

# Getting ahead of water-related disasters: Early warnings in a changing climate



Known, quantifiable  
threats

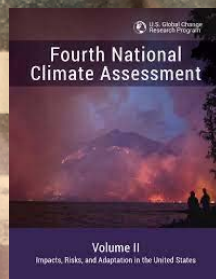
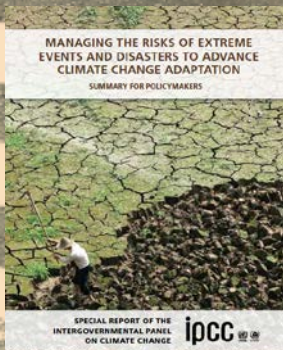


Roger S. Pulwarty

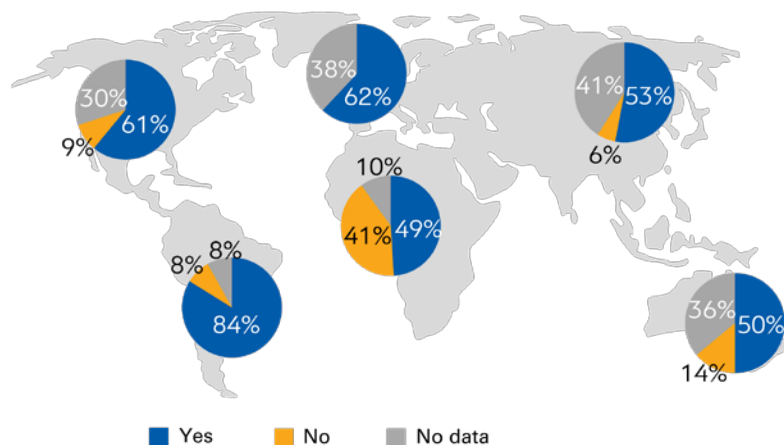
National Oceanic and Atmospheric Administration  
(and a lot of other folks and institutions)



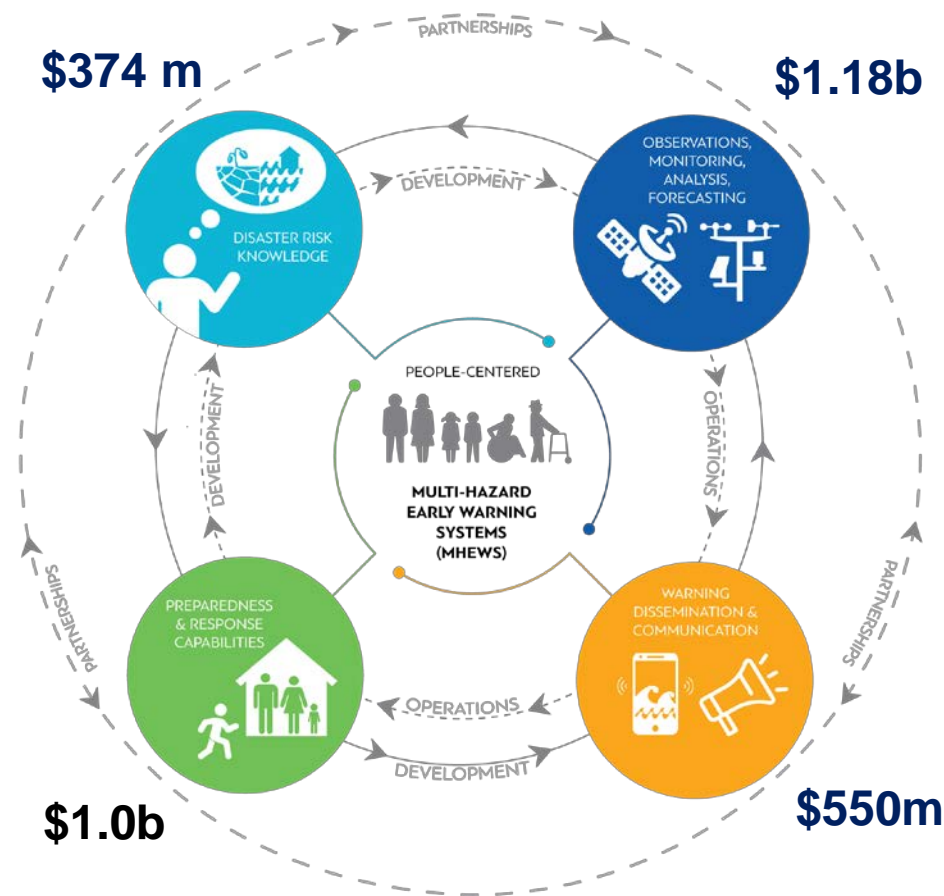
Cascading and compounding risks, local imbalances, and, global and regional network disruptions are overwhelming traditional approaches to risk management







Percentage of countries reporting as having Standard Alerting Protocols (*WMO Performance Monitoring System, July 2022*)



**“Ensure that citizens worldwide are protected by early warning systems against extreme weather and climate change.....within five years.....We must invest equally in adaptation and resilience.”**

Secretary-General António Guterres World Meteorological Day 23 March, 2022

UNFCCC CoP 27 November 2022

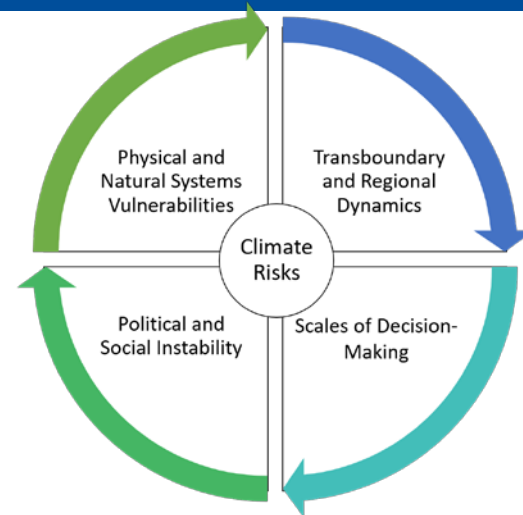
# Wilson Center Improving Predictive Capabilities for Water-related disruptions

An Evidence-Based Collaborative Framework for Managing Climate Risks and Disruption

Created baseline assessments on three different climatic “hotspots”:

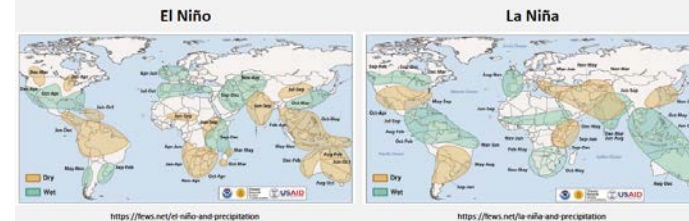
- The Horn of Africa
- The Caribbean
- Horn of Africa
- South Asia (GDM Basin)
- Central America
- Pacific COFA States

Goal: Building an evidence-based framework for addressing weather, climate and water-related disruptions and instability.

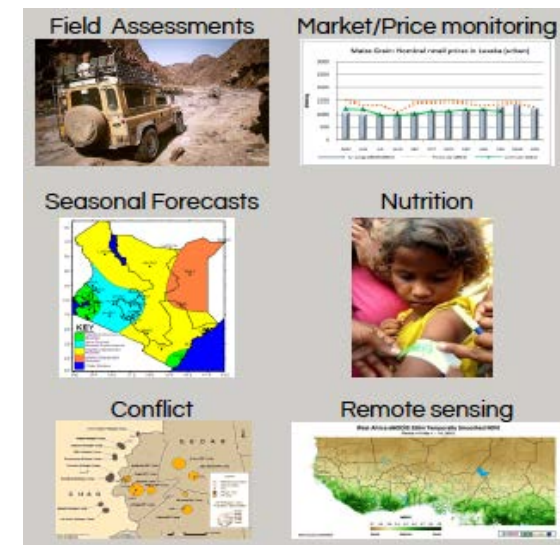


## Questions

1. What physical, social, and economic impacts may arise from cascading, clustered, or sequential extreme weather and climate events?
2. What is needed to construct early warnings and take proactive action on these issues?
3. How can we facilitate coordination between elements of the defense and intelligence community with regional experts and practitioners?



El Niño – Southern Oscillation is a Principal Source of Precipitation Predictability



## Integrated Food Security Phase Classification

PHASE 1 Minimal	Households are able to meet essential food and non-food needs without engaging in atypical and unsustainable strategies to access food and income.	
PHASE 2 Stressed	Households have minimally adequate food consumption but are unable to afford some essential non-food expenditures without engaging in stress-coping strategies.	
PHASE 3 Crisis	Households either: Have food consumption gaps which are reflected by high or above-usual acute malnutrition; <b>OR</b> are marginally able to meet minimum food needs but only by depleting essential livelihood assets or through crisis-coping strategies.	<b>URGENT ACTION REQUIRED</b>  <b>!</b>  Phase classification would likely be at least one phase worse without current or programmed humanitarian assistance.
PHASE 4 Emergency	Households either: Have large food consumption gaps which are reflected in very high acute malnutrition and excess mortality; <b>OR</b> are able to mitigate large food consumption gaps but only by employing emergency livelihood strategies and asset liquidation.	
PHASE 5 Famine	Households have an extreme lack of food and/or other basic needs even after full employment of coping strategies. Starvation, death, destitution, and extremely critical acute malnutrition levels are evident. (For Famine Classification, area needs to have extreme critical levels of acute malnutrition and mortality.)	

Understanding the context

Effective decision support

Efficient monitoring

Comparable classification

Scenario building

### USAID Program Management Team

#### Four Inter-Agency Agreements



#### University Coop Agreement



#### Five Contracts



#### Network Partners

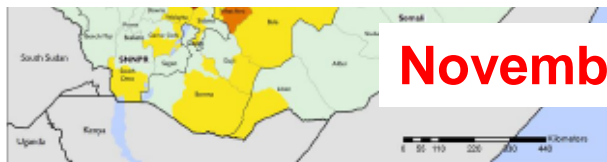
- National governments
- USAID Missions and Bureaus
- Regional technical organizations (CILSS, SADC, COMESA, IGAD)
- WFP, FAO, UNICEF, UNHCR, other international agencies
- Non-governmental organizations (NGOs)
- IPC working groups and other coordinating structures

## Examples of Sequential Drought

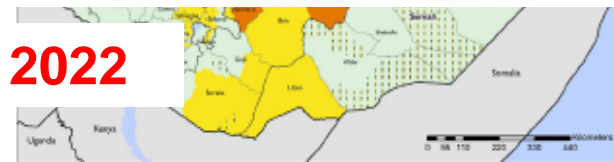


### Immediate global action required to prevent Famine in the Horn of Africa

A 5<sup>th</sup> consecutive season of drought has been set in motion by a poor start to October – December rains, and below-average rainfall is also considered likely to continue during the March – May 2023 season; a humanitarian catastrophe is occurring now, and more funds are crucial to save lives



As projected Feb 2016



As updated June 2016

### FAMINE EARLY WARNING SYSTEMS NETWORK

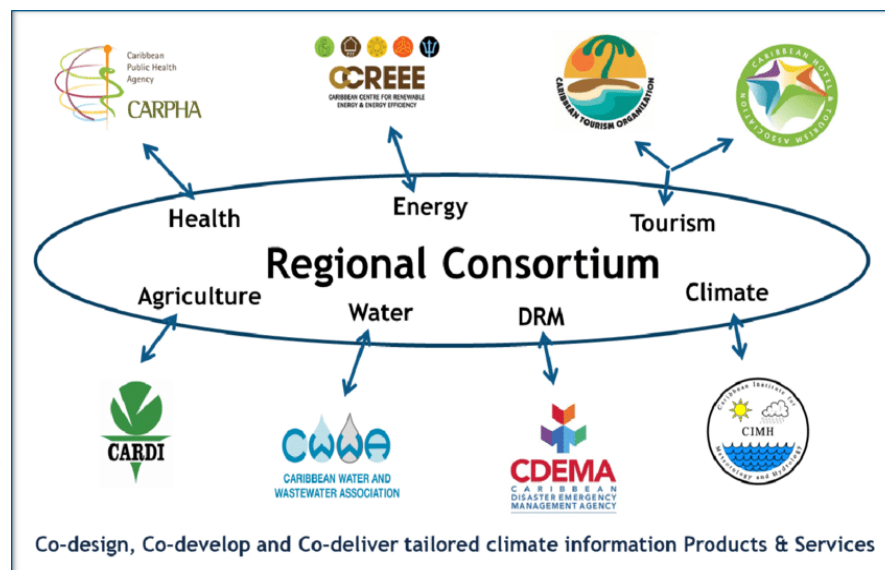
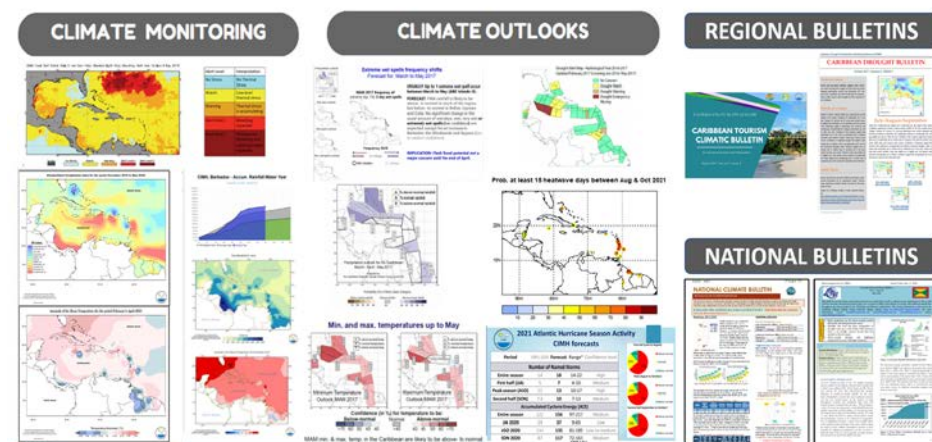
- Robust early warning and decision support services
- Social safety nets
- Conflict did not become an major issue

IPC Scale	Identifies areas and populations with:	Identify the need for urgent action to:
Acute Food Insecurity 	food deprivation that threatens lives or livelihoods, regardless of the causes, context or duration.	decrease food gaps and protect lives and livelihoods.
Chronic Food Insecurity 	persistent or seasonal inability to consume adequate diets for a healthy and active life, mainly due to structural causes.	address underlying factors and potentially implement safety net programmes.
Acute Malnutrition 	a high prevalence of acute malnutrition accompanied by high or increasing levels of morbidity or individual food consumption gaps.	scale up acute malnutrition treatment and prevention for affected populations.



# Caribbean Early Warning Information Systems Across Climate Timescales

Sustaining and evolving robust multi-hazard early warning systems. The Caribbean Institute for Meteorology and Hydrology partners with academia, regional agencies and institutions, development agencies among others, and the private sector



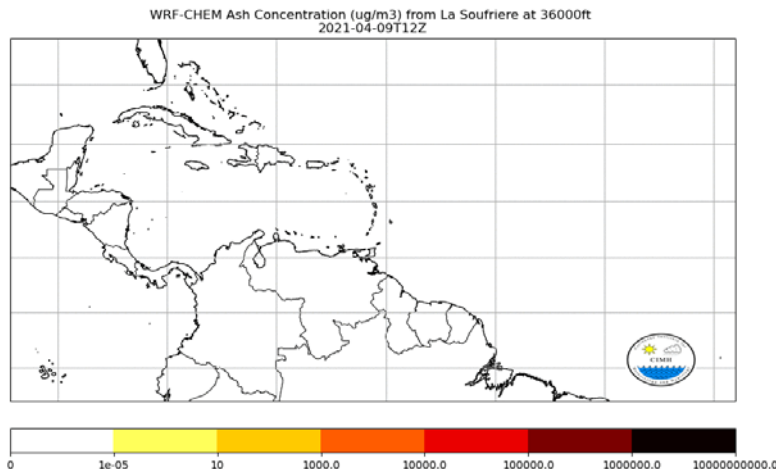
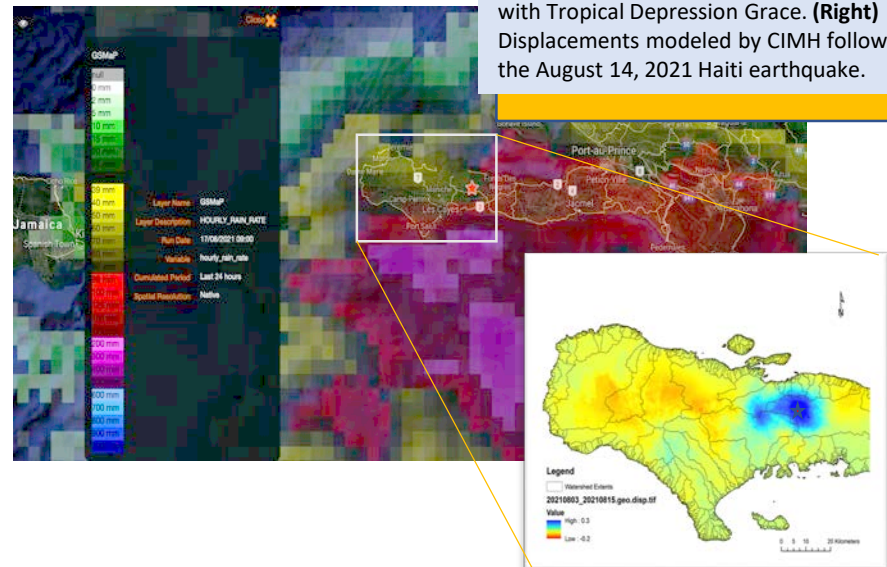
The Consortium has become the key regional mechanism that champions the design, development and delivery of tailored climate products and services for the agriculture and food security, disaster risk management, energy, health, tourism and water sectors.

# Caribbean Multi-Hazard EWS – Haiti and St. Vincent Examples

CIMH's Rainfall Predictions for Tropical Depression Grace and Related Impact-based Forecast and Risk Assessment for Earthquake Impacted Southern Haiti Triggered relief actions with CDEMA and Haitian Officials Prior to the Event

- Multi-hazard Early Warning System (MHEWS) capability integrating seismic hazard and resulting impacts with severe weather forecast - cascading impact.
- Tropical Depression Grace was forecast to impact southern Haiti 3 days after the region was impacted by a significant earthquake. Significant rainfall associated with the system (i) threatened an already vulnerable displaced population living outdoors and (ii) posed flood and landslide threats due to unstable slopes and displaced soils.

(Top): 24-hr precipitation (0900 UTC August 16 through 0900 August 17, 2021 Associated with Tropical Depression Grace. (Right) Displacements modeled by CIMH following the August 14, 2021 Haiti earthquake.



**La Soufriere ash plume at 14:11 UTC approximately 2 hours after eruption at 12:41 UTC (April 9th)**  
Credit: European Union, Copernicus Sentinel-3 imagery



Cumulative volcanic ash cloud from the La Soufriere eruption based on a ash recycling strategy implemented in WRF-CHEM.

**Impact of La Soufriere Volcanic Eruption (2021) on PV Production in Barbados**



# Roundtable on Financing Water

## The Roundtable on Financing Water

Regional meeting: The Americas, 26-27 June 2019

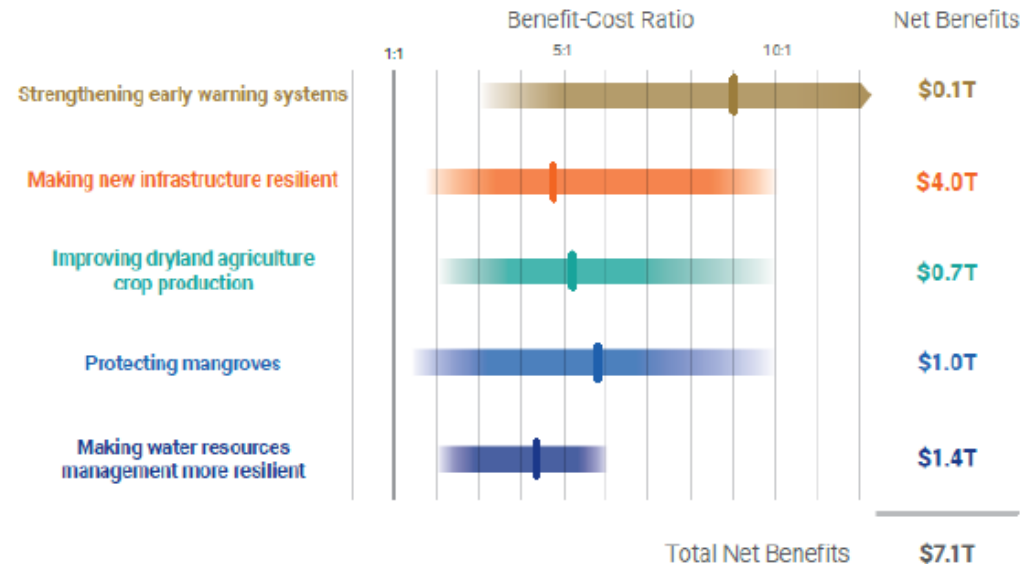
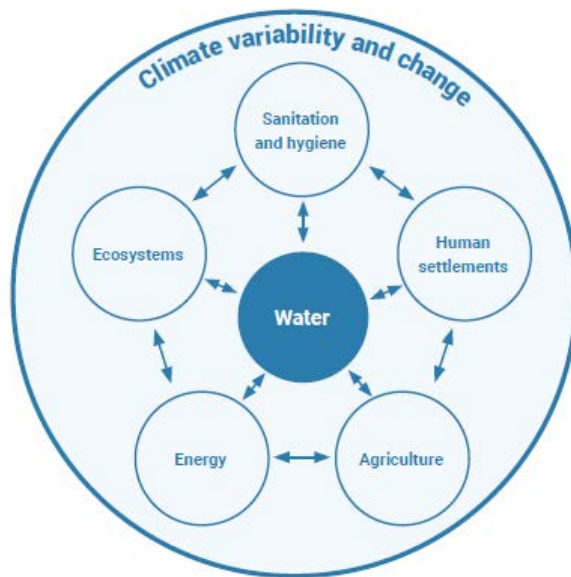
Inter-American Development Bank Headquarters, Washington, D.C.

8th Roundtable on Financing Water, focused on Climate Action in partnership with the U.S. Government

23-24 September 2021

Session 1: Setting the scene: Putting finance to work for a net zero, resilient, water secure future

## The interlinkages between water security and climate action



**Alignment of key disaster risk reduction, SDG6, and climate adaptation goals through improvements in water security:  
Benefits and costs of five identified investment areas**

# Navigating “through” a changing a climate: From risk to resilience

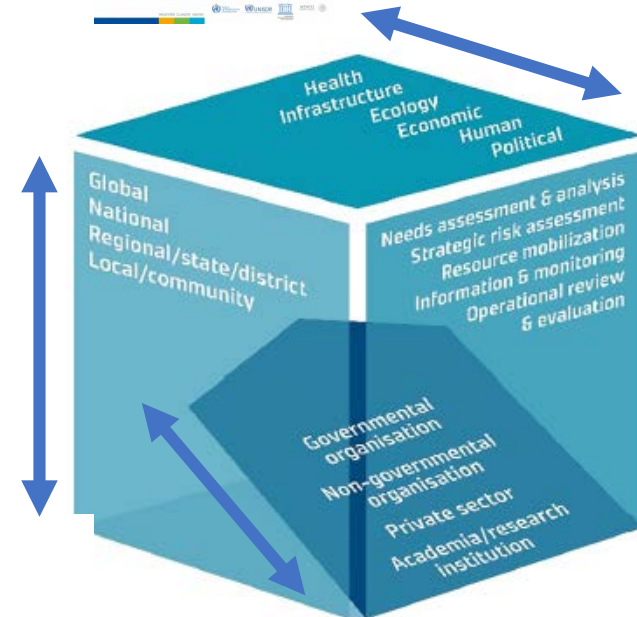
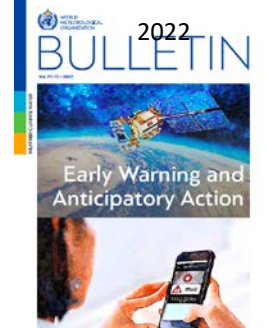
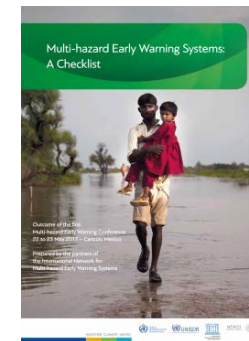
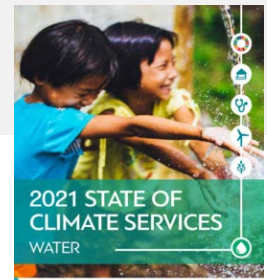
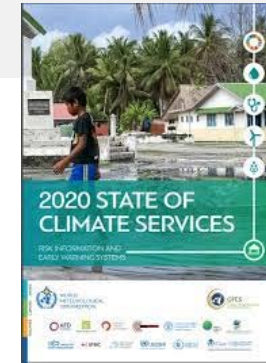
## 1. Structural and Systemic risks: Data and Science to better characterize and map risk accumulation and water resource dynamics

- A seamless link between multi-hazard early warnings and early action with public, private and civil society partners
- Stress-testing of dynamic thresholds and systemic risks

## 2. Adaptive Risk Governance: Aligning research, finance, and management across scales

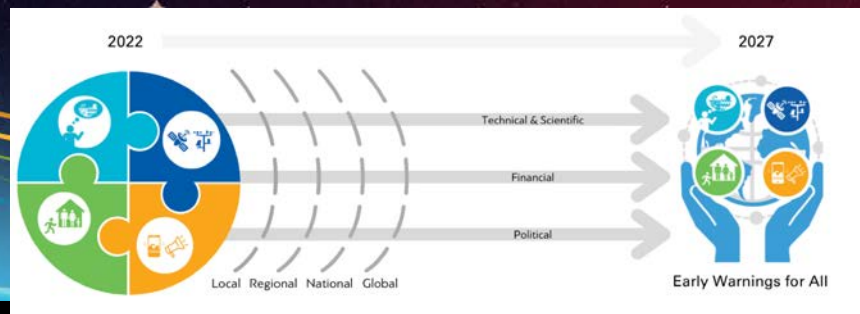
- Focus on reducing systemic risks and realizing opportunities to minimize investment needs for rebuilding after events

**Not just down to, but up from, “the last mile”**



# Ongoing challenge:

Enabling and sustaining collaborative networks across research, observations, services, and decision-making



Thank you!  
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<http://go.funpic.hu>

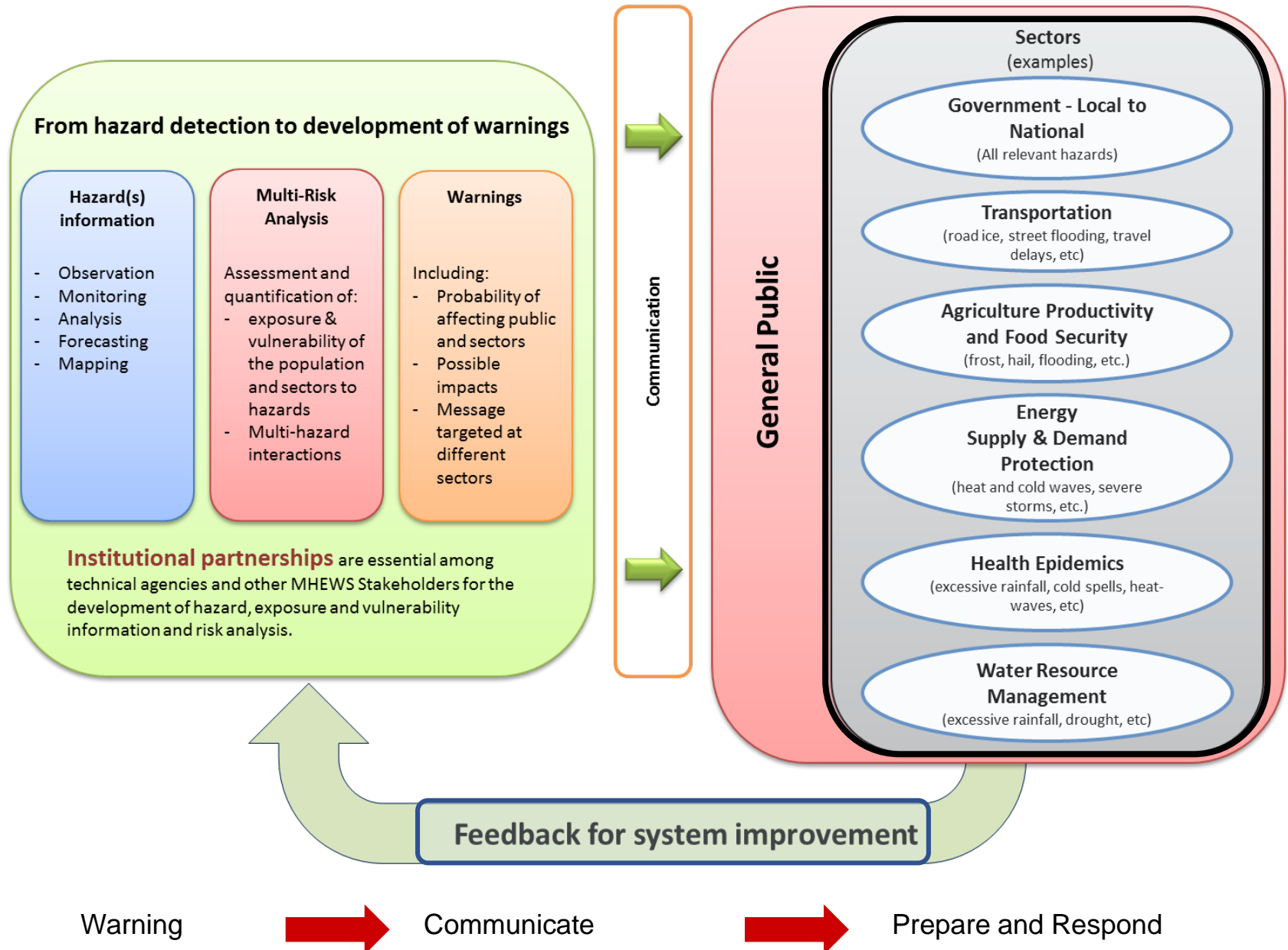




Backups

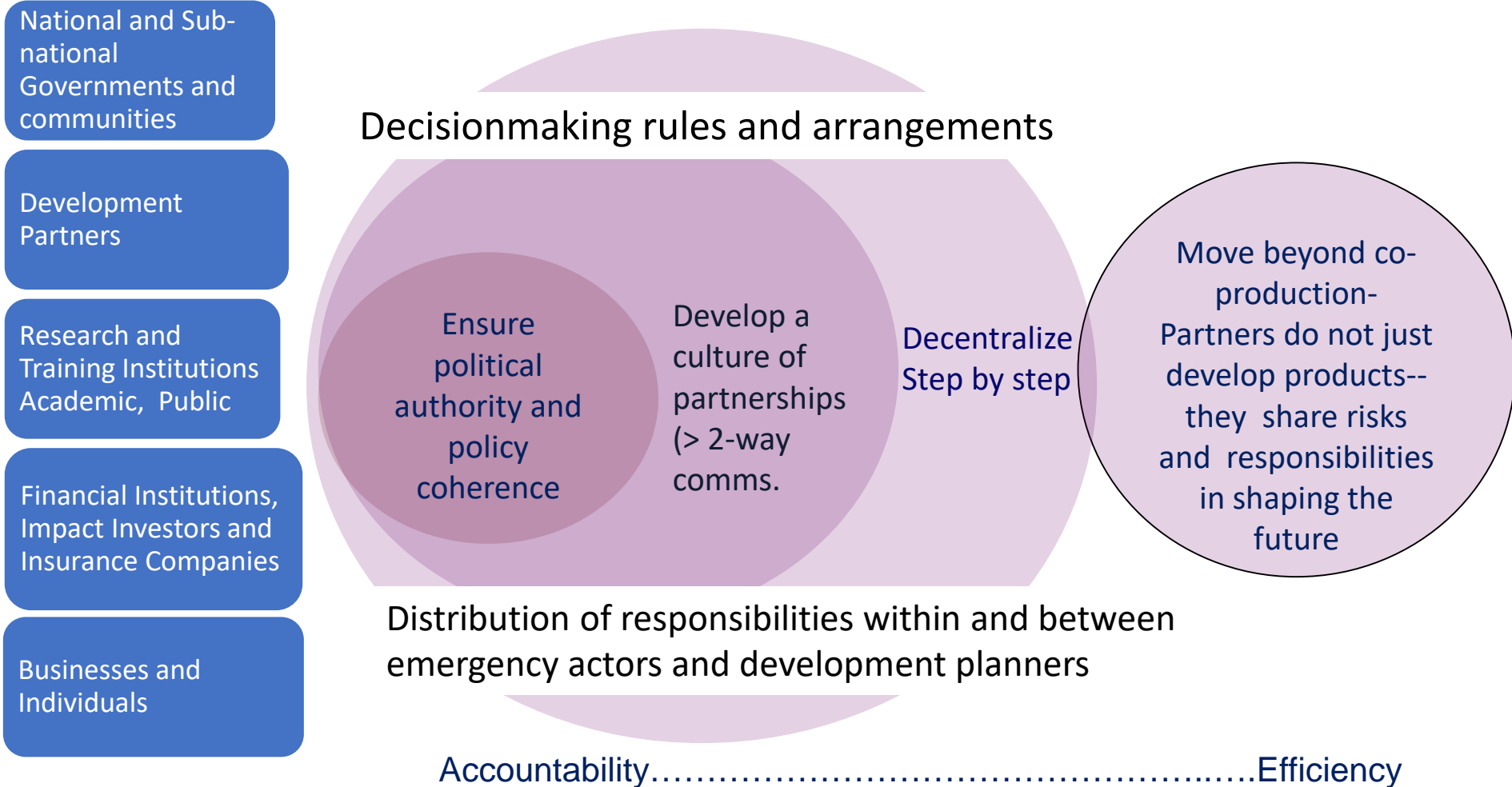
# Multi-Hazard Early Warning System

Warnings that Utilizes and Incorporates Impact & Risk information to Identify and Inform Specific At-Risk Groups



# Governance of risk knowledge and information

## Navigating through a changing climate



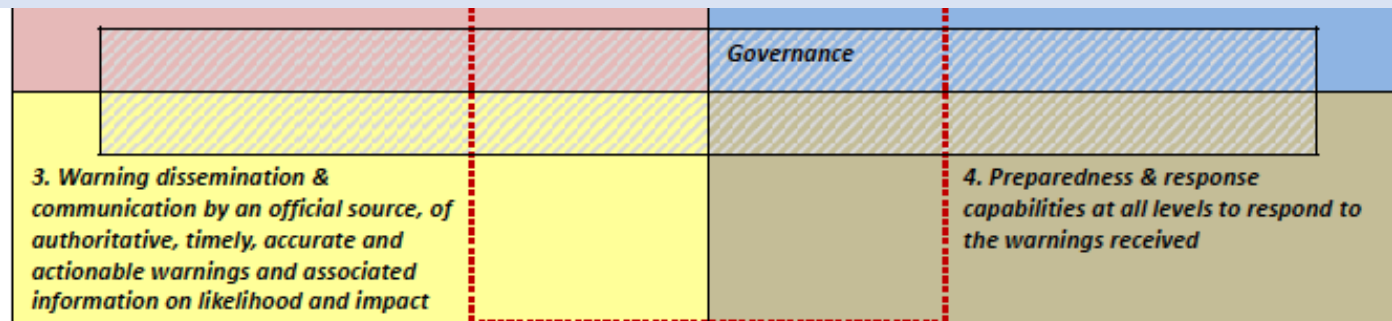


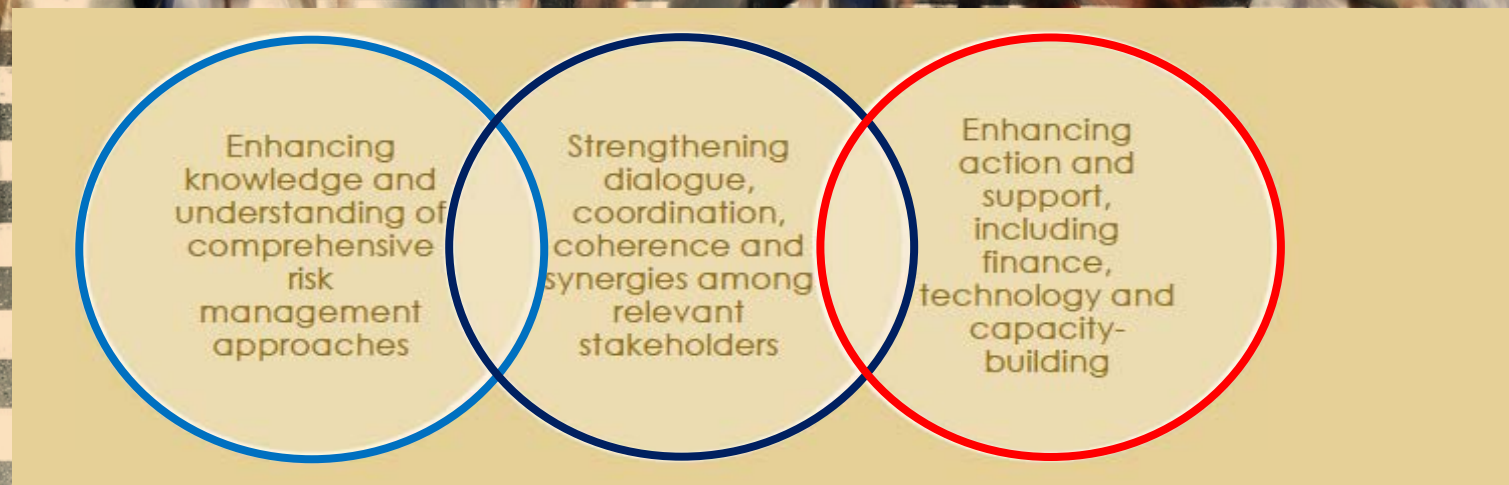
# What is a multi-hazard EWS (MHEWS)?

- “**Multi-hazard early warning systems** cover a range of hazards and impacts. They are designed to be used in multi-hazard contexts **where hazardous events may be simultaneous, cascade or be cumulative over time, and taking into account the potential interrelated effects.**
- A multi-hazard early warning system **increases the efficiency and consistency of warnings** through coordinated and compatible mechanisms and capacities, involving multiple disciplines for updated and accurate hazards identification and monitoring for multiple hazards.” (OIEWG 2016)

Four interrelated components **coordinated within and across sectors and multiple levels, including feedback mechanisms for continuous improvement.**

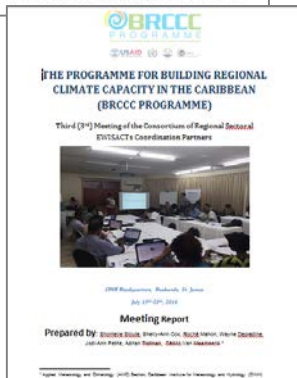
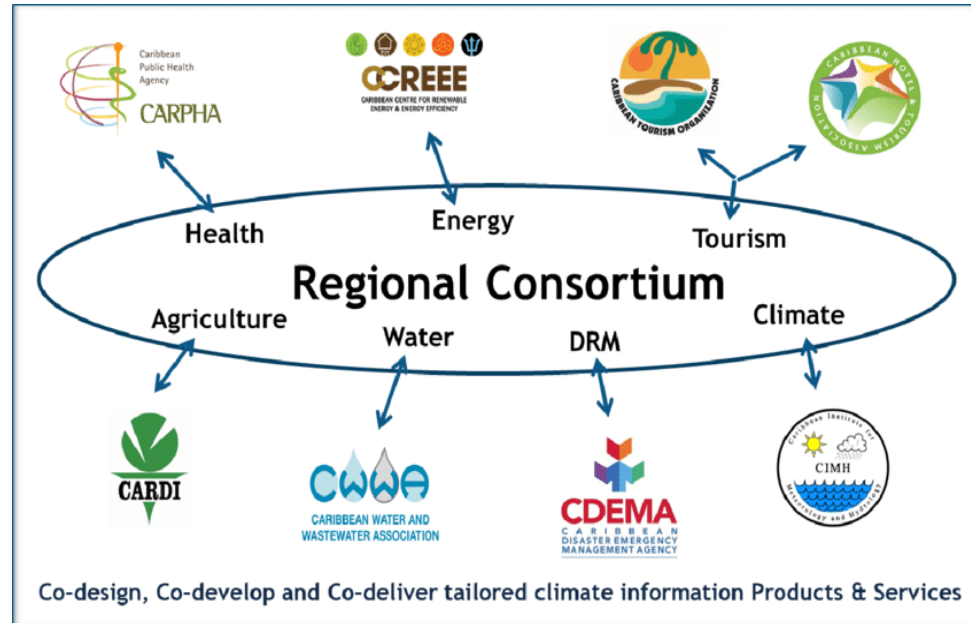
Failure in one component or lack of coordination across them could lead to the failure of the whole system.





Cascading and compounding risks, local imbalances, and global and regional network disruptions are overwhelming traditional climate risk management approaches

# Caribbean Early Warning Information Systems Across Climate Timescales



CTO and CHTA sign the LoA, September 16th, 2016



CWWA signs the LoA, October 26th, 2016



CARDI and CDEMA sign the LoA, December 6th, 2016



CARPHA and CIMH sign the LoA, April 26th, 2017

## Co-development of sector-specific climate indices

- Facilitates broader dialogue and sustained engagement with regional and national stakeholders;
- Facilitates the identification and sharing of textual and georeferenced sectoral datasets;
- Facilitates the identification and sharing climate-related impact data;
- Supports research that examines associations between climate and relevant sectoral productivity outcomes; and
- Promotes the dissemination of climate information.