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

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(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.
“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

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?

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

Effective decision support

Efficient monitoring

Comparable classification

Scenario building

Integrated Food Security Phase Classification

<table>
<thead>
<tr>
<th>Phase</th>
<th>Description</th>
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<tbody>
<tr>
<td>Phase 1: Minimal</td>
<td>Households are able to meet essential food and non-food needs without engaging in atypical and unsustainable strategies to access food and income.</td>
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<tr>
<td>Phase 2: Stressed</td>
<td>Households have minimally adequate food consumption but are unable to afford some essential non-food expenditures without engaging in stress-coping strategies.</td>
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<td>Phase 3: Crisis</td>
<td>Households either: Have food consumption gaps which are reflected by high or above-normal acute malnutrition; OR are marginally able to meet minimum food needs but only by depleting essential livelihood assets or through crisis-coping strategies.</td>
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<tr>
<td>Phase 4: Emergency</td>
<td>Households either: Have large food consumption gaps which are reflected in very high acute malnutrition and excess mortality; OR are able to mitigate large food consumption gaps but only by employing emergency livelihood strategies and asset liquidation.</td>
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<td>Phase 5: Famine</td>
<td>Households have an extreme lack of food and/or other basic needs even after full employment of coping strategies. Stavation, 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).</td>
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Climate modes

- El Niño
- La Niña

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

Field Assessments

Market/Price monitoring

Seasonal Forecasts

Nutrition

Conflict

Remote sensing

USAID Program Management Team

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 5th 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

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

November 2022
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.

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

Cumulative volcanic ash cloud from the La Soufriere eruption based on a ash recycling strategy implemented in WRF-CHEM.
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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Backups
Multi-Hazard Early Warning System
Warnings that Utilizes and Incorporates Impact & Risk information to Identify and Inform Specific At-Risk Groups

Institutional partnerships are essential among technical agencies and other MHEWS Stakeholders for the development of hazard, exposure and vulnerability information and risk analysis.

From hazard detection to development of warnings

- Hazard(s) information
  - Observation
  - Monitoring
  - Analysis
  - Forecasting
  - Mapping

- Multi-Risk Analysis
  Assessment and quantification of:
  - Exposure & vulnerability of the population and sectors to hazards
  - Multi-hazard interactions

- Warnings
  Including:
  - Probability of affecting public and sectors
  - Possible impacts
  - Message targeted at different sectors

Sectors (examples)
- Government - Local to National (All relevant hazards)
- Transportation (road ice, street flooding, travel delays, etc)
- Agriculture Productivity and Food Security (frost, hail, flooding, etc)
- Energy Supply & Demand Protection (heat and cold waves, severe storms, etc.)
- Health Epidemics (excessive rainfall, cold spells, heatwaves, etc)
- Water Resource Management (excessive rainfall, drought, etc)

General Public

Communication

Warning
Communicate
Prepare and Respond

Feedback for system improvement
Governance of risk knowledge and information
Navigating through a changing climate

Decisionmaking rules and arrangements

Ensure political authority and policy coherence
Develop a culture of partnerships (> 2-way comms.)
Decentralize Step by step

Move beyond co-production- Partners do not just develop products--they share risks and responsibilities in shaping the future

Distribution of responsibilities within and between emergency actors and development planners

Accountability.................................................................Efficiency
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.
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.

Caribbean Early Warning Information Systems Across Climate Timescales