovery training and capacity building
PPCR																								
Bangladesh	Coastal Embankment Improvement Project Phase I	IBRD		•				•						•			•	•	•					
Bangladesh	Coastal Towns Infrastructure Improvement Project	ADB		•			•	•	•				•		•				•	•		•		
Cambodia	Enhancement of Flood and Drought Management in the Pursat Province	ADB	•		•		•	•	•		•	•		•		•			•	•	•			
Caribbean	Investment Plan for the Caribbean Regional Track of PPCR	IDB		•		•					•			•							•			•
Grenada	Disaster Vulnerability and Climate Risk Reduction Project	IBRD		•		•			•					•	•	•						•	•	
Haiti	Strengthening Hydro-Meteorological Services Project	IBRD			•			•				•					•							
Haiti	Municipal and Urban Resilience Project	IBRD												•	•								•	
Jamaica	Adaptation Program and Financing Mechanism	IDB	•						•					•			•	•						
Jamaica	Improving Climate Data and Information Management Project	IBRD	•	•					•							•			•	•	•			•
Mozambique	Transforming Hydrometeorological Services Project	IBRD																	•		•			
Mozambique	Cities and Climate Change Project	IBRD																•						
Mozambique	Roads and Bridges Management and Maintenance Project	IBRD		•																				
Nepal	Building Resilience to Climate Related Hazards	IBRD			•	•	•	•	•							•					•			
Niger	Niger Irrigation Program	IFC												•				•						
Pacific	Pacific Resilience Program (PREP)	IBRD		•	•						•													•
Pacific	Implementation of the Strategic Program for Climate Resilience (SPCR)	ADB							•	•	•													
Papua New Guinea	Building Resilience to Climate Change in Papua New Guinea Project	ADB	•															•			•			
Papua New Guinea	Climate-Proofing Alotau Provincial Wharf Program	ADB													•			•						
Saint Lucia	Disaster Vulnerability Reduction Project (Climate Adaptation Facility — CAFF)	IBRD	•	•	•				•	•		•		•	•	•	•		•			•	•	•
Samoa	Enhancing the Climate Resilience of Coastal Resources and Communities	IBRD	•	•			•		•	•		•		•			•	•				•		•
Tajikistan	Improvement of Weather, Climate, and Hydrological Delivery Project	IBRD		•		•		•		•	•					•					•			•
Tonga	Climate Resilience Sector Project	ADB	•	•		•			•	•		•		•	•	•	•	•				•		•
Zambia	Strengthening the Climate Resilience of the Kafue Sub-Basin Project	AfDB													•					•				
TAF																								
Bhutan	Integrating Resilience into Bhutan's Economic Recovery from Covid-19	IBRD	•			•			•															•
Greater Mekong Subregion	Green and Resilient Covid-19 Recovery in the Greater Mekong Subregion	ADB							•									•			•			
Nepal	Nepal's Transition to Green, Resilient, Inclusive Development	IBRD							•							•		•						
Papua New Guinea	Climate-Resilient Farmer Group Development and Post-Harvest Technologies to Support C-19 Recovery for Smallholder Coffee farmers	ADB	•										•				•							
Turkey	Improving the Management of Coastal Protected Areas and Ecosystems	IBRD	•					•										•						

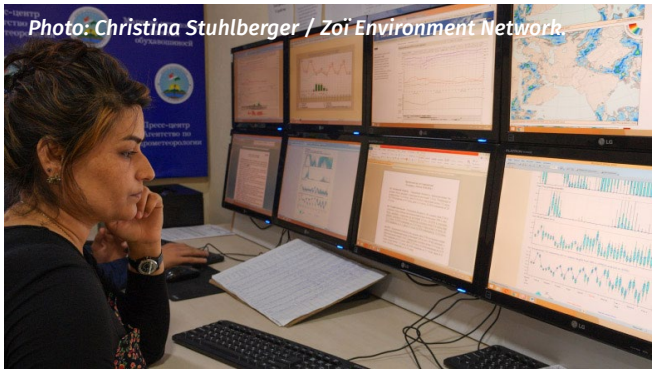


Photo: Christina Stuhlberger / Zoï Environment Network.

3.1. Priority for Action 1: Understanding Disaster Risk

3.1.1. Disaster risk assessment processes

CIF supports a deeper understanding of disaster risks through the deployment of risk and vulnerability assessments. These assessments have focused on the risks to sectors, such as agriculture, tourism, health, and water, where the need for improved climate resilience has been identified. Frequently, improved understanding through climate and disaster risk assessment has guided the resilient design of infrastructure projects for these sectors. Several assessments have sought to improve the understanding of risks at the community level, while others have taken a holistic approach and considered risks across landscapes, such as at the watershed scale or with respect to Coastal Zone Management (CZM).

In **Samoa**, risk and vulnerability assessments from the national to the village levels, characterized by participatory approaches and bottom-up prioritization, informed investments in the *Enhancing the Climate Resilience of Coastal Resources and Communities Project*. Traditional and scientific disaster risk knowledge and approaches have been integrated to create improved coastal infrastructure management (CIM) plans (see **Box 3**).[27]

In **Papua New Guinea,** a TAF grant[28] is seeking to enhance the understanding of climate and disaster risks to develop a blockchain risk insurance product for smallholder coffee farmers to reduce their risks and exposure to climate change and disasters.

3.1.2. Generation of products to better understand disaster risk

CIF projects have been active in gathering data on historic events and current conditions, as well as in simulating future processes that relate to disaster risks, such as coastal inundation through storm surges, incorporating sea-level rise and erosion. Climate downscaling and technical modeling has been the backbone of many projects, along with high-resolution digital elevation models (DEM), bathymetric models (BAT), Light Detection and Ranging (LiDAR), and the utilization of satellite imagery and earth observation. Hydrological models have been developed to help understand flooding and manage risks, while Geographic Information Systems (GIS) have been used to establish a mangrove inventory as part of coastal resilience. Supported by such tools and techniques, hazard, vulnerability, and risk maps and similar **products have been produced to provide a visual representation of disaster risks to facilitate the understanding of these risks.**

In **Grenada**, through the *Disaster Vulnerability and Climate Risk Reduction Project,* LiDAR mapping for the entire country has been completed and is available on a shared platform. Water resource management has been improved through the creation of a large-scale DEM and BAT. Hydrological models to analyze water flow, drainage management, and flood control have also been developed.

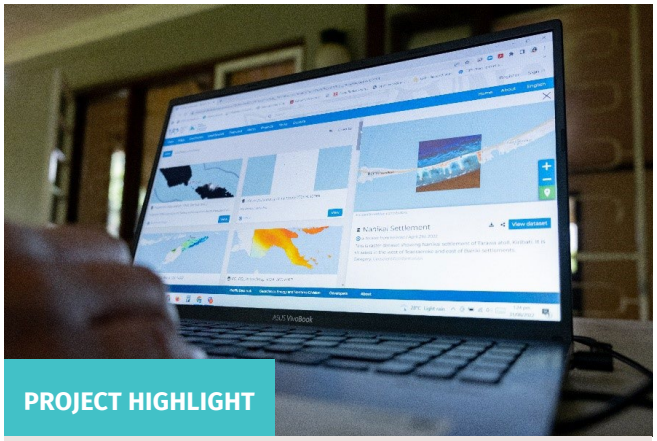
In **Mozambique**, the *Roads and Bridges Management and Maintenance Project* helped develop an online tool to plan for climate-resilient road works. The tool mobilizes a wide range of geospatial data related to road network criticality, traffic volume, poverty, agricultural productivity, fisheries, and flood events. Drawing on data and analytics related to the annual flood damage stemming from a wide range of flood events (with return periods from 1-in-5 to 1-in-1,000) under current climate scenarios and three future plausible ones, the tool assesses and visualizes, among other considerations, the flood vulnerability of the roads network.

3.1.3. Dissemination of information on disaster risks to the public, institutions, government stakeholders, and others for widespread understanding

CIF has sought to place information on disaster risks in the hands of those who will benefit from applying this information. For example, considerable effort has been made in strengthening the transmission of improved meteorological and hydrological (hydromet) and climate information and services. This has featured the development of centralized platforms for the sharing of information among user communities and public outreach, but it has also included the actual dissemination of information to target groups. An example is the deployment of weather and agrometeorological (agromet) products to farming communities to help reduce losses from hydromet hazards.[29]

In **Haiti**, the institutional strengthening of the hydromet services system, supported by the *Strengthening Hydro-Meteorological Services Project*, has provided the foundation to support decision-makers, such as those in the civil protection and agriculture sectors, with an improved understanding of climate-related hazards and the ability to better assess disaster risks.

In **Nepal**, the *Building Resilience to Climate-Related Hazards Project* has made weather and agromet information available to beneficiaries, including women, through the provision of easily accessible data and information. The Agriculture Management Information System (AMIS) provides critical and timely agromet climate and weather information to farmers to increase productivity and reduce losses from hydromet hazards. This has been achieved by developing and disseminating 12 agromet information and risk management products.[30] The provision of over 1,200 sets of mobile phones, rain gauges, and thermometers to farmers' groups, and the dissemination of agro-advisory information two or three times per week via the short messaging service (SMS) has placed decision-support tools in the hands of over 40,000 farmers and other relevant stakeholders.



PROJECT HIGHLIGHT

BOX 2. The Pacific Resilience Nexus

The World Bank-funded *Pacific Resilience Project (PREP)* sought to strengthen early warning, resilient investments, and the financial protection of participating countries. Component 2 of the project, namely, Risk Reduction and Resilient Investments, is specifically aimed at strengthening multi-hazard risk information systems and innovative knowledge sharing to support risk-informed decision-making.

A key activity implemented under this component is the development of the Pacific Resilience Nexus — an integrated web-based data and information platform to house all Pacific disaster and resilience knowledge. Nexus combines various information and database platforms under one umbrella. Pacific disaster management, climate change, resilience, and other related data and information can now be more easily accessed by practitioners. Users can access natural disaster hazard maps, technical reports, spatial data and information, exposure data, forest change detections, population predictions, early warning forecasts, and so much more.

At the Nexus launch event, Tevi Obed (Disaster Risk Management Specialist — World Bank Vanuatu) stated, *"[Nexus] provides good opportunities for countries to have access to existing information, but also to share data that they already have."* Mr. Obed is encouraging Pacific countries to use the platform to share their data, as sharing is part of the Pacific culture. Nexus is now implemented and managed by the Pacific Community's (SPC) Disaster and Community Resilience Programme and can be accessed by anyone at this address: https://nexus.pacificdata.org/.

Photo: Ministry of Forests and Environment, Government of Nepal

3.1.4. Specialized technical training on understanding disaster risks

> Capacity building

To strengthen the understanding of disaster risk, CIF has incorporated technical trainings in the use of technical and specialized technologies, such as LiDAR, GIS, hydromet, and climate services investments. The trainings, which at times were online due to COVID-19, focused on the application of knowledge and understanding to decision-making.

In **Grenada**, CIF supported capacity building across the government to ensure a broad understanding of risks and the new systems in place to monitor and assess risks. This includes building the capacity among government officials in the Ministry of Infrastructure, Development and Implementation; Ministry of Agriculture; Ministry of Finance; Ministry of the Environment, and the Meteorological Office, among others, to conduct an assessment of natural hazard risks and integrate such knowledge into policy making and decision-making for disaster risk reduction and response planning across sectors. In addition, activities have also included training in watershed modeling for flood and drought hazard mapping and the calculation of hydraulic parameters for climate-proofing infrastructure design. There has also been regional training on GIS, disaster risk management planning, risk models, and database management.

3.1.5. Public capacity building on understanding disaster risks

> Capacity building

CIF has worked on strengthening the disaster risk understanding of the public and specific local community groups. This has been approached through participatory workshops and the expertise of suitable local facilitators.

In **Samoa**, the project provided a two-week training to 10 civil society organizations (CSOs) on climate and disaster risk and resilience, including structural and nature-based solutions (NbS) for adaptation, community facilitation skills, and subproject procedures. Ultimately, five trained CSOs were contracted to support the villages. CSOs were supported in developing community engagement plans and identifying priority community adaptation measures, including for disaster resilience.

The Samoa project also reinforced the necessity of building resilience based on local knowledge and experience by utilizing proper processes of community engagement. For example, through a community survey, it was discovered that adaptive learning was the highest-rated resilience attribute. Seventy-two percent of the community members “agreed” or “strongly agreed” with the following statement: “Households have learned considerably from how we have dealt with past disasters. This knowledge is crucial in successfully dealing with future events.”

In **Nepal**, women’s capacity to make weather and climate-informed decisions for adaptation measures (including with respect to weather and climate-related natural hazards) in the agriculture sector was strengthened. A total of 6,085 female farmers took part in female-targeted capacity-building programs.

3.1.6. Reflections on understanding disaster risk

CIF projects have actively supported disaster risk assessments, the generation of information and knowledge products to better understand disaster risks, and the dissemination of disaster risk information. For example, in countries such as Bangladesh (Coastal Embankment Improvement Project Phase I [CEIP-I]) and in the Caribbean and Pacific regions (Pacific Resilience Program [PREP]), CIF has introduced sophisticated products, such as climate modeling and downscaling, LiDAR mapping, and GIS, to support the better understanding of disaster risks.

Results in the form of products are only a part of understanding disaster risks; **the ongoing journey of collaboration between stakeholders to continually understand risks better is the basis for integrated solutions.** Integrating multi-hazard disaster risk knowledge sources, such as scientific and traditional or local knowledge, and sharing experiences through South-South learning, are critical for successful outcomes, as the PPCR experiences in the Pacific Region and Samoa demonstrate (see **Box 3**). The growth and improvements in virtual training that emerged due to public health concerns during the COVID-19 pandemic have opened new opportunities for strengthening the understanding of disaster risk amongst stakeholders.

PROJECT HIGHLIGHT

BOX 3. Integrating Scientific and Traditional Knowledge to Understand Disaster Risks in Samoa

In Samoa, the *Enhancing the Climate Resilience of Coastal Resources and Communities Project* aims to support coastal communities in becoming more resilient to climate variability and change. The project looks to assess vulnerabilities and solutions on a ridge-to-reef basis, in recognition of the fundamental link between processes occurring in different parts of the catchment.

The recent decision by the government, encouraged by the PPCR Phase I, to change the focus of the CIM plans from infrastructure to more integrated community planning has made the CIM plan approach more innovative in a country where governance and decision-making are embedded within traditional community structures. Providing opportunities for strong participation among stakeholder groups, including local communities, to embed climate risks within planning helps in the formulation of solutions that are best suited to local conditions with the greatest chance of transformative and sustainable outcomes.

Therefore, participatory approaches and bottom-up prioritization have been blended with high-resolution satellite imagery and DEM, derived from LiDAR technology to inform CIM plans and investments.

3.2. Priority for Action 2: Strengthening Disaster Risk Governance to Manage Disaster Risk

3.2.1. Regional, national, and local governance structures, and mechanisms for collaboration to manage disaster risks

Recognizing the imperative for suitable regional, national, and local arrangements conducive to decision-making for the management of climate and disaster risks, **CIF has supported the establishment and strengthening of governance structures, mechanisms, and processes of engagement among multidisciplinary and varied stakeholder groups.** In doing so, PPCR has sought to strengthen collaboration at the regional and national levels through hydromet data and information sharing, and through processes that seek to better link national with district and local governance pertaining to risk.

Additionally, collaborative processes with local community groups, who ultimately experience the success and failure of DRM most directly, have been advanced through the establishment and strengthening of governance structures and mechanisms. They include farmer-to-farmer knowledge sharing and the formation of water management groups that work with others for the sustainability and effective functioning of water infrastructure in times of flood and/or drought risks.

In **Bangladesh**, *CEIP-I* successfully met its targets of supporting the establishment of community structures with the formation of 141 water management organizations (WMO) and 10 water management associations (WMA). These groups support the identification, design and implementation of structural investments made in polders, and go on to address operational and maintenance needs. This support includes closing gates to avoid tidal flooding and salinity intrusion, including during cyclones.

LESSONS

BOX 4. Learning from Cambodia on Transboundary Collaboration for Flood Risk Management

In **Cambodia**, the *Enhancement of Flood and Drought Management in the Pursat Province* project aims to support the Royal Government of Cambodia to undertake structural and non-structural measures to prepare for and manage disaster risks linked to floods and droughts.

Regional collaboration on transboundary flood management has been promoted between Cambodia and Vietnam through workshops, support for the development of a joint action plan, and engagement within the context of the Mekong River Commission (MRC) structures and mechanisms to implement the transboundary flood management options. Flood and drought forecasting has been transmitted to the MRC Regional Flood Management and Mitigation Center and on a web portal, as well as to the National Committee on Disaster Management (NCDM). At the local level, the communities who received training have established village disaster management groups (VDMGs) to design and implement community-based DRM activities and coordinate response and recovery in the event of a disaster. VDMGs have now prepared 50 gender-sensitive safer village plans that incorporate disaster risk reduction (DRR) measures.

Enhancing the regional data, information, and knowledge base for the management of floods and droughts was recognized as important in enhancing the resilience of communities and infrastructure to flood risks. However, the two-year period to develop the full flood management and forecasting, as well as early warning systems (EWS), was too short, and the component was, therefore, extended by 20 months. Establishing and strengthening effective EWS takes considerable effort based on processes of collaboration with end-users, particularly the poor and most vulnerable. Nevertheless, this is critical to achieve positive outcomes.

In **Nepal**, the project strengthened the interaction between key agencies responsible for hydromet and agromet services. For example, an interagency initiative, namely, the Working Group of Agricultural Meteorology (WOGRAM), comprising officials from agencies pertinent to the hydromet services value chain, was formed.

In **Turkey**, a TAF project[31] is looking at how the COVID-19 recovery stimulus can contribute to the climate resilience of protected coastal ecosystems, along with fishing, farming, and tourism communities. Stimulus measures could include the scaling up of economic incentives for fostering cross-sectoral and international collaboration on conservation activities in protected areas. This is relevant to disaster risks because the causes and, sometimes, the impacts of disasters are not confined to a specific location. Additionally, disasters require cross-sectoral collaboration to address their causes coherently. Collaboration on all scales is also important due to climate change for ecosystem integrity and health.

3.2.2. Mainstreaming disaster risk management in policy, planning, and regulation

Entry points for mainstreaming DRM through CIF investments have included undertaking analyses and supporting the development of existing policies, plans, strategies, and regulations. Specific sector plans, integrated water resource management (IWRM), and coastal planning, along with community DRR and safety plans, including for schools, have been advanced accordingly. The integration of DRM within different policies, plans, and other areas has been aided by the development and use of mainstreaming tools (including for gender considerations), guidelines (such as on flood and drought mitigation and ecosystem-based approaches), and standards (such as for the screening of infrastructure to assess capability to withstand hazards and the development of standard operating procedures).

In the **Pacific region**, a review and assessment of the current subnational planning processes, under the *Implementation of the Strategic Program for Climate Resilience (SPCR)* project, identified the priority needs for assistance in mainstreaming climate change adaptation (CCA) and DRR into development policies and plans in selected countries and sectors. This led to the development of mainstreaming tools on cost-benefit analysis (CBA), monitoring and evaluation, and a central agency appraisal checklist that all incorporate CCA, DRR, and gender considerations. Using the tools, the project developed and strengthened infrastructure, agriculture, and coordination policies in Kosrae, and the renewable energy, waste, and agriculture policy in Tuvalu.

In **Samoa**, 18 district and village-level CIM plans that identify climate and disaster risks and support adaptation measures have been updated. By directly engaging and coordinating with national agencies in updating and co-financing the CIM plans, as well as implementing the CIM plan priorities, the project helped ensure that climate information was used in the identification of adaptation/DRR solutions and in decision-making more broadly in four climate-sensitive sectors: community development, water, transport, and agriculture and fisheries. Furthermore, the project assisted 11 villages to adopt village fisheries management plans (VFMP) to support fish reserves.

In **Nepal**, coordination among ministries had posed challenges for multisectoral projects, including for climate and disaster resilience. The implementation arrangements of the project aimed to enhance the coordination between stakeholder agencies. The first component of this project was, therefore, designed to clarify the mandate of the Department of Hydrology and Meteorology (DHM) in relation to other government agencies through the Hydromet Bill and Regulation (promulgation pending). With benefits in terms of providing clarity for stakeholders including with respect to early warning, the project has developed standard operating procedures for DHM on hydromet services.

3.2.3. Financing mechanisms, structures, and arrangements for disaster risk management

CIF has worked on establishing financing and budgetary arrangements to help underpin DRM investments. This has included establishing designated trust funds, improving the business plan of hydromet services (based on helping ensure that users derive beneficial outcomes which in turn helps sustain demand and improves the case for investment), and promoting a programmatic approach that invites and relies upon collaboration and complementarity amongst different funding sources.

In the **Pacific region** under the *SPCR project,* technical inputs for mainstreaming CCA and DRR in national and local development plans and policies are fed into the budgetary decisions. The mainstreaming tools described above have been used in Kosrae to inform budgetary decision-making for the inclusion of CCA and DRR in the Malem-Utwe Road Project, the Lelu Water Infrastructure Proposal, and the agriculture subsector of the Kosrae Strategic Development Plan. Similarly, in Tuvalu, budgetary decision-making for CCA and DRR inclusion in the renewable energy infrastructure (i.e., biogas systems) and green waste management in Funafuti was achieved.

In **Tonga**, the *Climate Resilience Sector Project* introduced a financing mechanism for CCA and DRM through the Tonga Climate Change Trust Fund (CCTF) to ensure that vulnerable communities have access to finance for climate-responsive community investments, which are vital to livelihoods (see **Section 3.3.4**). The successful rollout of the first and second batches of small community-based adaptation projects in 2018 and 2020 under CCTF has been a revelation. It has provided a means for vulnerable communities and the outer islands to adapt to the adverse impacts of climate change through simple community initiatives.

PROJECT HIGHLIGHT

BOX 5. "Act to Adapt" Challenge in Saint Lucia[32]

The *Saint Lucia Disaster Vulnerability Reduction Project's* Act to Adapt competition was sponsored by the Saint Lucia Development Bank's (SLDB) Climate Adaptation Financing Facility (CAFF). It challenged all secondary school students to use the Act to Adapt App to assess their homes and determine the expected impact from a Category 5 hurricane. Students were further tasked to identify adaptation projects to reduce the expected impact level, using the app's resources.

Winners stood to obtain a CAFF grant to implement their proposed adaptation projects at the values of East Caribbean Dollar (XCD)5,000 (Low-Vulnerability Category), XCD7,500 (Medium-Vulnerability Category), and XCD10,000 (High-Vulnerability Category). Female students accounted for approximately 60 percent of the winning entries. One example is Nyann Joseph, a student at Castries Comprehensive Secondary School. She won a CAFF grant for her approach on reducing the flood risk in her home through improved drainage.

Families interested in implementing drainage or other home improvement projects to reduce vulnerability to floods, landslides, hurricanes, or water shortage can access low-cost financing through CAFF. The rehabilitation of riverbanks and improved drainage work funded by the project has benefited over 23,000 residents (whose homes are in close proximity to the works or drains) by reducing their vulnerability to natural hazards and climate change.

As part of a comprehensive and integrated approach to climate and disaster risk challenges, enabling local communities to access resources to implement their own DRM and adaptation solutions has strong grounds for sustainability and impact.

The injection of additional financing from the Ireland Trust Fund for Building Climate Change and Disaster Resilience (for 760 water tanks), as well as the government's own resources, has validated CCTF as an effective mechanism for driving small-scale community adaptation investments. Nonetheless, it will be deemed to have failed in the long term, unless urgent action is taken to ensure that the resources needed are in place for the ongoing implementation of CCTF, after project resources are no longer available at project closure.

3.2.4. Regional learning to strengthen disaster risk-informed decision-making

> Capacity building

At the regional level, CIF has supported governance arrangements regarding the management of shared risks and the improvement of knowledge through activities, such as bringing together the National Meteorological and Hydrological Services staff from countries at a regional level for improved collaboration. Activities have also included the strengthening of technical and institutional capacities for participating in transboundary initiatives regarding flood risks, along with the organization of training activities at the regional level in support of utilizing the tools that have been developed to improve the integration of climate resilience and DRM in relevant governance structures and processes.

In the **Caribbean region**, key staff from entities, such as in Jamaica, the Planning Institute of Jamaica; the National Water Commission; the Institute of Jamaica; the Ministry of Industry, Commerce, Agriculture and Fisheries; the National Environment and Planning Agency, and the Rural Agricultural Development Authority, were trained in the use of the Caribbean Climate Online Risk and Adaptation Tool (CCORAL), with support from the *Investment Plan for the Caribbean Regional Track of the Pilot Program for Climate Resilience (PPCR).* CCORAL, which is run entirely online, was developed for government officials to integrate climate resilience into general decision-making processes and activities in the Caribbean.

> *"Investments in training activities such as these are a very important part of securing the long-term future of Jamaica and the wider Caribbean,"*
>
> *said Ainsley Henry, Programme Manager of the Caribbean Regional Track of PPCR.*

In the **Pacific region**, the development, establishment, and operationalization of the Regional Technical Support Mechanism (RTSM), under the *SPCR project,* is geared to respond to or facilitate responses to the countries' CCA and DRR-related needs through a network of experts. Accordingly, a total of 15 TA requests have been actioned in the Federal States of Micronesia (3), Fiji (3), Nauru (2), Samoa (2), Tonga (2), Vanuatu (2), and Tuvalu (1). The RTSM facility also played a critical role in producing the technical studies required to access funds from the Green Climate Fund for Vanuatu (USD23 million) and Nauru (USD300,000). There is considerable interest in further using the RTSM and improving it. Specifically, the GIZ3-led initiative on nationally determined contributions (NDCs) has agreed to strengthen the RTSM for delivering the Pacific's regional NDCs hub activities.

In addition, the mainstreaming tools on CBA, monitoring and evaluation, and the central agency appraisal checklist (all incorporating CCA, DRR, and gender considerations) developed by the project were continuously tested and revised, with inputs from 16 training workshops and 18 case study applications to the pilot countries' national and sectoral policies, plans, projects, and budgets. Such support helped the Federal States of Micronesia to secure a grant of USD9 million from the Adaptation Fund.

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BOX 6. Regional Expertise in the Pacific Proves Beneficial

As noted by the World Bank-funded Pacific Resilience Project (PREP), a multi-hazard early warning system (MHEWS) is recognized as a critical need for Pacific Island countries. The Tonga volcano eruption in January 2022, reinforced the approach to continue building expertise at the regional level for countries to access when needed. When expertise is built within regional technical agencies that belong to member countries, as in the case of SPC, the cost of expertise (from within the region) is reduced, and its development is more sustainable.

3.2.5. National government capacity building to strengthen disaster risk-informed decision-making

> Capacity building

Further to participation in region-specific capacity-building initiatives, CIF has supported national DRM capacity building with respect to various entry points. This entails training for staff responsible for providing hydromet services and for the end-users of information to support application to decision-making. Capacity building has also been undertaken to enhance processes for strengthening climate and disaster resilience in government sectors at the national level, including fostering a programmatic and collaborative approach to resilience.

In **Saint Lucia**, the *Saint Lucia Disaster Vulnerability Reduction Project (DVRP)* has enhanced the government's capacity to use climate data and hazard information for improved decision-making and engineering analyses. Also, due to the extensive number of activities under DVRP, the hands-on technical support provided to the project coordination unit and implementing agencies has been invaluable in advancing project activities. Through supplemental grant funds, DRM technical support has been provided, as well as support in the areas of environmental and social safeguards, hazard and data management, and procurement.

PROJECT HIGHLIGHT

BOX 7. Saint Lucia Disaster Information Management System

DVRP responds directly to the priority areas of the SPCR by aiming to reduce immediate-term disaster vulnerability and increase long-term climate resilience by addressing the multifaceted risks associated with hydromet events.

With links to **Priority for Action 4,** the National Emergency Management Organization (NEMO) can use the established Disaster Information Management System for multiple disaster planning and response applications, such as the following:

- Enhancing communication within NEMO during and outside of disaster events;
- Identifying the best person(s) to respond to a particular event;
- Identifying capacity gaps and developing training and recruitment plans;
- Enhancing the placement of resource persons within the NEMO system, based on qualifications and capacities;
- Understanding the transportation and other support needs of NEMO volunteers;
- Determining the most suitable suppliers to meet specific post-disaster needs based on defined criteria;
- Maximizing the assignment, management, and mobilization of private and public sector partners in a disaster context;
- Determining gaps in the memoranda of understanding (MoU); and
- Identifying strategic areas requiring greater collaboration/partnership.

In **Tonga**, the project objective is to increase the resilience of vulnerable communities to climate change and disaster risks. Education and capacity building for mainstreaming climate resilience, inclusive of DRM, in the development planning of key vulnerable sectors, has been supported in multiple ways:

- Implementation of the Climate Change in Development Planning training program on CCA and DRM for 20 government staff;
- Implementation of a variety of climate change-related short courses for relevant public and private sectors with over 1,200 people participating;
- Provision of scholarships to 20 undergraduates who completed studies at the University of the South Pacific under the project's scholarship program, with 18 already employed by the government and contributing positively to building and retaining climate change capacity; and
- Provision of specialized training to local staff overseas at the Bureau of Meteorology in Melbourne, Australia, as part of on-the-job training for staff. In a positive step towards strengthening of hydromet services on a sustainable basis, the government committed USD1.4m (16% of total) for the Meteorology Division to support operations.

The project has also sought to increase the government's coordination and knowledge management capacity regarding the Joint National Action Plan for climate change (JNAP) Secretariat. This is to improve the coordination and implementation of existing CCA and DRM policies identified under the National Infrastructure Investment Plan.

LESSONS

BOX 8. Ensuring the Sustainability of Climate Resilience Outcomes in Tonga

In **Tonga**, the *Climate Resilience Sector Project* has successfully delivered short-term capacity development activities on climate resilience, inclusive of DRM. The challenge faced by small island developing countries is the retention of strengthened capacity and resources. Although the commitment of the Tonga government is strong, the tangible progress made under the project may soon cease at project closure. The government's own motivation and readiness for change, such as by mainstreaming climate change into the decision process and through the commitment of resources, will be critical for the project to build upon in order to sustain its outcomes. The Climate Change Fund Act is an important enabler for sustaining such action.

3.2.6. Local capacity building to strengthen disaster risk-informed decision-making

> Capacity building

CIF recognizes that local stakeholders, including the vulnerable and the marginalized, possess capacities and strengths. Therefore, it is essential to open opportunities for local voices to influence decision-making through local stakeholder engagement. To ensure that local voices are fully able to play a rightful role in the governance surrounding DRM, CIF has also invested in local capacity building.

In **Papua New Guinea**, a TAF project[33] is seeking to develop 30 farmer groups with females representing at least 15 percent of the membership on average.

Its aim is to promote farmer-to-farmer knowledge sharing to improve farming practices for a climate-resilient recovery from COVID-19. Achieving the objective of having 60 farmer group educators (FGEs), with at least one female and one male FGE per farmer group, entails engaging in community outreach to identify FGEs, develop the FGE training curriculum, and training participants.

Facilitating engagement among farmers for shared learning is known to be important; its significance will likely increase, as individuals, households, and entire regions face new challenges, such as the slow decline in productivity or the rapid loss of assets through extreme weather. New approaches to reduce such impacts will become more critical.

3.2.7. Reflections on strengthening disaster risk governance to manage disaster risks

CIF projects have actively supported regional, national, and local governance structures, institutional arrangements, and collaborative mechanisms to manage disaster risks by mainstreaming DRM in policy, planning, and regulation, along with financing and budgetary arrangements. A few noteworthy examples include the establishment and strengthening of local community groups in Bangladesh, improved transboundary flood risk management in Southeast Asia, policy development of key sectors in Saint Lucia and the Pacific region, and the bolstering of technical capacity in many settings.

DRM is a development concern, not a challenge that can be addressed meaningfully in isolation from other agendas. Without integrated risk reduction in all decision-making areas, we will not be able to ensure that future generations will have a planet fit for human habitation.[34]

The governance arrangements to help foster a healthy and conducive enabling environment for the implementation of structural and non-structural DRM and CCA measures are foundational for sustained action on these agendas. For example, the extent of people's vulnerability to disasters is intrinsically linked with social and economic inclusivity, personal and environmental health, and the stability of the climate, amongst other factors. **Ensuring that integrated governance structures and processes are established and strengthened for collaboration and cooperation at all levels and across all sectors is necessary.**

3.3. Priority for Action 3: Investing in Disaster Risk Reduction for Resilience

3.3.1. Structural measures: Structures for public protection

CIF has supported investments that aim to directly reduce disaster risk by managing and reducing exposures to natural hazards. Most commonly, activities have focused on engineered protections against coastal and riverine flooding. This has been approached by constructing and rehabilitating infrastructure, such as coastal protection sea walls and embankments, riverbank protection, the improvement of storm drainage capacity with culverts, and desilting activities. Other structural measures to reduce risks have included irrigation canals for aiding in both flood and drought control, as well as check dams.

In **Bangladesh**, the project has implemented considerable structural mitigation activities to increase the area in the 10 selected polders that are protected from tidal flooding and frequent storm surges, which are expected to worsen due to climate change. This includes the upgrading of 333 kilometers (km) of an embankment and 258 km of drainage channels; the construction of 73 drainage structures and 49 flushing structures; the repair of 17 existing drainage and flushing structures; and the completion of 9.5 km of bank protective works and 24 km of slope protective works (links with **Section 3.3.5** (Nature-based solutions), as they complement these structural measures, forming an important aspect of the work in Bangladesh).


Photo: ADB

PROJECT HIGHLIGHT

BOX 9. Relocation of a Tonga Hospital[35]

On January 11, 2014, Cyclone Ian — the most powerful storm ever recorded in Tonga's waters — passed directly over the northeast Tongan islands of Ha'apai. The Category 5 storm affected 66 percent of Ha'apai's population. The Niu'ui Hospital lost part of its roof in the storm; given its proximity to the eroding coastline, it was found that the hospital was more vulnerable to disasters than previously thought.

Through the *Climate Resilience Sector Project,* the hospital was moved to the highest point of the island and then built back better and bigger, with new features including a 500,000-liter rainwater storage tank and x-ray facilities. *"The relocation of Ha'apai's Niu'ui Hospital is a living, breathing example of the multiple benefits that may be gained from building public infrastructure back better. The new location is much less vulnerable to disasters and safer for patients, staff, and visitors,"* said Amelia Afuha'amango Tu'ipulotu, the Minister for Health.

Helping to ensure the continuity of health care during emergency conditions is a means of proactively mitigating the impact of disasters on the communities served. Additionally, for public coastal protection in Tonga, this project supported the construction of a two-kilometer-long sea wall.

In the **Caribbean region**, resilient agricultural production systems are being supported, as they can reduce livelihood and food security risks linked with climate change and disasters. Viable seed banks are an important component of such projects. Specifically, one such project installed a cold room at the Bodles Research Station in Jamaica for USD6 million. *"The cold room installation will ensure that the seeds stored will be viable for a longer time,"* said Georgia Golding, Plant Breeding Officer at Bodles. *"These seeds represent the facility's foundation planting material, a portion of which is made up of climate-resilient crop varieties,"* she added. The installation of the cold room forms part of a larger investment that also includes the purchase of a large seed batch-dryer and the refurbishing of the facility's seed bank facilities.

PROJECT HIGHLIGHT

BOX 10. Strengthening Resilient Livelihoods for Women Farmers in Niger Through Solar-Drip Irrigation[36]

The *Niger Irrigation Program* aims to promote access to affordable, efficient irrigation equipment for small and medium-sized farmers. Niger's mostly rainfed agriculture makes the dry season a time of low productivity when women are left to tend to the land and spend a considerable amount of time collecting water from wells. To help smallholder farmers, especially women, cope with worsening climate shocks such as droughts and floods, which decrease yields and aggravate food insecurity, the Niger Irrigation Program facilitated the installation of small and medium-scale solar-powered drip irrigation equipment for smallholder, community, and medium-sized commercial farms, covering 68 sites across 53 hectares (ha) of land.

Demonstrating important overlaps with non-structural DRM measures, the solar-powered drip irrigation scheme has helped build livelihood resilience in the context of droughts and floods, with women farmers now generating much more income through higher yields and the ability to produce crops not typically farmed during the dry season, thereby garnering higher market value (see **Section 3.3.4**). Moreover, with the time saved from not needing to fetch water from the wells, some women can engage in other income-generating activities, such as purchasing livestock and tending to them. Additionally, 78 percent of the surveyed farmers reported increased safety due to the provision of a local water source. Of the 900 project beneficiaries to date, 538 are women.

3.3.2. Structural measures: Structures made resilient to disaster risks

CIF has strengthened DRR through numerous measures that bolster the structural integrity, function, and resilience of a wide array of infrastructure types in light of hazard exposure. Resilient infrastructure has been enhanced with respect to roads, bridges, water supply and sanitation, schools, health centers, and public buildings.

In **Saint Lucia**, the project reduced the current and future risks to key infrastructure with respect to floods and landslides, including the reconstruction of critical infrastructure damaged during the December 2013 flooding, using the "Build Back Better" approach (see **Section 3.4**) and directly benefiting 155,790 people. The project has achieved the resilient rehabilitation of road sections along the national highway through drainage improvements, slope stabilization works and the retrofitting of select bridges, the climate-resilient rehabilitation of deteriorating water supply infrastructure, along with the retrofitting and rehabilitation of existing schools and health centers.

In **Grenada**, infrastructure projects have improved the safety of communities and preserved livelihoods by strengthening the country's resilience to the natural hazards and climate change impacts on the island's main transport roads, bridges, sewerage and storm drainage infrastructure. For example, the rehabilitation of the 80-year-old Lance Bridge on a main arterial road resulted in increased resilience to weather events, amongst other benefits. The Hubble Bridge — about 400 meters from the Lance Bridge — was heavily damaged by Hurricane Ivan. Considering that the bridge serves a residential area, two churches, and a school that also functions as an emergency shelter, its rehabilitation has revitalized connectivity. The project also includes the retrofitting of public buildings to improve disaster resilience.

3.3.3. Structural measures: Hydromet observation infrastructure and equipment

CIF investments in the strengthening of hydromet and climate services, geared to provide beneficial outcomes for user communities, are evident across all Priorities for Action. Functional observation infrastructure is the vital first building block of the hydromet and climate services value chain, providing an indispensable component for monitoring, forecasting, and early warning service provision (see **Section 3.4.1**). Consequently, CIF has invested in weather and river stations, including automatic weather stations (AWS), river gauges, radar, and other technologies.

In **Tajikistan**, the *Central Asia Hydrometeorology Modernization Project (CAHMP)* aspired to provide more timely hazardous and extreme weather warnings for events, such as floods, mudflows, droughts, high winds, and avalanches. As such, it is supporting the restoration and improvement of hydromet observation equipment and networks (including strengthening transboundary data exchange across the region), as well as national meteorological and hydrological data collection. The project has supported the rehabilitation of 54 weather stations and 16 river stations in Tajikistan. These efforts have helped improve the capacity of countries in the region to monitor, transmit, and analyze real-time weather, climate, and water measurements, thereby contributing to the increase in weather and river forecasting accuracy by 30 percent or more.[37]

In **Nepal**, the observation infrastructure has been modernized for advances in forecasting, with benefits for EWS and resilient agricultural livelihoods. This has entailed the installation of 88 AWS, 70 hydrological stations, and the first weather radar and lightning detection system in Nepal.

In **Jamaica**, the *Improving Climate Data and Information Management Project* improved and significantly expanded the meteorological (surface and atmosphere) and hydrological observation network and data transmission capability, and conducted the data rescue of past rainfall records.

More specifically, 72 AWS across Jamaica were procured and installed. It is important to note, that due to the demonstration effect of the initial installation of the AWS installation and the showcasing of their technical viabilities, the mobilization of funds was achieved, with seven AWS funded under the Global Environment Facility Small Grants Program and the United States Agency for International Development (USAID) and installed under the CIF project. Remarkably, the project is responsible for over 65 percent of the overall national hydromet network that makes up the Caribbean's first real-time weather reporting system.

Thirty-two soil moisture probes were also procured and installed. This has informed irrigation decisions on when to irrigate and how much water must be supplied to avoid low-quality production.

Furthermore, three tide gauges were procured for measuring the rise of the sea level. As a result, real-time movements in sea levels along the North Coast can be tracked. These sea-level tide gauges are the only such equipment on the North Coast, bridging a critical data gap in the country's hazard information. It feeds directly into and forms a part of the Caribbean tsunami monitoring network and EWS. Finally, the project has procured, shipped, installed, and operationalized a Doppler Weather Radar that is powered by solar energy.

3.3.4. Non-structural disaster risk management measures

CIF's investments in strengthening non-structural DRM captured in this section aim to (a) strengthen the resilience of livelihoods and (b) bolster public health. Other forms of DRM that can be categorized as non-structural, such as capacity building, NbS, DRM related policy and regulatory work, and other "soft" DRM measures, are included in different parts of the study. With respect to livelihoods, CIF has supported DRM outcomes by ensuring that livelihood activities are protected from losses on account of hazard events and maintain viability under changing conditions. Bolstering livelihoods to better weather shocks and stresses is a fight against poverty, which is a major underlying disaster risk factor and an outcome of disaster experiences. CIF has improved the viability of fragile livelihoods, such as agricultural livelihoods (for example, through reduced saltwater intrusion, the introduction of resilient crops, and through insurance) and fisheries (for example, through protected marine habitats), and enabled the diversification of income sources. With respect to public health, CIF has strengthened systems that help prevent disease outbreaks before, during, and after disasters.

Photo: CSSP and Ministry of Finance Samoa

PROJECT HIGHLIGHT

BOX 11. Building Climate-Resilient Livelihoods in Samoa

In **Samoa's** *Enhancing the Climate Resilience of Coastal Resources and Communities Project*, both agricultural and fisheries livelihoods have been improved with benefits for DRM. At the village level, 81 households replanted 50 ha of previously degraded land with more diverse, climate-resilient crops. This has led to improved food security through the ability to store food ahead of the cyclone and dry seasons, as well as improved financial security from the sale of surplus crops, with indirect benefits for improved resilience. At the district level, through public-private partnerships, the project has helped 785 farmers plant coconuts, cocoa, fruit, timber trees, and food crops on 349 ha of previously degraded land, through the provision of training to 1,200 farmers. It has also supported the certification of 2,000 organic farmers. The resulting annual average household income is estimated to have increased by USD1,207 (a rise of 27.2 percent) in addition to subsistence crops worth USD306/household/year.

For fisheries, VFMPs have been adopted and three new and five extended village fish reserves have been established, benefiting over 1,400 households. These interventions are expected to help counteract declines in fisheries yields due to overfishing, rising sea surface temperatures, and coral bleaching, thereby increasing annual average household income by USD665 — a rise of 14.9 percent.

In **Samoa**, public health has been improved with benefits for DRM. Improved waste management has been achieved in 18 villages, with the provision of rubbish stands, as well as wheelie bins for 650 households who did not have access to managed waste disposal previously. According to the beneficiaries' feedback, these investments have helped prevent waste accumulation and drainage contamination, thereby significantly curbing diarrhea and mosquito-borne diseases during floods and heavy rains.

In **Papua New Guinea**, the Climate-Resilient Farmer Group Development TAF project interventions have helped to protect coffee farmers' livelihoods. These interventions include blockchain insurance, improved post-harvest processing and storage, along with farmer knowledge to help farmers continue to improve yields and quality in the future. At the same time, they also serve to develop increased resilience to future climate and other disasters and disruptions.

In **Tonga**, with resilient livelihood benefits provided through CCTF, the project has helped 33 vulnerable communities to have access to climate-responsive community investments (see Section **3.2.3**). Furthermore, over 50 percent of eligible projects were awarded to women's groups.

3.3.5. Nature-based solutions

Unlocking investments in the protection, restoration, and sustainable management of nature can benefit people, economies, and ecosystems, and provide strong DRM and climate resilience outcomes. Indeed, ecosystem-based approaches are considered a core concept for integrated adaptation and DRM. **CIF has invested in a range of NbS that have wide-ranging benefits, including disaster resilience, and TAF has further invigorated NbS efforts in pursuit of green and resilient recovery from the pandemic.** Examples include afforestation for coastal resilience and erosion control; urban green infrastructure for flood mitigation; coral restoration for coastal resilience; sustainable forestry for soil water retention, and flood and landslide mitigation. In all settings, NbS are simultaneously associated with improved job opportunities and incomes.

In **Samoa**, the project investment included the replanting of 8.9 ha of degraded watershed areas with native species, the conservation and restoration of nearly 15 ha of mangrove reserves, and the restoration of two coral sites as part of a ridge-to-reef approach to resilience. As a result, this investment is helping to moderate coastal flooding, erosion, and sedimentation, thereby benefiting over 10,000 people.

In **Bangladesh**, CEIP-I supported the afforestation of 610 ha of the coastal area which involved the planting of 1,525,200 seedlings. The completed polder rehabilitation and improvement works, including extensive structural measures, are protecting nearly 54,734 ha of land and nearly 568,000 people from potential tidal flooding, storm surges, coastal erosion, and salinity intrusion (see **Section 3.3.1**).

In **Mozambique**, the coastal city of Beira is highly exposed and vulnerable to weather-related events and the effects of climate change, including recurrent floods from storm surges and heavy rains. With co-financing from the German Development Cooperation, the PPCR-financed *Cities and Climate Change Project* transformed the Chiveve River margin areas into an urban park. The park provides green infrastructure, which enhances the retention of soil moisture and provides additional drainage to increase capacity at low tide and prevent flooding. Valuable riverine and wetland ecosystems were restored, while the stormwater retention and drainage functions of the tidal river were protected and improved. Enhanced protection from flooding is estimated to benefit 50,000 people living in the river's catchment basin.

In **Jamaica**, 15 ha have been planted as reforestation in the Upper Rio Minho Watershed under the PPCR-supported *Adaptation Program and Financing Mechanism* project. Soil erosion on slopes in heavy rainfall and flooding events is being managed by planting pineapples, grasses, and other vegetation as "live barriers" to bind the soil. 64 km of live barriers have been supplied to farms in flood-prone communities.

Additionally, a marine sanctuary covering 150 ha of coral reefs, sea grass, and sand, where coral is being

restored has been established. The project seeks to achieve multiple aims. In parallel with strengthening coastal resilience, the project looks to improve fish stocks and sizes, and to enhance livelihoods through alternative income sources, such as employing fishers as coral gardeners and wardens (see **Section 3.3.4**).

3.3.6. Training and capacity building in support of structural risk reduction measures

> Capacity building

Technical expertise is needed to generate robust and decision-relevant weather and climate products and services. CIF projects that strengthen these services all require capacity building among identified stakeholders, and this capacity building transcends the breakdown of Priorities for Action used to frame this study. Here, we note some examples where **CIF has provided comprehensive training, in support of hydromet observation infrastructure investments.** In other capacity-building sections, examples relate to specific ways, such as data sharing and early warning dissemination and communication, in which hydromet services support disaster risk understanding. **CIF has also provided training and capacity building, in support of investments in structural measures,** such as in relation to the operations and maintenance of water management and transport infrastructure.

In **Niger**, to ensure the sustainability of the solar irrigation interventions, the *Niger Irrigation Program* built local capacity. Community field assistants and solar pump technicians were trained; they, in turn, provided training to 900 smallholder and medium-sized farmers, including 538 women, on how to operate the drip irrigation equipment. Furthermore, 517 farmers received training on operating solar pumps, while 306 were also trained on new markets and gaining access to them.

In **Cambodia**, under the *Enhancement of Flood and Drought Management in the Pursat Province Project*, the upgrading and maintenance of water management infrastructure has necessitated the training of 78 management committee members within the farmer water user committees (FWUCs) to improve their capacities for drought-risk irrigation and flood-risk management. Specifically, this was targeted at operations and maintenance, which also rely upon in-kind contributions, financial management, and conflict resolution.

3.3.7. Training and capacity building in support of non-structural risk reduction measures

> Capacity building

CIF's capacity-building support, pertaining to key non-structural risk reduction investments, includes training local communities on DRM and resilient livelihood practices.

In **Cambodia**, the community-based disaster risk management (CBDRM) team, in cooperation with the Provincial Department of Agriculture in Pursat, provided agricultural training. Focused on home gardening and poultry raising, this training was delivered to 184 farmers, including 132 females (i.e., 72 percent) in 15 selected villages, enhancing their capacity for CBDRM and strengthening their resilience.

LESSONS

BOX 12. Ensuring Strong Livelihoods in Cambodia

In the case of **Cambodia's** *Enhancement of Flood and Drought Management in the Pursat Province* project, further support for ensuring the sustainability and implementation of the safer village and CBDRM plans that have been prepared will be required. This indicates a necessity to ensure that local participation in DRM is integrated with local development and planning processes from the outset, wherever feasible, and recognized by stakeholders as an integral feature of strong livelihoods.

In **Zambia**, the *Strengthening the Climate Resilience of the Kafue Sub-Basin Project* demonstrated approaches that are commonly deployed to help build the resilience of fragile agricultural livelihoods, including in contexts where erratic and extreme weather disrupts productivity and increases vulnerability to disasters. For example, the training of communities and farmers on a wide range of livelihood skills and climate-resilient farming practices included agroforestry, micro-irrigation, crop rotation, intercropping, crop diversification, conservation farming techniques such as zero tillage, as well as the use of animal manure for soil enrichment and the retention of water.

3.3.8. Reflections on investing in disaster risk reduction for resilience

CIF projects have actively supported structural measures designed to reduce disaster risks to the public in Bangladesh, Tonga, Niger, and the Caribbean region; resilient critical infrastructure such as roads, bridges, water and sanitation in Saint Lucia and Grenada; and hydromet observation infrastructure in Tajikistan, Nepal and Jamaica. CIF projects have also supported non-structural DRM measures such as investments in resilient livelihoods in Samoa, Cambodia, and Niger; public health in Papua New Guinea; and NbS in Bangladesh, Samoa, and Mozambique.

Although non-structural measures may have less of a profile than expensive infrastructure projects, they are no less important. Integrated solutions depend on non-structural measures being fully woven into investments. Non-structural measures hold resilience-building efforts together and help ensure that technical and engineering solutions achieve their goals, particularly beyond project timeframes. The quality of **partnerships and engagement with local communities and other local stakeholders for investment decision-making** is a likely litmus test. Additionally, **integrated solutions are exemplified when livelihood strengthening and protection, restoration, and the sustainable management of the natural world are strong features of the investment.** Scaling up NbS, achieving land degradation neutrality, restoring the oceans, halting biodiversity loss, and prioritizing sustainable ecosystem management will be critical for success in achieving the Paris Agreement and Sendai Framework goals and outcomes.[38]

3.4. Priority for Action 4: Enhancing Disaster Preparedness for Effective Response and to "Build Back Better" in Recovery, Rehabilitation, and Reconstruction

3.4.1. Early warning systems

Through work across the Priorities for Action that collectively strengthen hydromet and climate services systems and networks, **CIF's investments are delivering results with respect to the enhanced dissemination and communication of early warnings for severe and hazardous weather conditions.**

In **Nepal**, a flood EWS model for Koshi and West Rapti river basins provides water runoff forecasts, which are essential for issuing early warnings of floods to vulnerable communities in the two river basins. The Ministry of Agriculture and Livestock Development estimates that over 1.55 million households, residing within Nepal's 26 districts, benefit from the AMIS and EWS for managing agricultural production risks caused by disasters and climate change.

In the **Caribbean**, an app for alerting fishers to weather-related events and hazards, and supporting resilient decision-making more broadly, has been developed through the *Investment Plan for the Caribbean Regional Track of the PPCR*. The functions of the app include hazard warnings, weather checks, the sending and receiving of alerts, the means to record and report on damages after disasters, and the filing of missing person reports. Such a tool is an asset where 90 percent of the 300,000 fishers in the region operate boats that are less than 12 meters (m) long, making them particularly exposed to severe weather conditions.

Fisheries Early Warning and Emergency Response app

In **Mozambique**, to ensure that the weather and climate information service (WCIS) products, including warnings, are fit-for-purpose and understood by end-users, extensive consultations with the farming and fishing communities took place to determine the type, language, and frequency of the forecasts and warnings. The *Transforming Hydrometeorological Services Project* enabled hydromet forecasts and early warning notices to reach over 300,000 beneficiaries in farming and fishing communities, daily, or even twice daily in some districts. Information is delivered by radio, mobile phone apps, and placards in designated locations within communities. Most beneficiaries have been using the forecasts to guide their day-to-day operational decisions, such as whether or when to go out to sea to fish, depending on the wind and sea levels.

3.4.2. Emergency infrastructure

CIF has enhanced disaster preparedness, response, and recovery by supporting the construction of multipurpose emergency shelters, escape roads, and communication networks that are better able to maintain their functions during severe weather and emergency situations. Also with preparedness, response, and recovery benefits, CIF has supported the rehabilitation and construction of water infrastructure that can help protect communities from mounting risks, including droughts. For example, the availability of water has been improved through the installation of water tanks, rainwater harvesting systems (RWH), and community ponds. Other examples of infrastructure investments with disaster management benefits also exist, such as upgrading an airport, thereby reducing the vulnerability to disruption and failure in the transportation network during the critical response and recovery phase of an emergency or disaster event.

In **Saint Lucia**, five multipurpose emergency shelters capable of withstanding hurricane conditions will provide a refuge for islanders. The reinforced concrete structures will feature hurricane-resilient roofs, windows, and doors, as well as RWH systems and wheelchair access ramps. Also, for improved access to potable water supply during the drought and hurricane season, water tanks have been provided to cover the needs of nearly 35,000 people (see **Section 3.3.1**).

In **Tonga**, four post-disaster evacuation roads were completed. The Ministry of Infrastructure (MOI) committed over USD5 million for the routine maintenance and repair of roads to sustain safe transport services and corresponding benefits, from the upgraded evacuation roads. Additionally, five schools at risk of flooding and tropical cyclones have been rehabilitated. One of the schools was successfully used as an evacuation center during Tropical Cyclone Gita on Feb 12, 2018. The project also supported a number of RWH community projects through CCTF applications (see **Section 3.3.1**).

Tonga has been a strong example of DRM and CCA strategies and approaches which are now being replicated and scaled up, as in the case of the World

Bank's Ocean Pathways project and other donors' investment responses to Cyclone Gita in 2018. This highlights the importance of collaboration and the sharing of lessons and experiences for future programming.

3.4.3. Emergency funding

CIF has established and strengthened various structures and mechanisms for financing DRM (see **Section 3.2.3**). Through a contingent emergency response instrument, CIF-funded investments have helped establish the means to reallocate project financing from various project components to allow for emergency responses and recovery costs in the event of disasters, including the COVID-19 crisis.

In **Saint Lucia**, the government's request to trigger the Contingent Emergency Response Component (CERC) was received on March 20, 2020, in response to the COVID-19 crisis, and the transfer of funds was made on May 8, 2020. Interventions undertaken through the CERC to support the health sector's response to the pandemic included the following: Victoria Hospital's infrastructural works (December 2020); electrical works at the Gros Islet Polyclinic (May 2020); and the installation of RWH systems at select medical facilities. Prior to disbursement, the CERC Operational Manual had to be revised to include health emergencies, thereby slowing down the speed of the response from the targeted four weeks to seven weeks. Also, an appropriate Action Plan of Activities to best manage the novel coronavirus had to be determined.

Developing contingent emergency response mechanisms in the future that are geared to address emergencies of all types would better facilitate a nimble response. Evidence illustrating the cost-effectiveness of an early response to a range of emergencies will help support the sustainability of such funding mechanisms (see **Section 3.2.3**).

In **Grenada**, the project has strengthened the capacity of the government and the community to respond to an emergency through improved access to immediate liquidity via the Contingent Emergency Response instrument. The project also helped Grenada to continue its membership in the Caribbean Catastrophe Risk Insurance Facility Segregated Portfolio Company (CCRIF SPC) and obtain parametric insurance coverage (i.e., insurance based on the magnitude of event rather than losses experienced) for impacts of hurricanes, excess rainfall, and earthquakes. It also enabled the government to access private sector financing from the international reinsurance and capital markets when payouts are triggered.

In **Haiti**, the *Municipal Development and Urban Resilience* project's CERC proved to be a flexible and critical component that helped to respond to the COVID-19 crisis. Almost 212,000 beneficiaries (of whom 105,957 are women) received COVID-19 emergency cash transfers. The cash transfers reached a total of 44,035 households in the nine communes, and 3,057 households in an additional two communes. Furthermore, 3,500 COVID-19 personal protection equipment kits, with masks, protective glasses, and other equipment, were distributed to civil protection committees. Finally, 43 communes benefited from the installation of handwashing stations. A total of 551 handwashing points were installed, built, or rehabilitated in 191 schools, for the benefit of 64,487 students.

3.4.4. Disaster preparedness, response, and recovery training and capacity building

> Capacity building

The skills that help to ensure investments in structures, systems, and instruments yield benefits for the safety and capacity of people to recover quickly from any losses experienced, have been strengthened by CIF in different ways. Investments in early warning capabilities have been supported by building the capacity of producers of hydromet data and information to disseminate and communicate warnings that result in action by user communities. In different settings, training and capacity have been built for mass casualty management, RWH functionality in response to crises, seismic risk capacity, and post-disaster needs assessments. Community preparedness has been strengthened more generally, too.

In **Samoa**, with CSO-led awareness raising, an estimated 14,900 community members (far exceeding the target of 5,000) were supported in the project's 18 targeted districts in upgrading CIM plans through a participatory process, taking into consideration DRM, sustainable development, and watershed management plans. This process taught beneficiaries how to prepare and respond to disasters and heed early warnings; clean drains to avoid flooding; identify and relocate to safe areas; plant trees to protect people from the hot sun; and conserve water and natural springs.

PROJECT HIGHLIGHT

BOX 13. Multi-Hazard Early Warning Capability Training in Tonga

In **Tonga's** *Climate Resilience Sector Project*, the Tonga Meteorological Services, SPC, the University of Cantabria (Spain), and the National Institute of Water and Atmospheric Research, worked together for two years to develop inundation models covering key hazards such as tropical cyclones, tsunamis, storm surges, undersea landslides, rainfalls, and wind that may impact Nuku'alofa. Training held from September 19–22, 2022 operationalized these models for use by Tonga Meteorological Services as part of the upgrade of their EWS. The Acting Director of the Tonga Meteorological Services, Mr. Laitia Fifita, stated, *"This is an important milestone for the Tonga Meteorological Services as it will strengthen our ability to provide more accurate warnings for the key hazards that affect Tonga. [The work done is] very vital [for] improv[ing] our capacity as multi-hazard early warning centers to better predict weather, climate, and ocean-related hazards and to provide better impact-based products and services that would support the livelihoods of the people of Tonga".*

3.4.5. Reflections on enhancing disaster preparedness for effective response and to "Build Back Better" in recovery, rehabilitation, and reconstruction

CIF projects have actively supported early warning, emergency infrastructure, and emergency funding mechanisms. For example, the early warning of hazardous events has been strengthened in Cambodia, the Caribbean region, and Nepal.

The preventive and mitigation basis of DRM is often not sufficient to alleviate the inevitability of disaster events, especially on account of climate change. Effective preparedness, response, and recovery hinge on interconnectivity with the wider risk reduction agenda. These three components are founded on a **partnership between humanitarian and developmental actors, and through the meaningful engagement of those most at risk** due to poverty and social marginalization on account of gender and other factors.

In Saint Lucia, PPCR has supported the rehabilitation of emergency infrastructure, such as shelters, and helped set up a CERC, boosting the country's preparedness and emergency response capacity. Additionally, in 2020, the government of St. Lucia was able to tap into the emergency funding to support the health sector's response to the COVID-19 pandemic. The experience of Saint Lucia accessing emergency funding to help respond and recover from the COVID-19 crisis draws attention to the wider need to ensure that challenges with widespread ramifications are not addressed in a fragmented way. It also highlights the **opportunity presented by a disaster or a crisis to act as a catalyst for change, so that recovery processes are better able to go beyond immediate needs and work towards mitigating future crises by deploying the principles of "Build Back Better."**

4. MOVING FORWARD

4.1. Investing in Integrated Solutions

A learning-oriented review of the Pilot Program for Climate Resilience (PPCR) and Technical Assistance Facility (TAF) portfolios has revealed that **CIF is advancing disaster risk management (DRM) in many spheres, as outlined in the Sendai Framework for Disaster Risk Reduction 2015-2030, while simultaneously tackling aspects of the climate emergency and promoting the Sustainable Development Goals (SDGs).** With an increasing understanding and acceptance of mounting climate change-attributable disaster impacts, as well as the breakthrough agreement on loss and damage at COP27,[39] there is both a dire need to deliver interconnected DRM and climate resilience and the growing momentum to do so. Such coherence is vital for strengthening the resilience of communities and nations, whilst recognizing that there are more ways by which DRM is strengthened than via investments in climate resilience alone.

It is evident that the CIF experience recognizes the interconnectedness of the threats we face. Challenges to sustainable development are not only with respect to climate change and disasters, but also on account of threats to public health, biodiversity loss and ecosystem collapse, financial and political instability, and how all these and other interconnected challenges can co-occur, cascade, and be experienced in all corners of the world, disproportionately affecting the poor and marginalized most acutely. **The need for integrated solutions befitting the integrated nature of the challenges is key.**

Integration is more than a demonstration of what specific activities and results are mutually reinforcing across frameworks and agendas such as the Sendai Framework, the Paris Agreement, and SDGs, as presented in this review. Integration is also about a practical reflection on the quality and extent of the partnership between agendas and how this influences decision-making. **Important for the future is a doubling down on processes conducive to fostering**

integrated solutions by learning from examples where this is already underway.

Among the many diverse experiences, **this study has identified and discovered especially salient areas where climate resilience action and DRM are intertwined.** The learning suggests some key areas that could inform ongoing climate and DRM efforts, or require further action:

- **Understanding risks** has proven to be and will remain dependent on access to and quality of climate information. This requires the iterative blending of scientific and Indigenous knowledge through insightful and equitable processes of engagement among critical stakeholders, such as women, Indigenous communities, and youth who are at the forefront of managing risks in their communities.
- **Practical governance arrangements** need to be strengthened at interconnected local, national, and regional levels, and the necessary funding must be provided, to ensure that the critical and often transboundary risks and challenges we face through climate change, disasters, public health, and biodiversity losses can be met with transformational integrated solutions.
- **Nature-based solutions** (NbS) are increasingly recognized as being at the heart of efforts to achieve the combined aspirations of the SDGs, Paris Agreement, and the Sendai Framework. They provide a practical and critically important field for investment in the form of conservation, restoration, and sustainable management of natural ecosystems, with Indigenous people and local communities as stewards at the center of how this is to be achieved. The Kunming-Montreal Global Biodiversity Framework (GBF), aiming at halting and reversing biodiversity loss by 2030, and agreed by almost 200 countries at COP15, includes specific targets of direct relevance.[40] Within the context of the wider aspirations of the GBF and SDGs, NbS offer a mutually reinforcing way to support both DRM and climate resilience actions. Unlocking the opportunity to advance these agendas in an integrated way offers promise for a more resilient future.
- **Emergency planning** pivoted to address the COVID-19 public health crisis, indicating a need for flexible funding. In some cases, PPCR investments tapped into emergency contingency funding instruments to respond to this challenge. How the response to the crisis was quickly set up and achieved through TAF, directed at helping secure a green and resilient recovery, provides especially important lessons on flexible and coherent approaches to DRM and reduction that can be applied to all contingency planning processes. In a world of complex, uncertain, and cascading challenges, supporting flexibility in preparedness planning in the most vulnerable regions and for the most vulnerable people will remain highly relevant.
- **Capacity building** is a strong feature cutting across all CIF DRM and climate resilience action examples and covering the four priority areas of the Sendai Framework. For efforts that reduce both climate and disaster risks while striving toward sustainable development pathways, people and institutions need more than one-off technical training sessions. A socially inclusive enabling environment for integrated approaches to address the pressing climate and disaster challenges requires sustained administrative, technical, and financial capacity, based on principles of coherence across agendas. This calls for strong and innovative communication, as well as South-South learning founded on practical experiences. In addition, several in-person training challenges that existed in past years are not barriers anymore due to the growth in virtual capacity. This flexibility could be viewed as an advantage while growing the skilled population base, even in unstable environments.

4.2. Learning from the CIF Experience Toward Transformational Resilience

Contributions made by climate investments for DRM can be further strengthened and accelerated by building on the experiences and accomplishments like those highlighted here. Likewise, investments targeted specifically at DRM can strengthen and accelerate progress on climate resilience action to achieve the Paris Agreement by helping address underlying climate vulnerability and risk drivers, and building the adaptive capacities of people, communities, and businesses (for example, see **Box 14**).

Further still, the interconnected and deeply significant challenges — posed by climate change, biodiversity loss and ecosystem collapse, public health crises, and economic and security instability that reach and affect us all, and too often manifest in the form of disasters — should guide us in forming a new and bold vision for devising enduring and transformative solutions. Signs of what this entails are evident in various PPCR examples but are gaining further traction through initiatives such as the COVID-19 TA Response Initiative to support green and resilient COVID-19 recoveries, and the establishment of the new CIF Nature, People & Climate (NPC) program. These initiatives, along with others, embrace holistic perspectives on systemic risks and focus a greater effort on working with, rather than, against nature.

BOX 14. Centre of Excellence for Climate and Disaster Resilience

An important milestone in enhancing knowledge standards and capacity development is the Centre of Excellence for Climate and Disaster Resilience (CoE), recently launched by the United Nations Office for Disaster Risk Reduction (UNDRR) and the World Meteorological Organization (WMO). The Centre has been designed to improve the reach of critical expertise in comprehensive disaster and climate risk management to fast-track the achievement of SDGs, the Paris Agreement, and the Sendai Framework.

Key potential areas of work of the CoE include (a) climate and disaster data and risk knowledge products (flagship global risk reports, data standards, knowledge management, etc.); (b) climate and disaster risk governance (streamlined technical assistance to countries, comprehensive risk management, integrated and scaled-up DRR-CCA for investment and financing frameworks, etc.); and (c) enhanced preparedness through multi-hazard early warning systems (MHEWS) (by enhancing the effectiveness of early warning, strengthening the link with anticipatory action, etc.) (UNDRR 2023; "UNDRR Inputs to the Paris Agreement's First Global Stocktake" 2023).

ANNEX 1: KEY CONCEPTS AND TERMS IN DISASTER RISK REDUCTION AND CLIMATE CHANGE ADAPTATION

	DISASTER RISK REDUCTION[1]	CLIMATE CHANGE ADAPTATION[2,3]
Focus	Disaster risk: The potential loss of life, injury, destroyed or damaged assets which could occur to a system, society or community in a specific period of time, determined probabilistically as a function of hazard, exposure, vulnerability and capacity.	Climate Change Impacts: Effects on the natural and human systems caused by a change in the state of climate identified by changes in the mean over an extended period or by climate extremes.
Approach	Risk reduction: Disaster risk reduction is aimed at preventing new and reducing existing disaster risk and managing residual risk, all of which contribute to strenghtening resilience and therefore to the achievement of sustainable development.	Adaptation: In human systems, the process of adjustment to actual or expected climate and its effects, in order to moderate harm or exploit beneficial opportunities. In natural systems the process of adjustment to actual climate and its effects; human intervention may facilitate adjustment to expected climate.
Risk	Potential interaction of hazard, exposure, vulnerability and capacity that present the possibility for losses or impacts on a population and elements of a society.	The result of the interaction of vulnerability (including capacity), exposure and hazard.
Hazard	A process, phenomenon or human activity that may cause loss of life, injury or other health impacts, property damage, social and economic disruption or environmental degradation.	Natural or human-induced events that have the potential to occur in the future and impact exposed and vulnerable aspects of a system.
Exposure	The situation of people, infrastructure, housing, production capacities and other tangible human assets located in hazard prone areas.	Existence of elements of humans and ecosystems in places and settings that could be adversely affected by climate change.
Vulnerability	The conditions determined by physical, social, economic and environmental factors or processes which increase the susceptibility of an individual, a community, assets or systems to the impacts of hazards.	Potential to be adversely affected, including factors such as susceptibility, predisposition and capacity.
Capacity	The combination of all the strengths, attributes and resources available within an organization, community or society to manage and reduce disaster risks and strengthen resilience.	The combination of all the strengths, attributes, and resources available to an individual, community, society, or organization, which can be used to achieve established goals.

Source: UNDRR, 2021, Promoting Synergy and Alignment Between Climate Change Adaptation and Disaster Risk Reduction in the Context of National Adaptation Plans, 22.
1 - Report of the Open-Ended Intergovernmental Expert Working Group on Indicators and Terminology relating to Disaster Risk Reduction, General Assembly Report A/AC.285/ CRP.2/Rev.3, November 2016.
2 - IPCC, 2012, Glossary of Terms, in "Managing the Risks of Extreme Events and Disasters to Advance Climate Change Adaptation," edited by C. B. Field, V. Barros, T. F. Stocker, D. Qin, D. J. Dokken, K. L. Ebi, M. D. Mastrandrea, et al., in A Special Report of Working Groups I and II of the Intergovernmental Panel on Climate Change (IPCC), 555–64, Cambridge, UK, and New York, NY: Cambridge University Press.
3 - IPCC, 2014, Synthesis Report. Contribution of Working Groups I, II and III to the Fifth Assessment Report of the Intergovernmental Panel on Climate Change, Volume 1, Geneva, Switzerland: IPCC, 151.

ANNEX 2: METHOD OF ASSIGNING PROJECT ACTIVITIES TO CORRESPONDING PRIORITIES FOR ACTION AND THEMES

Results, activities, and lessons learned were analyzed for all projects to determine key themes. The elements of individual projects that had a clear bearing on DRM were captured according to the identified themes. Examples of key and pertinent activities, results, and lessons learned are detailed in the results of this study. Other examples are provided in the annexes, as part of a summary of all activities analyzed.

Categorizing specific activities implemented by projects according to a framework (that is, the Sendai Framework), which was not a feature of the project design, will inevitably lead to a judgment-based process in order to ascertain the best fit. The findings in this study are no exception. Many projects have elements in their activities that transcend different Priorities for Action and themes. The best effort was made to categorize results and activities based on the main thrust of the specific examples.

For example, if infrastructure reduces the impact that a hazard event like a flood causes, should this investment be best categorized as a structural measure (Priority for Action 3) or a preparedness, response, and recovery measure (Priority for Action 4)? In this case, infrastructure that serves to explicitly protect in an emergency like a flood (for example, an emergency shelter) is categorized as “emergency infrastructure” (Priority for Action 4). However, infrastructure that is mainly designed to maintain its integrity in a flood (for example, a rehabilitated road), is categorized as “resilient infrastructure” (Priority for Action 3).

Similarly, several projects have strengthened hydromet and climate services, including early warning capabilities. Such projects transcend the Priorities for Action. For example, a hydromet project may result in enhanced hazard mapping. As this improves the understanding of disaster risk, it is categorized under “Generation of products (for example, mapping) to better understand disaster risk” (Priority for Action 1). The same project may have results related to the strengthening of collaboration and the sharing of data across a region in ways that benefit DRM. Consequently, this aspect is categorized as “Regional, national, and local governance structures and mechanisms for collaboration to manage disaster risks” (Priority for Action 2). To strengthen data collection as a backbone for the generation of climate services, including disaster management, hydromet equipment may be a major investment. This is categorized as "Hydromet observation infrastructure and equipment" (Priority for Action 3). Improved early warning capability is a common objective of hydromet and climate services investments. Improved severe weather warnings for end-users are categorized as “Early Warning Systems"

(Priority for Action 4). Finally, results and activities related to hydromet and climate services capacity building relevant to DRM are a likely feature across all Priorities for Action.

The above description of the themes, used to capture and categorize specific activities, provides the best indication regarding why the results and activities are presented with respect to that specific theme. However, it should be noted that nearly all results and activities are likely to have some connection with other themes and other Priorities for Action. Where this connection is especially apparent, the link is pointed out.

It should also be noted that the themes were derived by analyzing the various project activities and results. Therefore, the findings do not indicate a full array of actions necessary to accomplish the Sendai Framework goals. Instead, they indicate how the PPCR and TAF projects are contributing to the work outlined in the Sendai Framework.

ANNEX 3: PORTFOLIO OF CIF'S DISASTER RISK MANAGEMENT EXPERIENCE

SEE SEPERATE FILE HERE

ENDNOTES

CLICK ON ANY NOTE TO GO BACK TO THE REFERENCED PAGE

→ 1 United Nations Office for Disaster Risk Reduction (UNDRR Bonn Office). 2021. "Policy Brief: Disaster Risk Reduction and Climate Change."

→ 2 United Nations Office for Disaster Risk Reduction (UNDRR). 2022. "UNDRR Inputs to the Paris Agreement's First Global Stocktake 2023."

→ 3 Pörtner, Hans-O., Debra C. Roberts, Helen Adams, Caroline Adler, Paulina Aldunce, Elham Ali, Richard Betts, et al. 2022. "Summary for Policymakers." In *Climate Change 2022: Impacts, Adaptation, and Vulnerability. Contribution of Working Group II to the Sixth Assessment Report of the Intergovernmental Panel on Climate Change (IPCC),* edited by Hans O. Pörtner, D.C. Roberts, M. Tignor, E.S. Poloczanska, K. Mintenbeck, A. Alegría, M. Craig, et al., 3–33. Cambridge, UK and New York, NY: Cambridge University Press, doi: 10.1017/9781009325844.001.

→ 4 United Nations Office for Disaster Risk Reduction (UNDRR). n.d. "Sendai Framework Terminology on Disaster Risk Reduction: Disaster.": https://www.undrr.org/terminology/disaster.

→ 5 The World Bank. 2022. "Trade and Food Security in a Climate Change-Impacted World. Filmed October 7, 2022. Webex Video. https://www.worldbank.org/en/events/2022/10/07/trade-and-food-security-in-a-climate-change-impacted-world#1

→ 6 United Nations University – Institute for Environment and Human Security (UNU-EHS). 2021. "Interconnected Disaster Risks" [Authors: O'Connor, Jack; Eberle, Caitlyn; Cotti, Davide; Hagenlocher, Michael; Hassel, Jonathon; Janzen, Sally; Narvaez, Liliana; Newsom, Amy; Ortz Vargas, Andrea; Schutze, Simon; Sebesvari, Zita; Sett, Dominic; and Waltz, Yvonne]

→ 7 Notwithstanding other important global frameworks, such as the Kunming-Montreal Global Biodiversity Framework

→ 8 Article 7, Paragraph 1, of the Paris Agreement

→ 9 Climate Investment Funds (CIF). 2021. "Ensuring Green and Resilient Recovery." https://www.cif.org/news/ensuring-green-and-resilient-recovery.

→ 10 In 2019, supported by the government of Denmark, CIF-Technical Assistance Facility (TAF) was established to support upstream activities that led to the strengthening of policy and regulatory environments, the building of human and institutional capacities, and the design of market-facing solutions, such as innovative instruments and business models. All these activities have the overriding goal of accelerating downstream clean energy investments in client countries. The CIF-TAF aims to offer building blocks for a low-carbon and sustainable future through two tracks: Track 1: Accelerating clean energy investments and recognizing the losses and setbacks on account of the immense COVID-19 impact; and Track 2: Ensuring green and resilient recovery with a focus on COVID-19 response measures that are aligned with the host countries' climate and sustainable development plans.

→ 11 "Build Back Better" was first adopted in the DRM community following the Indian Ocean tsunami in 2004 and is also adopted as a hope for recovery from COVID-19. It encompasses holistic thinking on public and environmental health to mitigate and prevent future crises.

→ 12 https://www.preventionweb.net/files/resolutions/N1516716.pdf.

→ 13 LRI (Legal Response Initiative), 2020, Interfaces between the Sendai Framework, the Paris Agreement and the Sustainable Development Goals, see LRI's website at https://legalresponse.org/legaladvice/interfaces-between-the-sendai-framework-the-paris-agreement-and-the-sustainable-development-goals/.

→ 14 United Nations General Assembly. 2015. "Sendai Framework for Disaster Risk Reduction 2015–2030." https://www.preventionweb.net/files/resolutions/N1516716.pdf.

→ 15 United Nations Framework Convention on Climate Change (UNFCCC). 2008. "Integrating Practices, Tools and Systems for Climate Risk Assessment and Management and Strategies for Disaster Risk Reduction into National Policies and Programmes." Technical Paper FCCC/TP/2008/4

→ 16 United Nations Office for Disaster Risk Reduction (UNDRR Bonn Office). 2022. "Technical Guidance on Comprehensive Risk Assessment and Planning in the Context of Climate Change."

→ 17 For example, strengthening EWS has been estimated to have an average benefit-cost ratio of 9 to 1, and protecting mangroves 6 to 1. See Benefits and Costs of Illustrative Investments in *Adapt Now: A Global Call for Leadership on Climate Resilience* by the Global Commission on Adaptation. 2019.

→ 18 United Nations Office for Disaster Risk Reduction (UNDRR). 2021. "Words into Action: Nature-based Solutions for Disaster Risk Reduction." Sendai Framework for Disaster Risk Reduction 2015–2030.

→ 19 United Nations General Assembly. 2015. "Sendai Framework for Disaster Risk Reduction 2015–2030." https://www.preventionweb.net/files/resolutions/N1516716.pdf.

→ 20 See Seneviratne, S.I., X. Zhang, M. Adnan, W. Badi, C. Dereczynski, A. Di Luca, S. Ghosh, et al. 2021. "Weather and Climate Extreme Events in a Changing Climate." In *Climate Change 2021: The Physical Science Basis. Contribution of Working Group I to the Sixth Assessment Report of the Intergovernmental Panel on Climate Change,* edited by V. Masson-Delmotte, P. Zhai, A. Pirani, S. L. Connors, C. Péan, S. Berger, N. Caud, et al., 1513–1765. Cambridge, UK and New York, NY: Cambridge University Press, doi: 10.1017/9781009157896.013.

→ 21 (i) Risk Knowledge; (ii) Technical Hazard Monitoring and Warning Service; (iii) Communication and Dissemination; and (iv) Response Capability.

→ 22 International Federation of Red Cross and Red Crescent Societies (IFRC). 2015. "Unseen, Unheard: Gender-Based Violence in Disasters." The global study was accessed via the following link: https://www.preventionweb.net/files/51016_1297700gbvindisastersenlr2.pdf.

→ 23 Global Facility for Disaster Reduction and Recovery (GFDRR). 2022. "Gender Equality." https://www.gfdrr.org/en/genderequality.

→ 24 Stockholm International Water Institute (SIWI). "The Gender Dimension of Water and Climate Change." n.d. The policy brief was accessed via the following link: https://siwi.org/wp-content/uploads/2017/05/gender-dimension-brief-digital-version.pdf.

→ 25 International Federation of Red Cross and Red Crescent Societies (IFRC). 2015. "Unseen, unheard: Gender-Based Violence in Disasters." The global study was accessed via the following link: https://www.preventionweb.net/files/51016_1297700gbvindisastersenlr2.pdf.

→ 26 Unless explicitly specified as a TAF project, all listed projects are from the PPCR.

→ 27 During the project's first restructuring, the definition of CIM was changed to "Community Integrated Management Plan," with the same acronym maintained.

→ 28 The full name of the TAF project is *Climate-Resilient Farmer Group Development and Post-Harvest Technologies to Support COVID-19 Recovery for Smallholder Coffee Farmers.*

→ 29 Hydromet hazards refer to hazards that are of atmospheric, hydrological, or oceanographic origin and include cyclones, floods, drought, heatwaves and cold spells, and coastal storm surges. This definition was pulled from Prevention Web, accessed here: https://www.preventionweb.net/understanding-disaster-risk/component-risk/hazard#:~:text=Hydrometeorological%20hazards%20are%20of%20atmospheric,spells%3B%20and%20coastal%20storm%20surges.

→ 30 These 12 agromet AMIS tools and products are: (1) Agromet Advisory Bulletin (AAB), (2) Kisan Call Centre (KCC), (3) an SMS system, (4) Hamro Krishi App duly synchronized with AMIS web portal, (5) Package of Cultivation Practices (POCP), (6) Climate Vulnerable Area Mapping (CVAM), (7) a Frequently Asked Questions feature (FAQ), (8) Irrigation Canal Data, (9) Crop calendars of various crops, (10) SMART Agriculture Manual, (11) Weather and Climate Change induced Disease/Pest Occurrence and relevant management practices in crops and livestock, and (12) Agriculture Handbook. Information accessed from the project's Implementation Completion Report.

→ 31 Turkey TAF project's full name is *Improving the Management of Coastal Protected Areas and Ecosystems as a Nature-Based Solutions Climate Resilience and Addressing Climate Resilient Rural Development Issues.*

→ 32 Disaster Vulnerability Reduction Project. 2022. "Resilience Newsletter of April to June 2022." Vol. 9, Issue 2. The Resilience Newsletter was accessed via the following link: https://myemail.constantcontact.com/Resilient-Saint-Lucia---2nd-Quarter-2022-Project-Highlights---DVRP-Newsletter.html?soid=1132945053663&aid=aMd-VyvtU5w.

→ 33 Papua New Guinea TAF project's full name is *Climate Resilient Farmer Group Development and Post-Harvest Technologies to Support COVID-19 Recovery for Smallholder Coffee Farmers.*

→ 34 United Nations Office for Disaster Risk Reduction (UNDRR). 2022. "UNDRR Inputs to the Paris Agreement's First Global Stocktake 2023."

→ 35 Asian Development Bank (ADB). 2019. "ADB Helps Relocate Tonga's Ha'apai Hospital as Part of Project to Manage Climate Risks." ADB News Releases, November 6, 2019. https://www.adb.org/news/adb-helps-relocate-tongas-haapai-hospital-part-project-manage-climate-risks.

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→ 37 The World Bank. 2019. "Enhancing Weather, Climate, and Water Information Services across Central Asia." *World Bank News,* January 21, 2019. https://www.worldbank.org/en/news/feature/2019/01/21/enhancing-weather-climate-and-water-information-services-across-central-asia.

→ 38 United Nations Office for Disaster Risk Reduction (UNDRR Bonn Office). 2021. "Policy Brief: Disaster Risk Reduction and Climate Change."

→ 39 United Nations Climate Change. 2022. "COP27 Reaches Breakthrough Agreement on New 'Loss and Damage' Fund for Vulnerable Countries." *UN Climate Change News,* November 20, 2022. https://unfccc.int/news/cop27-reaches-breakthrough-agreement-on-new-loss-and-damage-fund-for-vulnerable-countries.

→ 40 Target 8 includes efforts to minimize the impact of climate change and ocean acidification on biodiversity and increase resilience through mitigation, adaptation, and DRR actions, including through NbS and/or ecosystem-based approaches. Target 11 aims to restore, maintain, and enhance nature's contributions to people, including ecosystem functions and services, such as the regulation of air, water, and climate, soil health, pollination, and the reduction of disease risk, as well as the protection from natural hazards and disasters, through NbS and/or ecosystem-based approaches for the benefit of all people and nature. See Convention on Biological Diversity (CBD). 2022. "COP15: Nations Adopt Four Goals, 23 Targets for 2030 in Landmark UN Biodiversity Agreement." *Official CBD Press Release,* December 19, 2022. https://www.cbd.int/article/cop15-cbd-press-release-final-19dec2022.

THE CLIMATE INVESTMENT FUNDS

The Climate Investment Funds (CIF) is one of the largest multilateral climate funds in the world. It was established in 2008 to mobilize finance for low-carbon, climate-resilient development at scale in developing countries. 15 contributor countries have pledged over US$11 billion to the funds. To date CIF committed capital has mobilized more than $64 billion in additional financing, particularly from the private sector, over 70 countries. CIF's large-scale, low-cost, long-term financing lowers the risk and cost of climate financing. It tests new business models, builds track records in unproven markets, and boosts investor confidence to unlock additional sources of finance. Recognizing the urgency of CIF's mission, the G7 confirmed its commitment to provide up to $2 billion in additional resources for CIF in 2021.

CIF CLIMATE INVESTMENT FUNDS

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