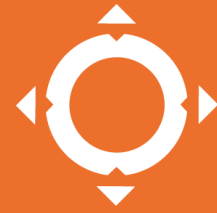


REPORT



**Global
Risk
Modelling
Alliance**

GRMA Programme in Costa Rica

Scoping Report

December 2023



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List of Acronyms

AAL	Annual Average Loss
AED	Alianza Empresarial para el Desarrollo
ARESEP	Autoridad Reguladora de los Servicios Público
AyA	Instituto Costarricense de Acueductos y Alcantarillados
A2ii	Access to Insurance Initiative
ASADAS	Asociaciones Administradoras de Sistemas de Acueductos y Alcantarillados Comunes
BCCR	Banco Central de Costa Rica
CAPRA	Probabilistic Risk Assessment Platform
CIS	Cámara de Intermediarios de Seguros
CCSS	Costa Rican Social Security
CDRFI	Climate and Disaster Risk Finance and Insurance
CEPAL	Economic Commission for Latin America and the Caribbean
CGE	Economic model of general equilibrium
CIGEFI	Centro de Investigaciones Geofísicas, Universidad de Costa Rica
CNE	Comisión Nacional de Prevención de Riesgos y Atención a Emergencias
CRA	Climate Risk Assessment
CFIA	Colegio Federado de Ingenieros y Arquitectos
CVF	Climate Vulnerable Forum
CONASSIF	Consejo Nacional de Supervisión del Sistema Financiero
DRM	Disaster Risk Management
DRR	Disaster Risk Reduction
ERN	Evaluación de Riesgos Naturales (Private company)
ESG	Environmental, Social and Governance
FNE	Fondo Nacional de Emergencia
FONAFIFO	Fondo Nacional de Financiamiento Forestal
GDP	Gross domestic product
GIS	Geographic Information System
GIZ	Deutsche Gesellschaft für Internationale Zusammenarbeit GmbH
GS	Global Shield Initiative
GRAF	Global Risk Assessment Framework
GRMA	Global Risk Modelling Alliance Programme
IDF	Insurance Development Forum
IFAM	Instituto de Fomento y Asesoría Municipal
IGN	National Geographic Institute
IKI	International Climate Initiative
IMN	Instituto Meteorológico Nacional de Costa Rica
ICE	Instituto Costarricense de Electricidad
INS	Instituto Nacional de Seguros
IMF	International Monetary Fund
ISF	InsuResilience Solutions Fund
KfW	Kreditanstalt für Wiederaufbau (German Development Bank)
LANAMME	Laboratorio Nacional de Materiales y Modelos Estructurales
LiDAR	Light Detection and Ranging
MINSA	Ministerio de Salud
MEP	Ministerio de Educación Pública
MERCI-CR	Metodología de Evaluación de Riesgo Climático de Infraestructura de Costa Rica
MINAE	Ministerio de Ambiente y Energía
MIVAH	Ministerio de Vivienda y Asentamientos Humanos
MIDEPLAN	Ministerio de Planificación Nacional y Política Económica
MICITT	Ministerio de Ciencia, Innovación, Tecnología y Telecomunicaciones
MOPT	Ministerio de Obras Públicas y Transportes
NAP	National Adaptation Plan
NBS	Nature Based Solutions
NDC	Nationally Determined Contributions
NGO	Non-Governmental Organisation
PDNA	Post-Disaster Needs Assessment
PES	Payment for Ecosystem Services
PNGR	Política Nacional de Gestión de Riesgos
RECOPE	Refinadora Costarricense de Petróleo
SBD	Sistema Banca para el Desarrollo
SINAC	Sistema Nacional de Áreas de Conservación
SNIT	Sistema Nacional de Información Territorial


SNGR	Sistema Nacional de Gestión de Riesgo
SUGESE	Superintendencia General de Seguros
SUPEN	Superintendencia de Pensiones
SUGEVAL	Superintendencia General de Valores
SUGEFIN	Superintendencia General de Entidades Financieras
TA	Technical Assistance
TWG	Technical Working Group
UNDP	United Nations Development Program
UNDRR	United Nations Office for Disaster Risk Reduction
USD	US Dollar
V20	The Vulnerable Twenty Group of Ministers of Finance of the Climate Vulnerable Forum
WB	World Bank

1. Context

This report describes the origin of GRMA support to Costa Rica, and outlines the activities and outcomes of the first country workshop and bilateral meetings. It then suggests options for the GRMA's risk modelling work for consideration and selection by Costa Rica's GRMA Technical Working Group.

1.1. The Global Risk Modelling Alliance

The Global Risk Modelling Alliance (GRMA) results from a strategic agreement between the V20 Group of Ministers of Finance and the cross-sector Insurance Development Forum (IDF). Its purpose is to strengthen climate and disaster risk insight, support strategic decision-making and help unlock risk finance for public good. Working side by side with officials and local experts in ministries and their agencies, it offers open risk management tools, technical assistance (TA) and funding for open models and data. Funded by the German government and supported by the international insurance industry, the GRMA offers countries open data, technology, and practical learning through co-development of risk management strategies and applied risk finance projects. It aims to strengthen local capacities in risk understanding and support the establishment of open-source risk modelling platforms. The GRMA programme is a significant contribution to the Vision 2025 of the InsuResilience Global Partnership, which aims to catalyse financial protection for 500



The GRMA is a public-private technical assistance programme to address persistent challenges of risk understanding in the most climate vulnerable countries. The GRMA programme will assist countries in building, sharing, and developing local capability in climate and disaster risk understanding, using open modelling principles and private sector knowledge to increase access to risk finance. The GRMA programme comprises three key elements:

1. An open-source risk modelling platform and open data standards to promote accessibility, choice, and sharing across departments and sectors.
2. A model and data component providing a funded mechanism to fill critical gaps with data and models produced as digital public goods, with a particular emphasis on co-developing these with local knowledge and information.
3. The GRMA technical assistance team, which provides human interaction and connects private sector experience to development needs.

million vulnerable people by 2025.

Furthermore, the GRMA has been selected as a key resource for the Global Shield Initiative (GS), particularly during initial in-country climate risk assessments and subsequent capability development. The GS, launched at COP27, is an initiative launched by the G7 in partnership with the Vulnerable Twenty Group (V20) of Finance Ministers for pre-arranged financial support designed to be deployed during climate disasters. It aims to increase protection for poor and vulnerable people by substantially enhancing pre-arranged finance, insurance and social

protection mechanisms against disasters which will help to minimise losses and damages exacerbated by climate change, in an efficient manner.

The GRMA is also an integral component of V20 Climate Prosperity Plans, now being rolled out in a number of Climate Vulnerable Forum (CVF) member states.

The objectives of the GRMA program include:

1. Strengthen long-term local capacities in risk understanding.
2. Co-develop clear (sub-)national risk priorities for application of risk analytics to disaster risk reduction, adaptation and Climate and Disaster Risk Finance and Insurance (CDRFI), as well as own (sub-) national climate and disaster risk management strategies.
3. Develop capacity on modelling techniques and data acquisition to enable sustainable access to open risk modelling data and tools through practical learning / experience.

1.2. Costa Rica request for GRMA support

The Ministry of Finance of Costa Rica submitted an expression of interest in GRMA support on June 15, 2023. (see Annex 1), in which the Superintendencia General de Seguros (SUGESE) was nominated as In-Country Coordination Lead.

The letter of expression of interest states how it is important for Costa Rica to ensure a clear alignment between the government's risk priorities and their integration into national climate and disaster risk management strategies, including the understanding of the priorities of different risk reduction and transfer measures, along with potential financial solutions. Recognising the heightened frequency and intensity of climate risks, the letter emphasises the crucial importance for Costa Rica to thoroughly understand its present and future risks. This necessitates access to models and tools to formulate and monitor comprehensive national climate and disaster risk management strategies, encompassing risk mitigation and financing measures.

The letter highlights how for Costa Rica, it is important that this initiative nurtures local capacities and facilitates access to sustainable tools essential for autonomous risk assessment and understanding the resulting socio-economic impacts. Consequently, the requested support by the Ministry of Finance from GRMA is centred around the following areas aligning with the general objectives of the GRMA programme:

1. Determining the scope of support required for evaluating climate and disaster risk.
2. Assessing existing gaps in relevant risk models and local data, in the context of Costa Rica's risk priorities.
3. Developing local expertise to effectively apply relevant risk instruments and models.

After initial discussions with SUGESE during 2023, an official kick-off call of the GRMA project took place on September 4. A country workshop was held on October 19 and 20 in San José, Costa Rica, to define the potential GRMA support in greater detail, and in collaboration with SUGESE.

1.3. Costa Rica context

I. Climate conditions and risk

The location and volcanic topography of Costa Rica results in distinct regional climates within the country and influences the distribution of climate hazards. The country's climate is characterised by a strong influence of the trade winds, leading to two major rainfall regimes: one on the Caribbean slope and the other on the Pacific coast (Vargas 2001). On the Pacific side, a bimodal distribution of precipitation features a dry season from November to April and a rainy season from May to October. In contrast, a more homogenous and generally hot and humid climate is present along the Caribbean coastal areas. Climate regimes in Costa Rica are also subject to interannual variability due to the El Niño Southern Oscillation, which might cause extreme weather events such as storms, floods, and droughts (World Bank 2021).

Climate change is expected to continue driving an increase in temperatures in Costa Rica across all emissions scenarios, as well as more frequent climate extremes and drier climate regimes. Climate projections suggest that whereas north/northwest and central regions in the country will likely experience the highest increases in maximum temperatures and a decline in precipitation, the Caribbean and southern Pacific coasts will be subject to increased risk of storms and floods (Nawrotzki, 2023). According to global sea level rise projections, an increase in sea level height of 25 cm is expected to impact Costa Rica by 2050.

A review of historical disaster data, available for the period 1910–2022 in the EM-DAT catalogue (EM-DAT, CRED / UCLouvain, Brussels, Belgium – www.emdat.be), shows 76 disaster events were recorded. 39% were listed as flood, 22% earthquake, 14% storm, 9% volcanic activity, 7% drought and 4% epidemic. Floods caused 37% of the total economic damages and 5% of the fatalities, storms contributed to 36% of the economic damages and claimed 4% of the fatalities, while earthquakes caused only 24% of the economic damages but claimed 87% of the fatalities.

According to the OECD, Costa Rica faces varying estimates of annual average losses (AAL) from disasters, ranging from USD 37 million (PreventionWeb, 2017) to USD 280 million (UNISDR, 2015). The disaster risk profile conducted by the World Bank indicates that the AAL attributable to earthquakes is USD 407.5 million, representing 0.82% of GDP. Conversely, the AAL from hurricanes is USD 0.25 million, making up 0.001% of GDP.

Accumulated losses from natural hazards in Costa Rica are prominently attributed to floods. In 2005, heavy rains in Limon, Heredia, Cartago, and Alajuela Provinces led to estimated losses of USD 133 million due to ensuing floods and landslides. Similarly, in 2015, rain-induced floods and landslides in the province of Limon and in Sarapiquí and Turrialba cantons resulted in estimated losses of USD 173 million (OECD, no date). A study by Deval (Nawrotzki, 2023) indicates that over the span of 1994 to 2021, floods have resulted in total losses amounting to USD 1.37 billion. The National Risk Management Policy (PNGR) states that, at current levels of risk, losses by 2030 will surpass USD 7 thousand million, projected to grow to over USD 30 thousand million by 2050 if no risk-reduction interventions are put in place.

II. Institutional arrangements in disaster and climate risk

Costa Rica is a member of The Vulnerable Twenty (V20) Group of Ministers of Finance of the Climate Vulnerable Forum, which is a dedicated cooperation initiative of economies systemically vulnerable to climate change. Costa Rica held the inaugural presidency of the V20 Group.

The Costa Rica Government has an established governmental / institutional structure to improve the financial, physical, and social resilience to climate risk. The country has a robust policy system for disaster risk management, aligned with international processes.

- Law: Costa Rica approved in 2006 the National Law of Emergency and Risk Prevention (Law Number 8488), which introduced the concept of risk management and disaster response. The Law nominates the National Commission of Emergency (Comisión Nacional de Prevención de Riesgos y Atención a Emergencias - CNE) as the entity responsible for Risk Management National Plans, including design of the Plans and coordination of public institutions and resources.
- Policy: Under the law, the Sistema Nacional de Gestión de Riesgo (SNGR) was created, which is the cross-institutional, cross-ministerial policy body for disaster risk management.
- Public policy instrument: The SNGR developed the National Risk Management Policy, adopted in 2016 (Política Nacional de Gestión de Riesgos, PNGR 2016-2030). The PNGR is the key instrument of public policy related to risk management (pre, during and post-disaster) across all actors: government institutions, private sector and civil society. The policy is divided in phases, called Risk Management National Plan. Currently active is the “Plan Nacional de Gestión de Riesgos 2021-2025”.
- International alignment: The PNGR is aligned with the Sendai Framework for Disaster Risk Reduction and with the Sustainable Development Goals.
- Alignment between NAP and the Risk Management Plan: The National Adaptation Plan (NAP) 2022-2026 includes the actions from the Risk Management National Plan 2021-2025 relevant to climate change.
- National Strategy for Financial Management of Disaster Risk (Estrategia Nacional de Gestión Financiera del Riesgo de Desastres): Developed by the Ministry of Finance and aligned with the PNGR. It aims to involve the private sector and provides recommendations of instruments needed, including infrastructure insurance, public-private partnerships for insuring national infrastructure, farming insurance, microinsurance and catastrophe bonds (page 26 of the Strategy).

Climate risks in the financial sector

The four superintendencies (SUPEN, SUGEF, SUGESE, SUGEVAL) who regulate the financial sector have created a Committee for Climate Change Coordination and Sustainability of the Superintendencies in the Financial System. They are working together in developing a Green Taxonomy for the financial system, supported by the Green Climate Fund and UNEP. This is part of the program “Aligning Financial Flows of Costa Rica’s Financial Sector with Climate Change Goals”, launched in 2022 by the four superintendencies, the Central Bank and the Ministry of

Environment and Energy (MINAE), with support from UNEP-FI and the European Commission. This is in line with the NAP and the Nationally Determined Contributions (NDCs).

On October 4, 2023 the superintendencies launched a joint declaration, connected to a roadmap, to support a transparent and resilient financial system against climate risks. In the declaration, the superintendencies commit themselves to:

1. Enhance the capacity of the Costa Rican Financial system to identify and manage financial risks arising from climate change and sustainability-related issues.
2. Facilitate the mobilisation of resources toward sustainable growth objectives and support initiatives that contribute to the transition to a low-carbon, sustainable and climate-resilient economy.
3. Leverage the exchange of regulatory and supervisory experiences and best practices in climate change management and the development of sustainable financial products.
4. Improve the disclosure of information on environmental, social and governance aspects by financial institutions for adequate risk assessment and risk management.
5. Promote continuous technical capability development on topics related to climate change and sustainability.

2. Bilateral meetings, San José, 17-18 October 2023

In preparation for the workshop, SUGESE identified current relevant activities to be presented at the workshop. Bilateral meetings with stakeholders were arranged on 17 and 18 October 2023 with the aim to introduce the GRMA program and understand the roles and objectives of key institutions. The bilateral meetings help to better understand the gaps in risk understanding and modelling to inform the workshop and co-define GRMA support. The following points were highlighted in the meetings:

1. Disconnection of stakeholders in the field of CDRFI reported challenging from several public and private actors. E.g. Academic data producers, need to better understand what and how they prepare data for use cases, and how those data are being used or can be used. While there is a good amount of technical information in Costa Rica, much of it should be developed further or re-formatted to provide metrics on economic impacts and inform financial decisions.
2. Climate scenarios modelling approaches: Information and data for modelling is currently insufficient, particularly in the provision of sub-national climate modelling that can represent Costa Rica's variety of zones within its relatively small land area.
3. Investing in the resilience of capital assets to minor damages in the face of more frequent but less intense rainfall is crucial. Prioritising infrastructure planning with a focus on complex multi-hazard connections is key, shifting away from a sole emphasis on emergency response and recovery. Bridges were cited as key infrastructure requiring improved planning and resilience.
4. Costa Rica faces diverse hazards, which vary by location: the North Pacific faces drought/wildfires, the Caribbean slope faces floods, and both Pacific and Caribbean coastlines deal with sea level rise. Earthquakes are a risk nationwide, while urban areas face floods and in the long-term urban heat and volcanic risks. Public infrastructure, especially roads, is at risk across these areas, and there is interest in the Central Bank and superintendencies in understanding the potential systemic impacts of infrastructure failure.
5. While the risk construct ($\text{Risk} = \text{Hazard} \times \text{Exposure} \times \text{Vulnerability}$) is being applied in the financial sector (by BCCR, for example), there is a need to support that process with improved exposure data and sector-level vulnerability information.
6. Several needs and opportunities highlighted by MINAE (see chapter 2.3).
7. A general opportunity is the interest in unlocking financial instruments for disaster risk as part of the National Strategy for Financial Management of Disaster Risk (see 1.3 above), reinforced by CNE observations.

2.1. Banco Central de Costa Rica (BCCR), 17 October 2023

After introducing the GRMA program to BCCR's economic advisor, director of the Information Management division and their climate data lead, BCCR expresses a need to communicate the risk of disasters to the public and build greater awareness of climate change. Global climate models are a problem for Costa Rica, because it is such a small country with many varied climatic regions – these details are overlooked by coarse scale models.

BCCR are most interested in how both physical and transitional climate risk (not least as partner of the Network of Greening the Financial Sector) affect the interconnected insurance and banking sectors – insurance companies' risk-taking exposes banks, and vice versa. Fiscal risk affects the entire population and is thus systemic. Data is crucial, and a collaboration with the Canadian government aims to improve data management. However, better understanding of exposure to physical climate risks, and how climate change and biodiversity loss affect the financial sector are needed, both for insurance companies and fiscal management. BCCR have staff in economic research, environmental science and statistics working on these aspects, to help integrate latest research into day-to-day operations on financial stability.

The risk framework of $Risk = H \times E \times V$ is being applied using public information, accounting for subnational geographic differentiation, in analysis by the Strategic Group of Analysis for Climate Change in BCCR. It is an interdisciplinary group created to evaluate how climate change can impact the financial stability objectives of the Central Bank. The group's first objective is to understand how climate analysis can be translated into financial terms. So far, they only have partners on the hazard side (CNE and the National Institute for Meteorology (INM)), and they recognise that many times exposure and vulnerability can be greater drivers of risk than the hazard. The group has a roadmap of tasks including looking at transition risk. Partners include the Met Agency in developing hazard information, which has started with hydrometeorological risks, looking at 2050s onwards with warming scenario of 1.5 and 2°C, and including climate variability such as El Niño.

BCCR are interested to understand more on ecosystem services and a key priority for them is the area of "nature dependency", encompassing all the economic activities that are dependent of nature, which are crucial for Costa Rica's GDP. They highlighted the SNIT website as a resource for GRMA (www.snitcr.go.cr/) as a source of geographic and environmental information.

2.2. Comisión Nacional de Emergencias (CNE), 17 October 2023

The GRMA team met with Carlos Picado (Head of Strategic Development Unit of National Disaster Risk Management) and Catalina Artavia (Strategic Development). CNE oversees the national disaster risk management strategy, oversees national risk policy, and monitors activities of related national institutions. CNE is also in charge of emergency response, including recovery and collection of loss data.

While there are impressive centres of research in Costa Rica, improved knowledge exchange would support more efficient disaster risk management. Dialogue between institutions and holistic view including losses and financial stability aspects of climate-related risk, will leverage existing, already strong capacities. Aspects related to data are thereby of high relevance, including

incorporation of local data, data sharing, understanding of data generation (metadata), and their potential use case.

All components of the risk modelling framework ($\text{Risk} = H \times E \times V$) need attention for improved risk assessment. This includes the understanding of the most important factor for increased risk, i.e. human development vs climate change.

Hazard: multi-hazard assessments, intensity of earthquake vs climate-related events, high intensity/low frequency vs low intensity/high frequency from floods, duration events such as drought from dry spells or flood from consecutive rains, landslides.

Exposure and their vulnerability: Infrastructure, e.g. building codes from bridges related to flooding, increased exposure through informal settlements with high vulnerability; CNE emphasised the need to build connections across the scientific, financial and public sector communities, so that scientific modelling can be translated into financial metrics. In this context GRAF was explained (as per section 3.1.I below).

CNE mentioned several myths need to be addressed:

1. Climate change is not the primary driver of the losses that Costa Rica is experiencing. There is a greater problem of exposure and vulnerability in the country, including infrastructure (e.g. bridges have earthquake codes but not flooding/high flows), and informal settlements are being allowed to develop in very vulnerable locations, such as riverbanks.
2. Costa Rica's losses are not driven by the most extreme events. Losses are largely driven by frequent, medium intensity events (particularly floods). Infrastructure is not resilient enough to cope with these frequent events and regular investment is required to build resilience.
3. The CNE Fund cannot pay all damages arising from natural hazards. There is a fiscal crisis and not enough funds are available to cover everything. In addition, the increased frequency of medium intensity events puts pressures on the Fund outside its scope. It is necessary that each organisation understands its risks and manages them (e.g. investments in resilience and insurance). The National Strategy for the Financial Management of Disaster Risk refers to this (examples in section 3.1 below). The CNE Fund should be used for extreme events only.

CNE sees insurance as an opportunity to help with governance on these three points, putting rules in place as well as providing payouts.

2.3. Ministerio de Ambiente y Energía (MINAE), 18 October 2023

The ministry is responsible for issuing environmental policies on environmental protection, management and sustainable use of natural resources and renewable energy sources to achieve the objectives and goals proposed in the National Adaptation Plan (NAP). MINAE is also responsible for all energy infrastructure. The objective of this meeting was to understand how the

GRMA programme can assist MINAE and understand their priorities. They highlighted three areas, connected to the NAP, where they would like help from the GRMA:

1. Programme of Payment for Ecosystem Services (Programa de Pago de Servicios Ambientales – PSA): The Government compensates financially landowners for managing forests or for converting their land into forests and agroforests (further explained in 3.1.VII). MINAE is now developing the same system for mangroves. MINAE is focusing on mangrove conservation due to coastal risks. They also emphasised in the meeting that mangroves are at the moment high in the priorities of both MINAE and Ministry of Finance. Two areas of interest around mangroves:
 - a. carrying out risk studies on mangroves to insure them for restoration after storms and to help the local communities who depend on them (e.g. fishery, tourism).
 - b. assessing how much carbon mangroves store, to then generate carbon offsetting business, like Costa Rica has done with forests.
2. Ecolandscape Programme (Ecopaisaje): The aim for this program is to develop organic products (agriculture and farm animals) that respect forestation. These producers need insurance protection.
3. Infrastructure Adaptation Code (Código de Adaptación para la Infraestructura). This will be applicable to future infrastructures and they are interested in linking it with insurance (This is explained in 3.1.III).

In the bilateral it was said that no risk modelling has been done and it could be valuable to do capacity building and procure models (though this may have been contradicted in the workshop, with risk modelling cited for mangroves, and requires checking). MINAE highlights the absence of models for understanding climate vulnerability in agricultural crops and the need for financial instruments to support community efforts in preserving marine ecosystems, particularly mangroves. There is a lack of expertise and studies on mangrove conditions and carbon impacts, and the carbon offsetting market for marine ecosystems is underdeveloped, although efforts are being made to replicate successful models from inland areas and initiatives like REDD+. Collaborative international work is essential to address these challenges comprehensively. Additionally, they are pioneering work on agricultural landscapes, aiming to protect crops and introduce export crop insurance.

2.4. Centro Agronómico Tropical de Investigación y Enseñanza (CATIE) , 18 October 2023

CATIE is an academic centre, including research and higher education for innovation and sustainable development in topics related to agriculture, management, conservation and sustainable use of natural resources. They implement projects across Central America and have 14 member countries.

The Climate Action Unit, established 20 years ago, focuses on managing landscapes, employing system-based adaptation methods, and assessing regional-scale impacts of climate change on

hydrology, meteorology, biodiversity, and socio-economic factors. The unit avoids risk terminology, using vulnerability definitions and adaptive capacity instead. Their work includes modelling feedback between hydrology and biodiversity at national and regional levels, and designing adaptation responses for specific elements like crops. Additionally, an environmental economics team assesses ecosystem services, maps priority sites, and identifies suitable practices and beneficiaries.

Furthermore, CATIE collaborates with CEPAL to develop a conceptual framework on landscape actions, including mitigating risks, systematising data, modelling work and emphasising Nature Based Solutions (NBS). There is a focus on transport and WASH sectors (Water, Sanitation and Hygiene), more sectors follow in the next stage. The unit also explores climate services and weather index-based insurance for agriculture in Northern Central America. They are seeking a more strategic view on addressing risks to agriculture and are working with finance organisations, to identify financial mechanisms for local level. Challenges include lack of experience on crop insurance, with a need to address historical risk complexities.

CATIE has further experience with an ecosystem-based approach for mangrove adaptation in the Dominican Republic. Efforts include innovation in monitoring, mapping mangroves, and restoring 300 hectares of former sugar cane and salt/shrimp production areas. Additionally, there's a focus on risk analysis, particularly forest fire anticipation through vegetation mapping.

On the urban environment, CATIE focus on urban heat, including collaboration with municipalities on urban heat mitigation in land planning and construction, incorporating NBS. Activities include mapping green infrastructure, as response mechanism to heating and urban floods, and emphasising the importance of data and maps in convincing politicians about climate risk management, considering factors such as heat inequalities and vulnerable populations.

2.5. Superintendencias, 18 October 2023

The superintendents' offices of Costa Rica comprise:

- Superintendencia de Pensiones – SUPEN;
- Superintendencia General de Entidades Financieras – SUGEF;
- Superintendencia General de Seguros – SUGESE;
- Superintendencia General de Valores – SUGEVAL; and
- Consejo Nacional de Supervisión del Sistema Financiero – CONASSIF (this is the overarching coordinating body across the four superintendencies)

This meeting included an introduction to GRMA, and workshop logistical discussions due to SUGESE's role as co-convenor of the country workshop and contact point for the GRMA support request.

During the meeting it was highlighted that before introducing a large technical component, it must be translated into financial impact and actionable steps. There's a need to connect progress in the technical/scientific community with regulations to ensure system stability. Previous work of the superintendencies involves analysing cross-cutting changes for bonds in ESG factors-related risk management. Regulators find it complicated to mandate specific methodologies without assessing entities' access to relevant data and analytical capacity. Data accessibility and affordability are crucial. There is a call for collaboration between securities superintendency (SUGEVAL) and companies issuing bonds, emphasising the importance of defining policies related to ESG/climate risks by December. The overall effort is still in its early stages. It was also highlighted in the meeting that metrics have not been decided for stress testing.

3. Country workshop, San José, 19-20 October 2023

The objective of the workshop was to engage key officials and subject matter experts in Costa Rica, and to develop the work programme of support requested within the expression of interest submitted to the InsuResilience Solutions Fund Management by the Ministry of Finance.

The proposed outcomes of this workshop were:

1. A proposal for the programme scope, including collaborative development of a preliminary roadmap.
2. Identifying key stakeholders in Costa Rica within the context of climate and disaster risk management. Stakeholders will have the opportunity to contribute to defining the GRMA programme based on their existing and aligned activities.
3. Identifying potential technical projects with SUGESE as the In-Country Coordination Lead and other stakeholders, which will address gaps in models, data, and technical capacity.
4. Initial scope and roadmap for technical projects, including identifying institutions responsible for the ongoing implementation and sustainability of technical support beyond the GRMA programme.

In addition to the ministries and departments with whom we held bilateral meetings, the workshop brought together participants from several Costa Rican ministries and institutions, insurance companies and banks, and many international agencies. The attendance list can be found in Annex 4.

Moreover, some stakeholders were unable to attend the workshop, but their opinion would be very valuable for the GRMA project and shall be included in the overall GRMA process. This included the Ministerio de Hacienda and the Ministerio de Agricultura y Ganadería, as well as civil society organisations such as the Instituto de Fomento y Asesoría Municipal (IFAM).

Day 1 comprised a presentation of the GRMA program and the value of risk analytics, and the political framework for disaster risk management in Costa Rica. A stocktake on risk understanding was presented by multiple stakeholders and included an overview of available risk profiles, CDRFI solutions being used and the status of climate change information. The GRMA team ran an activity in the final session to share the contributions of as many participants as possible to understand from the attending organisations and institutions: *(1) what relevant activities they carry out in the area of climate and disaster risk financing and insurance (CDRFI) and (2) where the participants see the greatest needs in Costa Rica to improve risk modelling capabilities and access to risk information for major hazards.* The activities used group discussion to consolidate and develop ideas before sharing with the whole workshop. Participants' contributions were captured by the GRMA team and analysed to inform day 2.

Day 2 started with a recap of the first day and included an introduction to the technical projects. A discussion followed with all participants proposing their priorities for GRMA support based on institutional requirements and future capacity needs. The participants were divided into small

working groups according to their thematic area of expertise to collate priorities and develop the first draft descriptions of operational projects. This included trying to define: *model/data/capability gaps that the proposed project would address; the role of Costa Rican organizations that already have technical competencies; non-existent capabilities that GRMA would have to coordinate; and project sustainability potential* (what Costa Rican organizations would need to continue evaluating selected risks in the long term).

3.1. Ongoing CRA and CDRFI activities in Costa Rica

The workshop and bilateral meetings allowed GRMA to consolidate, confirm and deepen, knowledge developed from earlier literature review, and provided an opportunity to take stock of the ongoing or planned climate risk assessment (CRA) and CDRFI activities of the government and development partners active in Costa Rica. This stocktake is particularly critical for defining the GRMA program, and in the context of the Global Shield, which aims to address and improve the fragmented state of the current global CDRFI architecture. Under this umbrella, the GRMA aims to ensure that there is synergy between complementary activities and avoid duplication of work.

This section summarises recent reviews and recommendations, strategies, and technical tools available. The proposed GRMA program will seek not only to fill gaps in data, models, and technical capacity but to also identify pathways to support ongoing initiatives and recommendations made by other institutions and projects.

I. Global Risk Assessment Framework (Marco Global para la Evaluación de Riesgo/GRAF)

The CNE, as the entity responsible for the coordination of the Risk Management Plan 2023-2026, has an alliance with UNDRR for piloting GRAF, which is being carried out in Costa Rica as part of the National Policy for Risk Reduction.

The application of GRAF is aimed at strengthening the capacity of countries to better access and apply risk-related data, integrating data about threats, vulnerability, and exposure, with which to delimit future and complex scenarios, with a focus of integral analysis of the impact on the cascade of risks in all systems.

Likewise, it is centred on the development of a set of methods for understanding and representing the levers and drivers of risk, as well as the points of inflection associated with the fragility of social and economic systems showing the strength and interconnection of development factors that generate risk in order to tackle them.

Since 2020 Costa Rica has served as a pilot country for the application of GRAF, with various positive results that serve as an example for the region, with an inventory of sources of available information about risk, available on the web page and accessible to the public; a promotion of dialogue and cooperation between scientific sectors, public companies responsible for vital services and the financial sector, within the framework of the National Risk Management System; the application of the Post-Disaster Needs Assessment (PDNA) in the sectors that have most to lose as a result of disasters; and a risk probability evaluation exercise, using the Probabilistic Risk Assessment Platform (CAPRA). Several hundred of risk-related data sources and reports have

been added to the Risk Information Exchange (RiX, <https://rix.undrr.org>) as part of the inventory of information about risk in Costa Rica. While not all information is available due to e.g. proprietary rights the RiX data platform represents an important repository for ongoing and future risk-related initiatives and applications.

The big achievement of GRAF was to create in Costa Rica a community of ministries and public organisations that have a mandate to reduce risks. GRAF allowed them to see themselves as a community and work together.

In December 2023 GRAF will speak at the forum of the National Policy for Risk Reduction, presenting their work on probabilistic risk. The aim is to achieve national support for institutionalising the work of GRAF and to show how it can be used by different ministries and institutions to reduce risks.

GRAF has four pillars:

1. Increase the availability of information for systemic risk assessment with the view to make it accessible.
2. Identify where information gaps are and how to fill them.
3. Transfer existing tools and methodologies among relevant institutions and identify common interests for new ones.
4. Promote the concept of systemic risk assessment in public investment and in decision-making, creating national groups that have or can develop:
 - a. An interest in risk assessment
 - b. Capabilities for risk assessment

Tools:

- Post-Disaster Needs Assessment (PDNA): methodology for post-event data collection. It conducts impact assessments when a national emergency is declared.
 - ➔ Gaps identified: other significant events, highly impactful but not declared a national emergency, are not documented.
- Evaluación de Riesgos Naturales (ERN) a private Mexican company, in collaboration with an expert group from the University of Sao Paulo, Brazil, are working with the national GRAF team to develop a methodology for assessing probabilistic risk of high-impact events. This collaboration is producing a tool with two outputs:
 1. **Risk Modelling** (by ERN and University of Sao Paulo) carried out in three steps:
 - a. Probability assessment of main hazards (volcanic, earthquake and floods). In terms of hurricanes, GRAF is looking into the floods caused by hurricane. This is because Costa

Rica suffers more from the indirect impact of hurricanes (floods) than the direct impact (wind).

- b. Identification of exposure and vulnerability: critical infrastructure (transportation, hospitals, communication, electricity, water, roads), housing distribution and population.
- c. Scenarios of damages and losses under shocks forced by events with different probability levels (different geographies around the country), with the first results expected to be available in December.

2. **Economic model of general equilibrium (CGE)** (carried out by the University of Sao Paulo)
The results of the risk modelling will be applied to an economic model to express losses in GDP terms. They are taking the economic outputs of the risk modelling, with losses that are hazard specific (floods, volcano, etc) and apply them to GDP levels. This is a pathfinder exercise to inform conversations with relevant stakeholders and illustrate what modelling can do for taking decisions in the financial system. BCCR gave GRAF the economic matrix and input to pass onto the Sao Paulo economists. The economists are including loss and damage from the impacts, as well as the costs of reconstruction, in the economic model to obtain a collection of scenarios of impact on GDP.

Data

- Identified 300 sources of freely available risk information in Costa Rica and uploaded it on the RiX platform.
- Collected another 100 sources with very helpful information (e.g. the electricity network) but not on the RiX platform because of data restrictions. CNE has it and it is available on an excel spreadsheet.
- 682 data sets were identified for Costa Rica (floods, biodiversity, critical infrastructure, road networks, vegetation covers...). RiX brings them together.
- Challenges:
 - o The RiX platform is not user-friendly and very difficult to search for data as it is not organised by themes. One has to go through the whole list of 300, one by one, to search for the aimed result.
 - o Part of the information collected is available to the public and part not.
 - o The costs of rebuilding critical infrastructure developed during GRAF at the moment not available to the public.

Final phase (by December 2023):

The final phase needs to identify who can store/host and maintain all the information developed by GRAF and make it open source. The information collected and used for the modelling called "matriz de riesgo", combines all types of critical infrastructure (rail network, water distribution,

electricity networks, hospitals, clinics, schools). Currently the work is not made openly available because of lack of available funding. CNE has offered to host it, possibly the Ministry of Science and Technology could too. The challenge is the lack of resources to create the server and maintain the platform and additional sources of information, as well as to make it user friendly. Additional challenges: fiscal crisis (no additional funds are available) and cybersecurity concerns (might be a factor limiting the willingness of institutions to provide access to data).

II. Sistema Nacional de Información Territorial (SNIT)

Mapping/data portal administered by the National Geographic Institute (IGN)¹ brings together geographic information sourced from different systems and generated by many institutions of the public sector, by means of common standards and duly established protocols. Currently, there are 340 layers of information, which are available freely and at no cost not only for viewing but also for downloading.

The SNIT is the official platform through which fundamental geographic information is published in a standardised manner and following the technical standards used in the generation of geospatial information at the national level.

The SNIT is a network of entities that actively exchange spatial information. Each institution that has georeferenced digital geographic information and is integrated to the SNIT, must implement a computer architecture with the most convenient solution, which complies with the standards for the publication of geospatial information, defined by IGN, contemplating the needs of potential users of the information.

Currently, the National Registry, through the IGN, has been administering and managing the geoportal of the SNIT since May 2014, ensuring the sustainability of the SNIT's operational platform from the outset.

III. Metodología de Evaluación de Riesgo Climático de Infraestructura de Costa Rica (MERCICR)

The International Climate Initiative (IKI) project “Enhancing Climate Services for Infrastructure Investments (CSI)” was launched as a joint initiative in 2017 by an expert committee made up of various ministries and federations to improve the climate resilience of infrastructure in Costa Rica.

The outcome “Metodología de Evaluación de Riesgo Climático de Infraestructura de Costa Rica” – “MERCICR”² for short – is a methodology for measuring climate risks to infrastructure and deriving recommendations for action. The document is the result of six years of interdisciplinary work from a group led by MINAE. Alongside CFIA (Colegio Federado de Ingenieros y de Arquitectos de Costa Rica), experts from Costa Rica’s weather service and Transport Ministry (MOPT) were also involved.

MERCICR is based on the Canadian Public Infrastructure Engineering Vulnerability Committee Protocol (PIEVC), named after the committee responsible for its development. To ensure its

¹ For more information: <https://www.snitcr.go.cr/index2>

² For more information: <https://www.international-climate-initiative.com/en/iki-media/publication/pievc-high-level-screening-guide-a-guide-to-completing-screening-level-climate-change-risk-assessments-using-the-pievc-process-new6411b15f0f1a2395181144/>

application, MINAE issued a decree on resilient infrastructure in 2018, the ministry then enshrined climate risk assessments for infrastructure within its new National Adaptation Plan in 2022. In addition, the National Audit Office established MERCI as the standard for assessing risks to new public infrastructure. CFIA is cooperating with the University of Costa Rica to integrate MERCI into its engineering degrees. The overall aim is to increase the pool of experts able to use MERCI.

IV. Fu-Turismo

The Access to Insurance Initiative (A2ii) launched the third Inclusive Insurance Innovation Lab - the climate lab - in October 2021. Costa Rica was one of the country teams.

Costa Rica's climate web tool "FuTurismo" is an online platform to help build awareness on the impact of climate change within the small and medium enterprises tourism sector. In addition, it provides risk assessments and sustainable risk management solutions including insurance. The team began working on a roadmap for the development of the prototype and is currently in the process of hiring a project manager to help implement the different modules of the web tool. The team is also engaged in close consultations with various government agencies to ensure that the tool covers various aspects of climate risk resilience as broadly as possible.

Organisations participating in Fu-Turismo include: Superintendencia General de Seguros (SUGESE), Instituto Costarricense de Turismo, Instituto Nacional de Seguros (INS), BN Sociedad Corredora de Seguros, S.A., SAGICOR Seguros, Pan-American Life Insurance, Aseguradora del Istmo, Seguros Lafise, Popular Seguros Correduría de seguros S.A. The project was presented to the participants at the GRMA workshop.

V. MIDEPLAN – Metodología para el análisis de riesgos con enfoque multiamenaza y criterios probabilísticos en los proyectos de inversión pública

The purpose of applying the Methodology for Risk Analysis³ with a multi-hazard approach and probabilistic criteria in MIDEPLAN's Public Investment projects is that the entities in charge of the design of public infrastructure, operation, maintenance, refurbishment and repair projects can apply it for risk assessment under a multi-threat approach throughout the life cycle of Public Investment Projects.

The MGR is composed of 4 phases: 1. Identification. 2. Quantification. 3. Assessment. 4. Results.

This methodology can be divided into two main parts, the first one corresponds to the estimation of the expected cost of each risk, while the second one allows to determine the total expected cost of all the risks that could affect the project.

VI. Taxonomy of sustainable finance

The project "Aligning the Financial Flows of the Costa Rican Financial Sector with the Climate Change Objectives of the Paris Agreement" is financed by the Green Climate Fund and the European Union through the EUROCLIMA Program. The initiative launched in April 2023 and aims to develop a national taxonomy of sustainable finance and support its implementation in the

³ For more information: https://documentos.mideplan.go.cr/share/s/P_9G3PlpSI-4f4oogAD2WQ

financial sector. At the same time, it will create a framework to map, quantify, and disclose climate-related financial risks. These methodologies and tools will also be tested in the portfolios of banks and insurers to assess their exposure to these risks and define mitigation strategies. In this way, the Costa Rican financial sector will be provided with the necessary guidance structure to mobilise private capital towards a low-emissions and climate-resilient economy and to strengthen its capacity to adapt to the effects of climate change.

The institutions involved in this initiative are: UNEP, UNEP FI, EC, MINAE, SUGEF, SUGEVAL, SUPEN, SUGESE, BCCR

VII. Payment for Ecosystem Services (PES)

The Costa Rican Payments for Ecosystem Services (PES) Program, which is executed through the Fondo Nacional de Financiamiento Forestal (FONAFIFO) and the Sistema Nacional de Areas de Conservacion (SINAC), aims to protect primary forest, allow secondary forest to flourish, and promote forest plantations. Through the programme Costa Rican private landowners receive financial incentives from a fund financed by the government, private and international public donors, in exchange for ecosystem services in the form of forest protection, commercial reforestation, agroforestry, sustainable forest management or regeneration of degraded areas. The programme addresses an environmental externality by collecting taxes from polluters and by channelling them to agents protecting the environment. The programme is structured around four ecosystem services: capturing and storing atmospheric carbon, protecting water sources, conserving biodiversity and safeguarding scenic beauty. Introduced in 1996, The Costa Rican PES scheme represents one of the earliest payment schemes introduced globally.

VIII. Water Security Plans

The Instituto Costarricense de Acueductos y Alcantarillados (AyA) and UNDP launched in 2019 a Tool for Integrated Risk Management in ASADAS (GIRA) with the aim of strengthening the capacity for prevention and risk reduction, and the preparation of measures to address emergencies in communal aqueduct systems (ASADAS).⁴

This tool aims to facilitate the identification, assessment and management of disaster risks in drinking water and sanitation systems by community water managers. In addition to developing procedures to prevent and mitigate these risks, respond to emergencies and recover from potential impacts.

Asociaciones Administradoras de Sistemas de Acueductos y Alcantarillados Comunes (ASADAS) (Community Water Supply and Sewerage System Administrators Associations). This association looks after 26 to 30% of Costa Rica's population, mainly in poor, rural areas where the public water network does not reach. These networks are very vulnerable to climate hazards and they mostly lack risk assessments.

IX. National Emergency Fund (Fondo Nacional de Emergencia (FNE))

The Fund is one of the oldest in the region, is managed by the CNE, and those resources are used both to address emergencies and to prevent disasters. According to Law N°8488, all institutions

⁴ For more information: <https://www.undp.org/es/costa-rica/publications/herramienta-gira>

in the Central Administration, decentralised Public Administration and public enterprises must transfer 3% of their profits and cumulative budget surplus to the Fund in the first three months of the year (Article 46) for the CNE ordinary budget. These funds must be channelled to develop the National Risk Management System. Additionally (Articles 43 and 47), this applies to intakes, contributions, transfers and donations to the Fund coming from public institutions, individual or legal, and (Article 43) items allocated in the ordinary and extraordinary budgets of the Republic, intakes resulting from financial instruments and interest generated from the temporary investment of resources, destined to address emergencies.

CNE uses and directly executes these funds, under the oversight of the CGR and the CNE Internal Audit. However, the bulk of FNE expenses go for emergency, recovery and even reconstruction efforts, leaving little room for disaster prevention and risk reduction actions. In summary, most of the FNE resources available to respond to emergencies are transfers from public institutions once a state of emergency is declared, limiting its financial sustainability. It mostly relies on voluntary acts of institutional executives, generally not enough to complete the recovery of affected areas.

X. Contingent Credit Lines (DPL with CAT DDO)

In 2008, Costa Rica was the first country in the world to take out a Development Policy Loan with a Catastrophe Deferred Drawdown Option (DPL with CAT DDO) with the World Bank thus securing readily available financial resources in the event of large-scale disasters.

The credit was active for almost 9 years and included two Loan Contract renewals. It also offered the possibility to quickly access resources on occasion of large-scale disasters, such as the Cinchona earthquake, Tropical Storm Nicole and Hurricane Otto (funds were disbursed almost immediately upon Declaration of the Emergency).

This instrument ensured the optimal financial conditions to funds related to the emergency and rehabilitation stages since the Government did not have to resort to capital markets weeks after the disaster, when liquidity risk is usually very high and credit conditions are very unfavourable.

Once the CAT DDO ended, the country had no instrument to fund future effects of disasters. Therefore, in 2018 the Legislative Assembly approved a new standby facility in the sum of US\$20 million with the IDB.

XI. Insurance of public assets

Under the General Law on Internal Control, Law N° 8292, the leadership of each sectorial entity is responsible for “the protection and conservation of all institutional assets,” which also implies identifying the exposure of public assets to climate risks and taking measures to reduce the financial impacts of disasters, including buying insurance. Besides, the Government of Costa Rica instructs that all properties that benefit from Family Housing Bonds for construction or remodelling must have insurance. As mentioned above, however, the absence of an updated inventory of State-owned asset values hinders insuring such properties under suitable conditions, which will hopefully be corrected under a new system. Additionally, the frequent under-pricing of insured assets results in insufficient indemnification to reconstruct/replace the damaged property and assets.

3.2. Synthesis of ongoing activities

Table 1 presents a summary of ongoing activities, the sector of application and synergies with GRMA, to identify areas of potential support.

Table 1 Summary of ongoing CRA and CDRFI activities in Costa Rica

	Target sectors and provinces	CRA activities	CDRFI activities	Potential GRMA synergies
CATIE	<ul style="list-style-type: none"> National 	<ul style="list-style-type: none"> Tool for systemisation of data for development projects 	<ul style="list-style-type: none"> Leads studies on decision-making under risk, addressing climate change adaptation, and in particular crop insurance demand 	<ul style="list-style-type: none"> Working on risk assessment and climate risk insurance solutions Existing capability development activities
Costa Rican Social Security	<ul style="list-style-type: none"> National 	<ul style="list-style-type: none"> Disaster Risk Management assessment methodology for continuity of critical and safe services in social housing. 	<ul style="list-style-type: none"> Emergency health care assistance during severe natural hazards. 	<ul style="list-style-type: none"> Working on risk assessment with a focus on clinical services
Emergency Fund for the National Animal Health Service (SENASA)	<ul style="list-style-type: none"> Farmers 	<ul style="list-style-type: none"> None 	<ul style="list-style-type: none"> Emergency assistance for farmers during severe weather events. 	<ul style="list-style-type: none"> Providing tools for climate risk analytics
Fu-turismo	<ul style="list-style-type: none"> SME's in tourism sector 	<ul style="list-style-type: none"> Provides risk assessments and sustainable risk management solutions including insurance. 	<ul style="list-style-type: none"> Online platform to help build awareness on the impact of climate change within the small and medium enterprises tourism sector. 	<ul style="list-style-type: none"> Working on risk assessment and climate risk insurance solutions Existing capability development activities
GRAF	<ul style="list-style-type: none"> For analysis: education, health, roads and bridges, water and sanitation, as well as telecommunications. 	<ul style="list-style-type: none"> Provides a framework to assess disaster risks. Collating disaster/climate-related data in the RiX system 	<ul style="list-style-type: none"> None 	<ul style="list-style-type: none"> Existing expectation since 2020 of MDAs working together on risk. Source of existing data for GRMA projects; Sector specific GRAF research 300 RiX data sets (UNDRR have done global data, not in-country collation yet)
IKI/MERCI	<ul style="list-style-type: none"> National 	<ul style="list-style-type: none"> Methodology for Climate Risk Assessment of Infrastructure 	<ul style="list-style-type: none"> Provides an online tool to foster climate and disaster risk awareness in the infrastructure sector. 	<ul style="list-style-type: none"> Source of existing data for GRMA projects There might be existing capability development activities

Insurance for public assets	<ul style="list-style-type: none"> National 	<ul style="list-style-type: none"> None 	<ul style="list-style-type: none"> Leadership of each sectorial entity is responsible to protect all institutional assets, which also implies identifying the risk exposure of public assets and taking measures to reduce their financial impact. 	<ul style="list-style-type: none"> GRMA can bring experience from other countries (e.g. Peru) as well as the IDF recommended approach to insurance of public assets⁵
MAPFRE	<ul style="list-style-type: none"> SME's 	<ul style="list-style-type: none"> Performs climate risk analyses in collaboration with Lobelia Earth to integrate climate risk information on its assessments. 	<ul style="list-style-type: none"> Project under development: SME cat insurance Insurance for SMEs to cover disasters (natural events). It also has catastrophic insurance in other branches. 	<ul style="list-style-type: none"> Source of existing data for GRMA projects
MIDEPLAN	<ul style="list-style-type: none"> National 	<ul style="list-style-type: none"> Methodology for Risk Analysis with a multi-hazard approach and probabilistic criteria in Public Investment projects, including carbon pricing and guidelines for incorporating risk management. 	<ul style="list-style-type: none"> None 	<ul style="list-style-type: none"> Existing capability development activities
National Emergency Fund	<ul style="list-style-type: none"> National 	<ul style="list-style-type: none"> None 	<ul style="list-style-type: none"> Resources are used both to address emergencies and to prevent disasters. 	<ul style="list-style-type: none"> Source of information
Payment for Ecosystem Services	<ul style="list-style-type: none"> National 	<ul style="list-style-type: none"> None 	<ul style="list-style-type: none"> Addresses an environmental externality by collecting taxes from polluters and by channelling them to agents protecting the environment. 	<ul style="list-style-type: none"> Source of existing data for GRMA projects Existing capability development activities
SNIT	<ul style="list-style-type: none"> National 	<ul style="list-style-type: none"> Official platform through which fundamental geographic information is published in a standardised manner and following the technical standards used in the generation of geospatial information at the national level. 	<ul style="list-style-type: none"> None 	<ul style="list-style-type: none"> Source of existing data for GRMA projects Existing capability development activities
Special Prevention and Infrastructure Fund (FEPI)	<ul style="list-style-type: none"> Banana plantations 	<ul style="list-style-type: none"> None 	<ul style="list-style-type: none"> Aims to protect banana plantations by maintaining and reconstructing the water basins, roads and bridges needed for the plantations. 	<ul style="list-style-type: none"> Providing tools for climate risk analytics

⁵ See: <https://www.insdevforum.org/wp-content/uploads/2020/08/Practical-Guide-to-Insuring-Public-Assets.pdf>

UCR Geophysics group (CIGEFI)	<ul style="list-style-type: none"> National 	<ul style="list-style-type: none"> Leads research on disaster risk modelling for geophysical hazards. 	<ul style="list-style-type: none"> None 	<ul style="list-style-type: none"> Source of existing data for GRMA projects
Water Security Plans	<ul style="list-style-type: none"> National 	<ul style="list-style-type: none"> A tool to facilitate the identification, assessment and management of disaster risks in drinking water and sanitation systems by community water managers. 	<ul style="list-style-type: none"> tbc 	<ul style="list-style-type: none"> Source of existing data for GRMA projects Working with local communities

3.3. Insights from participant discussions

The workshop brought together participants from many international agencies and Ministries of the Costa Rica government. The outcomes of the interactive activities and discussions aimed to elicit participants' perceived needs and priorities in risk understanding and management. The findings of those discussions are summarized in the following:

I. Day 1 – Gaps identified

The gaps identified in risk modelling capabilities and access to risk information by the different groups can be gathered into three general categories:

Data and modelling

All groups identified a common lack of an open-source data inventory for risk management, which is easily accessible for the public sector. Some groups went further and identified the need of such database to contain risk information at canton level. Moreover, several groups highlighted the need to improve risk modelling, particularly at higher resolution and regional scale.

Capability development

The participants identified a clear need to improve capability development, particularly to enhance insurance management skills and risk modelling. An important gap addressed was the lack of continued resources for research and training, which might influence retention rates.

Disaster risk management strategies and policies

All groups identified gaps related to disaster risk management and provided examples of strategies that are either absent or insufficient. Amongst those, the participants suggested the improvement of recovery projects, preparation of response and action plans. Moreover, several groups suggested the implementation of a data governance system, since lots of information is available but scattered, and the increase of insurance coverage for public infrastructure.

II. Day 2 – Gaps identified

The second activity involved asking the participants to brainstorm potential technical projects and the associated gaps, roles, capacities, and sustainability.

The outcomes of the participant discussions reflect the following priorities [or focus areas]:

Agriculture and food security

Participants in this group identified a range of challenges in their efforts to model and manage agricultural risks. These challenges include a lack of crucial biological and historical crop data, as well as limited public access to existing data. Additionally, the lack of capacity building, with inadequate training for both producers and relevant agencies, has hindered effective risk management efforts.

On an institutional level, there is discouragement in working on risk management, especially in areas with fewer producers. While there has been progress in establishing insurance mechanisms for the coffee sector, other supply chains do not enjoy the same level of access to such risk mitigation tools and are often inaccessible to small-scale producers.

Food security is another pressing issue, with an increasing reliance on imports for basic grains, which is discouraging traditional national production. This shift not only makes Costa Rica dependent on countries facing higher climate risks but also disincentivises risk management.

Water safety and health

The group's discussion highlighted several key points for both Primary Health Care and Clinical Services in the context of water and sanitation. The primary gap identified concerned the importance of establishing a centralised database at the national level to make data accessible for relevant stakeholders. For Clinical Services, the group prioritised the development of a multi-hazard risk assessment model to identify health risks associated with water and sanitation.

Critical infrastructure diagnosis and analysis

Participants emphasised the importance of interconnecting information systems to improve data sharing and coordination across infrastructure sectors. Additionally, defining governance structures, roles, and actions was seen as essential for efficient management. The group acknowledged challenges related to the lack of financial capacity and human resources, which can hinder infrastructure development and maintenance. Effective project monitoring was highlighted as crucial to ensure project success. Lastly, they discussed the need for more attractive economic models to promote asset insurance, particularly for housing and critical infrastructure assets and to enhance resilience.

Financing risks disasters for infrastructure

The group identified several gaps regarding disaster risk financing for infrastructure. They emphasised the need for a thorough diagnosis of critical infrastructure and the evaluation of existing disaster risk financing mechanisms. A key focus of their discussion was on improving the governance of critical infrastructure, with an emphasis on building resilience of essential services through the allocation of adequate resources and the development of necessary capacities to rebound quickly after a shock. This way ensuring the service continuity of critical infrastructures.

Furthermore, the group discussed the importance of creating a National Disaster Risk Financial Management Strategy Action Plan, which would serve as a crucial roadmap for managing disaster risks and financing. To support these efforts, the group emphasised the importance of building a comprehensive system-based approach diagnosis and analysis of critical infrastructure and collecting relevant data for modelling. This data would be instrumental for assessing service disruption and its social and economic impact as well as resilience objectives of the service.

Coastal erosion

Participants identified a range of challenges and areas for improvement, including issues with marine coastal permits involving various entities such as municipalities, water (AyA) and electricity companies (CNFL). The group addressed a lack of knowledge regarding vulnerabilities in coastal zones and climate change risk, emphasising the need for training local government authorities. Additionally, they emphasised the need for coordination between scientific and technological knowledge, and political decision making.

Quantifying the magnitude of losses due to coastal erosion and addressing residual risk and its financing were seen as critical steps. The group suggested the need for an update of relevant legislation, including tariffs, penalties, and environmental damage regulations. Moreover, they proposed a climate change awareness campaign and called for increased resources for research on coastal erosion.

3.4. Outcomes of the workshop

The outcomes of the interactive activities and discussions aimed to elicit participants' perceived needs and priorities in risk understanding and management. The overall outcome of the workshop was that there is much and varied interest in GRMA support for Costa Rica. Apart from the specific risk questions raised, some common themes and observations emerged from across all discussions:

1. Data governance: collating, sharing, collecting, and hosting data for risk assessments, as well as their maintenance.
2. Estimating financial impacts of disasters and prioritising climate and disaster risk finance and insurance strategies.
3. Ensuring effective transfer of knowledge and bridging existing silos between climate and disaster risk stakeholders and institutions.
4. Agreement of participants regarding priority towards specific sectors rather than hazard or region.
5. Acknowledgement of potential underrepresentation of specific sectors due to absence of representatives of ministries, such as Ministry of Agriculture, Ministry of Finance, Ministry of Education, or representation of rural communities.

The workshop discussions provided a base for possible GRMA support and the definition of potential GRMA operational projects. A technical working group (TWG) set up and chaired by SUGESE and involving key Costa Rican stakeholders will ultimately decide on the priority areas and operational projects receiving technical assistance within the GRMA.

4. Options for GRMA support

The following section contains potential focus areas and operational projects where Costa Rica could receive technical assistance under the GRMA. These high-level descriptions are based on discussions and findings during and around the first workshop. The technical working group (TWG) chaired by SUGESE decides on the prioritisation of these possible activities. The preferred activities will subsequently be defined in detail respecting the time constraints of 12 to 18 months and the available budget.

GRMA typically offers to undertake a strategic risk assessment for multiple hazards at national scale, including projecting risk in a future climate and considering projected socio-economic change. Strategic projects will usually inform policy instruments or are fundamental for further risk understanding. If no strategic project is required, the resource will be reallocated to Operational Projects. The project could entail one of the following options:

- New, joint modelling project for climate and geo-hazards
- Informs national policy instruments (e.g., NAP), or strategic risk capability
- Limited work to fill gaps in current strategic risk understanding, e.g., to add probabilistic views of future climate or exposure or add unmodelled hazards
- Sovereign level, sector-specific focus (e.g., Infrastructure, Health, Agriculture...) covering multiple hazards under current and future conditions

In addition GRMA offers the implementation of one or two Operational Projects, with the aim to strengthen the technical competence of climate and seismic risk assessments. They may include a specific hazard, or multiple hazards, can be focused on a specific locality at high resolution or nationally focused with a focus on a single sector. An Operational Project can be defined as including some or all of the components:

Project [N] will focus on [purpose] in [region] for the benefit of [vulnerable population]. It will deliver [outcome] for [financial mechanism].

Examples for financial mechanisms are investment in adaptation projects (e.g. more resilient bridges, tourism infrastructure, natural capital); risk transfer instruments (e.g. insurance to protect critical infrastructure); social protection (e.g. income protection for SMEs); insurance to protect natural assets (e.g. mangroves).

The options presented are:

1. Strategic projects:
 - a. Strategic risk assessment of critical infrastructure
 - b. Systemic macro-economic impact assessment
 - c. Multiple hazard risk assessment for water, sanitation, and health sector
 - d. Best practices for risk data platform
2. Operational Projects on:
 - a. Infrastructure
 - b. Tourism

- c. Agriculture
- d. Eco-System Services

Note, the order of listed options does not reflect any predetermined priority. The GRMA budget is limited and it is stressed that not all of these options can be taken up, but it is anticipated that up to three options may be executed. Some options are mutually beneficial, and the complementarity with the NAP of Costa Rica is noted in the section below.

1. Strategic Projects

a. Risk assessment of critical infrastructure

The overarching aim of this would be to provide a multiple hazard diagnosis on key infrastructure on a regional or national scale informing multiple sectors and inform national policies including the National Adaptation Plan. The details of such a project would have to be defined further and would need to build on previous achievements such as CNE's work on the GRAF programme. Specifically, the Technical Working Group should agree the purpose of the infrastructure risk modelling, as this will determine the type of modelling and metrics that could be delivered. For example:

- Will the modelling help prioritise investment in the resilience of infrastructure to reduce the disruption of essential services?
- Is it for reinforcement and improving resilience of essential services?
- Will it be for financial protection of timely resilience of the essential service and protection of existing infrastructure?
- Does this focus only on essential services disruption socio-economic costs, resilience targets, and financial instruments to reduce the disruption and its impact, or does it also look at infrastructure reconstruction?

The project could include a systematic approach analysis of selected critical infrastructure and essential services (multiple hazard, system level, multi-sectoral, public-private, life-cycle approach, risk management cycle, risk-based and layered approach, transboundary dimension), the socio-economic cost of services disruption, and cost-effective financial instruments. A clear selection of the focus would be necessary in order to be able to carry out the project. This would continue progress made through GRAF and IKI/Merci-related activities. New hazard assessments such as excess rainfall and flood could be combined with work already achieved on earthquake or volcano. It is suggested that the assessment would be conducted for a selected region, undertaken with significant capability development on all elements of the analysis, enabling later application to other regions, creating a template for future work. The GRAF-empowered community of ministries and organisations with a mandate to reduce risks would be foreseen to be part of this project. This project would complement ongoing activities at CNE and the [GRAF](#) project.

Complementarity with NAP:

- Axis 1.2.27 At least 1 diagnosis of criticality and the effects of climate change on the country's public infrastructure prepared (strategic and complementary national road network, airport infrastructure, airports, airfields, ports, the railway system and river works).

- Axis 4.2.8 100% of the diagnoses of vulnerability and climate risk of vital and critical public infrastructure associated with the strategic and complementary national road network, airports, airfields, ports, the railway system and river works.

b. Systemic macro-economic impact assessment

The goal of this project would be to build upon current activities in Costa Rica to simulate macro-economic impacts of physical climate risks from multiple hazards on economic development and fiscal stability. Based on established risk modelling approaches in academia and/or the insurance sector, the assessment would inform disaster risk management policies and would provide tools for financial entities to integrate future climate into their governance and risk management processes. The assessment would give insight into the effectiveness of existing climate and disaster risk finance and insurance options including the investment in adaptation measures and include projection of risk according to scenarios of change in socio-economic and climate conditions. Ensuring added value of this assessment to forthcoming results of the GRAF project in particular the modelling of ERN and the University of Sao Paulo is imperative.

This project would inform planned activities of BCCR and SUGESE.

Complementarity with NAP:

- Axis 6.3.1 1 programme in operation to promote that 40% of insurance industry entities (insurers) incorporate climate change risk issues into their governance and risk management infrastructure.
- Axis 6.3.3 1 diagnosis that assesses access to financial instruments (insurance and reinsurance) associated with climate risk by vulnerable sectors and/or regions.

c. Multiple hazard risk assessment for water, sanitation, and health sector

The aim of this project would be to undertake a strategic national multiple hazard risk assessment informing the ongoing efforts of AyA and their existing [GIRA tool](#). Clinical services would also benefit from such an assessment. Key infrastructure elements of public water networks vulnerable to climate-related hazards would be identified. A further related element could include risk mapping of regions with water scarcity in future. The recent hazard assessments conducted by GRAF / ERN would be assessed for their suitability (in e.g. scale and resolution) to be applied to assessment of WASH facilities, infrastructure and operations.

Complementarity with NAP:

- Axis 1.2.11 1 analysis for the identification and design of climate products for biodiversity and water resources management, based on user demand.
- Axis 3.3.10 2 capacity building processes are carried out so that AyA targets in risk management planning instruments for the period 2021-2025 are adjusted to integrate climate-related risks and incorporate climate change adaptation actions.

d. Best practices for risk data platform

The objective of this project would be to introduce a wide range of stakeholders to the benefits of data and metadata standardisation and open-source principles for risk related data. It would focus on a central, open catalogue of metadata to describe the characteristics and provenance of available models and data. This will allow easier collation, sharing, and extension of data sets, and facilitate cross-sectoral exchange and knowledge transfer. The practicality of easily finding existing data sets or the awareness of an existing data set will make the access to risk information more efficient. This includes all components for climate and disaster risk modelling, i.e. hazard, exposure, and vulnerability. This project could support a hosting organisation with the establishment of a new platform, or enhance an existing one such as SNIT (SNIT's operational and legal capacity would need to be clarified). However, the GRMA programme is not able to provide all necessary means for creation or sustaining such a service continuously.

This project could be complementary to the development/improvement of the [SNIT](#) database and has high potential for capability development across all stakeholder groups.

Complementarity with NAP:

- Axis 1.1.7 A territorial information system, with indices for vulnerability and hazard delimitation, including climate-related hazards, that is freely accessible and supports capacity building for risk assessment by actors involved in land use, investment, infrastructure development and financial protection.

2. Operational Projects

a. De-risking options for infrastructure

In relation to the strategic assessment and diagnosis and analysis of critical infrastructure, one more focussed project could be the analysis of specific service and its infrastructure on a regional or sectoral scale. The spatial extent will depend on the number of different types of infrastructure and the similarity of faced risks. Information from the GRAF project and the potential strategic GRMA infrastructure assessment would form a base for this more detailed assessment and include de-risking options. One objective could be to enhance loss estimations of service disruption by including indirect effects such as business interruption and systemic economic implications of, e.g. destruction of ports or transport routes. Using 'What-if' scenarios the cost and effect of potential pre-arranged financing mechanisms for de-risking such infrastructure elements would be assessed. This includes particularly the analysis of a layered risk finance approach combining several mechanisms available on both local and global scale with a cost-effective analysis of the financial instruments also considering the need of the resources for a response, rehabilitation and reconstruction (build back better). Also, the project could define resilience objectives for the sector or region, for example, a maximum of hours of days that are socially and economically acceptable for specific service disruption and maximum acceptable expansion of the disruption geographically or by the number of persons affected. The Technical Working Group should specify the desired practical outcome of the modelling – for example would it lead to specific resilience investment objectives? Or to risk transfer mechanisms, or to contingent finance in fiscal planning? The GRAF-

empowered community of ministries and organisations with a mandate to reduce risks would be foreseen to be part of this project.

Complementary projects as in strategic assessment (1a): [GRAF](#), [IKI/Merci](#), NAP.

Complementarity with NAP:

- Axis 4.1.1 1 methodology for public investment projects incorporating criteria for climate risk assessment and identification of adaptation measures.
- Axis 4.4.1 100% of pre-investment studies in CCSS infrastructure projects incorporate climate change risk analysis.

b. Tourism

This project would build upon the existing [Fu-Turismo](#) project increasing risk awareness of small and medium enterprises in the tourism sector. The project is still in a pilot phase and GRMA support could help fill specific gaps regarding the quantification of risks as well as effect and cost of risk reduction and/or risk transfer mechanisms focussed on the tourism sector. The regional coverage could potentially be scaled-up.

Complementarity with NAP:

- Axis 5.1.4 1 document with guidelines for the adaptation of the tourism sector to climate change available, facilitating compliance with the related CST criteria.

c. Agriculture

Analytics to provide quantified risk estimates in terms of crop yield or export losses are not widely applied in the agriculture sector. An operational project could provide farmers and agencies alike with a demonstration of the benefits of this concept through provision of risk estimates and also introduction to the principles through capability development activities. While further discussions and prioritisation of crops on which to focus would require a larger group of stakeholders from the agricultural sector than present at the workshop, a GRMA operational project could help with systematic use of crop yield data, provision of crop yield model, provide overview and estimate cost and effect from risk reduction and risk transfer solutions, estimating financial aspect of climate smart agriculture practises and/or long-term climate changes in crops with insurance.

This project would inform ongoing activities at MINAE and IMN.

Complementarity to other projects: Ecolandscape Programme ([Ecopaisaie](#)).

Complementarity with NAP:

- Axis 5.2.6 1 training programme and transfer of available technologies, on practices that strengthen agricultural resilience and promote ecosystem-based adaptation to climate variability and change at different scales: small, commercial and agro-industrial (2,450 producers).

d. Ecosystem Services

This operational project could aim to quantify ecosystem services through its economic value or a biodiversity index and thus quantify the risk around it. Risk understanding around ecosystem services options for financial de-risking was mentioned as an area of interest from a wide range of stakeholders as it also prominently features in the NAP (see below). Prioritisation of what type of ecosystem service and which region to be assessed will have to be defined but could include the Caribbean coast and the effect of mangroves.

This project would inform ongoing activities at CATIE, MINAE and MIDEPLAN.

Complementarity to other projects: [Payment for Environmental Services Program](#), Conservation or Trust Funds under MINAE, such as Forever Costa Rica Association or Fonafifo.

Complementarity with NAP:

- Axis 1.2.11 1 analysis for the identification and design of climate products for biodiversity and water resources management, based on user demand.
- Axis 1.2.38 10 valuations of Ecosystem Services (ES) in the country to characterise their contribution to climate change adaptation and resilience.
- Axis 3.1.1 At least maintain an amount of 300,000 hectares per year under the Payment for Environmental Services Programme, in total in all socio-economic regions of the country, which protect ecosystem resources and promote sustainable and adapted land management.
- Axis 6.2.3 1 new or adjusted financial mechanism based on the valuation of ecosystem services, with special emphasis on vulnerable ecosystems.

5. Next steps

A technical working group (TWG) will be established and chaired by SUGESE. Members can be employed by a government office, partner agency or institution which supports adaptation and resilience objectives of Costa Rica.

The GRMA TWG of Costa Rica will decide on the final focus areas and eventually on the operational projects. The project suggestions by GRMA are outlined above in Possible GRMA activities.

The next step is for SUGESE to appoint the GRMA TWG with the support of the GRMA team. All members would be invited by SUGESE, as chair of the group, to a virtual kick-off meeting to discuss the TWG's priority hazards, impacts and sectors within the possible areas for GRMA support. A second in-country workshop would be designed to take place in 2024, with the focus on final design of the selected projects, or if this step can be completed virtually with the TWG, the next workshop could take place as a project inception meeting with the project consultants executing the work.

The TWG, GRMA and SUGESE can then define a workplan and agree which priority areas or proposals can be supported in the available time and budget for GRMA technical support. At the same time, SUGESE can already begin to complete the formal application for GRMA support following the application process and templates available at grma.global/join-the-alliance/.

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ANNEXES

Annex 1: Letter of Interest to GRMA

Annex 2: Invitation letter

Annex 3: Concept Note and Agenda

Annex 4: Participant list

Annex 5: Selected workshop photographs