RPV Mission

To contribute to transforming the way societies manage risks to economic, ecological, and social systems while confronting the global trends that are amplifying these risks.
5 thematic areas and key methods

Risk analysis and modeling
Risk analysis, extrem value statistics, copula

Understanding disaster resilience
Concepts, surveys, empirical investigation, shared learning tools

Socioeconomics of risk management and climate adaptation
Economics of risk and uncertainty

Risk pooling and sharing: disaster safety nets
Policy analysis, empirical investigation

Governance in transition
Participatory methods, stakeholder exercises
1. Refocusing disaster management

How to inform stronger investment in pre-disaster management?

- Leverage tight budgets
- More secure safety net
- Link to risk reduction

Linnerooth-Bayer et al 2005
IIASA has been a leader in the development of probabilistic models of risk management.

The IIASA CATSIM model assesses the economic and developmental risks of extreme events and supports risk management strategies.

Bridges gaps between outcome driven risk modelling and policy-oriented methodologies respecting plural values.

For Mexico, CATSIM provided a clear picture of the different layers of risks posed by earthquakes to the public finances and helped identify which risks could be transferred to the international market at an acceptable cost.

Victor Cardenas, Ministry of Finance, Mexico
CATSIM - Methodology

1. Direct Risk
   - Produced capital
   - Human capital
   - Environmental capital

2. Financial Resilience
   - Ex-post sources
   - Ex-ante sources

3. Financial Vulnerability
   Inability to finance relief and reconstruction

Risk Management

Economic Risk
CATSIM: simulating and risk stress testing

**Loss Distribution**
- Probability of Default
- Lower Confidence Interval
- Upper Confidence Interval
- Best Estimate

**Fiscal Resilience**
**Ex Post:**
- Diversion from budget
- Foreign reserves
- Domestic bonds and credit
- Multilateral borrowing
- International borrowing
- Aid

**Ex Ante:**
- Reserve funds
- Sovereign insurance
- Catastrophe bonds

**Fiscal vulnerability**

![Graph showing billion US$ across year-events](image)
Protecting the fiscal position
Mexico

Recursos Presupuestados y Ejercidos del Fonden

Source: Cardenas, 2007
Simulated Future Earthquakes (100,000-year catalog)

Source: AIR, 2006
Exposure

Fonden Exposures Summary
Total Residential Replacement Value

Total Replacement Cost of the Residential Building Inventory
$850 Billion

Source: AIR, 2006
9 zones modeled with potential losses

Source: AIR, 2006
Risks transferred

Catastrophe bond

- Successfully placed in the market in 2006
- Index based: linked to physical trigger
- Total of 160 million USD protection

Event Level Emergency Loss ($M) - by Zone

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</table>
CATSIM has been interactively used by officials in over 20 countries

- Caribbean Catastrophe Insurance Facility (CCrif)
- Disaster risk management pool for the Indian Ocean Council Islands
Sovereign disaster risk financing around the world

Mexico: FONDEN fund, Catastrophe bond

Caribbean Catastrophe Risk Insurance Facility

Indonesia: Exploring Sovereign EQ risk transfer

Philippines: DRFI Strategy, Climate and Disaster Resilience Fund, Sovereign risk transfer

Colombia: DRFI Strategy, Insurance of public assets and concessions

African Union, African Risk Capacity

Ethiopia: Scalable social safety net

Kenya: Agricultural Insurance

Indian Ocean Islands: Exploring regional risk pooling initiative

Pacific Catastrophe Risk Assessment and Financing Initiative

Uruguay: Insurance for the impact of drought / oil prices on hydropower

Malawi: Drought risk management

Seychelles: Contingent Credit (CatDDO)
This discussion traced the development of fiscal disaster risk management around four steps. These steps and activities may lead to three dividends as framed in the project overall as follows:

(i) Understanding fiscal risk;
(ii) Protecting public finance through risk financing instruments (1st dividend);
(iii) Working towards comprehensively managing disaster risk including risk reduction and risk preparedness as they affect development (2nd dividend);
(iv) Pursuing a synergistic strategy of managing disaster risks and promoting development (3rd dividend).

As we have shown, all steps and foci are seeing some activity: steps (i) and (ii) have been implemented in a number of countries, and increasingly (iii) is being tackled, while (iv) will need more attention in the future to truly create measurable benefits and build resilience throughout. There is increasing recognition that a broad-based perspective is necessary to incentivize risk reduction, avoid risk creation and generate additional benefits that go beyond the direct and indirect gains from reducing risk.

Benefits can be achieved by better integration of disaster risk management with fiscal risk management, public debt management and development policy and planning as suggested in figure 14.

![Diagram](image-url)
2. Managing climate extremes

Key messages

• A changing climate leads to changes in extreme weather and climate events
• There is evidence that anthropogenic climate change have changed these extremes
• Hazard attribution possible, risk attribution difficult
Climate negotiations and climate extremes

RPV played a key role in a climate risk pooling proposal that became part of the UNFCCC COP16 negotiating text.

IIASA developed the concept of a financial mechanism with 3 layers:

Layer 1 "reinsures" extreme weather losses of the most vulnerable countries;

Layer 2 supports novel insurance instruments, like index-based weather insurance and sovereign catastrophe bonds;

Layer 3 supports risk prevention for frequent and low impact climate events.
Dealing with risks “beyond adaptation”

• 2013 Establishment of the “Warsaw international mechanism for loss and damage:” to deal with and provide support for climate-related damages after adaptation

• Contested terrain
  • ‘Southern countries’ at risk (such as AOSIS countries) demand climate justice
  • OECD negotiators willing to support good risk management, but liability and compensation considered red lines
Positioning Loss & Damage in the climate justice debate

- **Justice principle**: Distributional justice, Compensatory justice
- **Ethical approach**: Non-Consequentialism, Consequentialism
- **Political principles**: Capacity & needs, Liability & rights
- **Policy & Implementation**: Needs & rights-based Climate Risk Management
- **Time horizon**: Short to medium term, Medium to long term
The disaster burden is real and in reducing specific risk have been significantly strengthened. Progress has been limited in most countries, however, in the challenge facing middle income countries like the Philippines.

Progress across the HFA Average level of • Is disaster risk going to increase in the future? • How much are disasters costing us? • How much progress has there been in implementing the HFA?

Multi-Hazard Average Annual Loss (AAL) [million US$]
Earthquake, flood, cyclone wind, storm surge and tsunami

Global multi-hazard average annual loss is US$314 billion.

Disasters continue to cause significant damage, both in terms of risk reduction of US$360 million.

Extensive mortality, 1990-2013

Average annual losses from cyclone wind damage alone.

Extensive mortality, 1990-2013

- In most cases, climate change will increase the risk of disasters;
- Mortality from smaller-scale events continues to be significant;
- However, mortality from smaller-scale events continues to be significant;
- It is therefore di fficult to perceive trends over relatively short periods of time.

Managing risks, rather than managing disasters; accumulation of new risks; strategies would support resilience in the face of residual risk.

Reforming developing institutions, policies and legislation for disaster risk management and the underlying drivers of risk.

Managing disaster risk for sustainable development with: Is it possible?

- Many countries would not pass a stress test of their fiscal health, as constant disaster losses erode development efforts.
- New public infrastructure and services are constantly eroding essential development assets.
- Disaster risk can be reduced and it is possible to prevent increases in gap years?

In 2005, the world’s annual losses from natural disasters were estimated at US$928 million.

In 2010, the world’s annual losses from natural disasters were estimated at US$3,300 million.

Considering the expected average annual losses in 2013, it is clear that the world is a very different place.

Annual global investment of US$6 billion in new and additional average annual reserves.

Progress will be measured in terms of risk reduction of US$360 million.

Extensive mortality, 1990-2013

Global disaster risk today

Average level of

Prospective

Average level of

Prospective

The global disaster burden is real. Progress has been limited in most countries, however, in the challenge facing middle income countries like the Philippines.
Portfolios: Layering risk management

Loss and Damage?

Government risk bearing and compensation

Risk prevention

Mechler et al., Nature Climate Change 2014
The disaster burden is real, major diseases. An average of 428 million human life years are lost in disasters each year, equivalent to the number of years lost to tuberculosis. This burden is shouldered by those with lower incomes: of all the life years lost, more than 50% is due to disaster-related mortality.

Further, capacities for risk assessment and identification, managing the underlying drivers of risk, strengthening governance, reforming financial systems, and mainstreaming disaster risk management to development are essential. Implications of disaster risk for development capacity include:

- Compensating all countries for loss and damage beyond their coping capacity
- ~ USD 10 billion annually
- Increasing over time
- Signal for mitigation challenge

IIASA for GAR, 2015
Hochrainer-Stigler et al., Global Environmental Change, 2014
Climate risk layering

Example Bangladesh

Layering risk management

Risk layers with climate change (B1 scenario and no additional risk reduction)

Based on Mechler and Bouwer, *Climatic Change* 2015
IIASA and Loss & Damage Network

• Focus on comprehensive climate risk management and attribution
• Leading international institutions committed, first writing meeting in Fall 2015
• Neutral analysis and various actionable perspectives
• Publications and blogs, book and network project
• Linking up to work and interest in Mexico?
3. CD Links: Linking Climate and Development Policies
A H 2020 project -IIASA led by Energy Program

Explore linkages between climate change and multiple sustainable development objectives – G20

<table>
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Country-specific adaptation portfolios for managing climate-related risk and resilience

- **Objectives**
  - Estimate possible impacts of climate change - focussing on current adaptation efforts and weather-related risks,
  - Assess how adaptation/risk management policies reduce and manage some of these impacts and risks,
  - Gaps, limits of adaptation and the associated costs.

- **Focus on extreme events and state-of-the-art of climate and development-related contributions in G20 countries under different emission scenarios.**
4. Community Flood Resilience Alliance
RPV, ESM and WAT programs
A cross-sector collaboration to catalyze change

- Knowledge for action
  - Research and modeling
  - Systems perspective
  - Science-society-practice interface

- Sponsor and private sector actor
  - Risk engineering
  - Financial resources
  - Influence and advocacy

- Technical Innovation Development sector
  - Small and agile
  - Innovation and ideas piloting
  - Solutions catalogue

- Global Reach-Humanitarian Sector
  - Community presence
  - Scale and reach
  - Influence and advocacy

- Case studies

- Methodologies & tools

- Innovation & Technical Advice

- International Federation of Red Cross and Red Crescent Societies
Community & research activities are looking at flood risks in different locations and settings.

- Rural community flood resilience programs in region of Tabasco, Mexico
- Urban & rural community flood resilience programs in Lima & Piura, Peru
- Post Event Review of the Central European Floods in June 2013
- Flash floods & Early Warning System Analysis in Koshi & Kamali river basins, Nepal
- Recurrent flooding & livelihoods program in Bangladesh
- Urban & Rural community flood resilience programs in West Java, Indonesia
Project activities

• **Conceptual review** and shared understanding of disaster resilience
• **Development of a measurement framework** for community flood resilience
• **System dynamics** model to support policy exercises
• **Crowdsourcing risk information** to enhance awareness and ability to act
• **Participatory research** on disaster risk reduction for policy implementation
Designing an inclusive adaptive management cycle and tools for bolstering flood resilience

**External-driven Analytical Process**
- Identify Actions
- Awareness
- Analyze & Assess
- Challenges
- Community-driven Learning Process
  - Lessons
  - Experience
- Implement
- Monitor & Evaluate

**Solutions Catalogue**

**Assessment Toolbox**
- FLORES
- Institutional & Context Mapping
- Stakeholder analysis
- (P)VCA
- Flood Risk Modeling
- Livelihood Risk Tool
- Integrated Assessment Tool (DPSIR logic)

**Decision Toolbox**
- CBA
- MCA
- RDMA
- Policy Exercises

**Measurement Toolbox**
- Flood Resilience Measurement Tool
- Geo-Wiki
Figure 1. Location map of the three sites that the Alliance visited July 14 and 15, 2015. Locations of communities provided by Red Cross Mexico and INEGI; other map data originates from INEGI (http://www.inegi.org.mx/default.aspx last accessed 14 August 2015).
Resilience Measurement Tool

Step 1. Establishing community selection criteria
Step 2. Defining aims, objectives, and approach jointly with communities
Step 3. Baseline flood risk and risk perception assessment
Step 4. Vulnerability and capacity assessment
Step 5. Assessment of community flood resilience
Step 6. Identification of potential resilience-enhancing activities
Step 7. Prioritization of flood resilience activities through risk-based CBA and other decision tools
Step 8. Implementation and training
Step 9. Monitoring and evaluation
Step 10. Learning and dissemination of results

Purposes of the community flood resilience measurement:
- Identify priority areas for improvement per indicator/per category
- Demonstrate community progress over time through interventions

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<th>Community B (pop. 141)</th>
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<td>Personal security</td>
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<td>Access to expertise</td>
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<td></td>
<td>External relationships</td>
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<td>Local government</td>
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<td>Livelihood stability</td>
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For more see: the Resilience White Paper and Issue Brief.
IIASA Risk Geo-Wiki
Providing actionable information via citizen science
Flood Hazard Mapping

Fig 9: Zooming in to visualize different flood hazard indicators

Fig 10: Areas above river level.
- Blue: River network according to Hydroshed SRTM 3" elevation data
- Red to green: elevation above the next river level (e.g. 0 m = same level as the next river = high danger of flooding)
### Crowdsourcing
Validating information with citizen science

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<th>Increasing Citizen Involvement</th>
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Source: McCallum et al., *in preparation*
Capacity building

Sergio Saldaña Zorrilla

- 2002: Colosio Scholar
- Guest and research scholar until 2007
- Co-supervised PhD at University of Economics and Business, Vienna
Risk, Policy and Vulnerability

The Risk, Policy and Vulnerability Program aims to better understand the risks to economic, ecological, and social systems arising from global change and to help transform the ways in which societies manage them.

Society needs to make effective responses to the risks associated with global change. To that end, scientists must understand the systemic and dynamic linkages of environmental, social, and economic risks and how these are impacted by different policy measures. This will enable risk management and governance systems to be improved in order to facilitate long-term sustainable development.

Systems analysis, risk modeling, and transformative governance are fundamental to the mission of Risk, Policy and Vulnerability (RPV). The Program examines environmental and socioeconomic risks and policy options across multiple spatial and temporal scales to provide an analytical foundation for improved management and governance of natural disasters, address climate change, and ease the technological and ecological transitions to sustainability.

The Program has four specific goals:

- To advance the conceptual and methodological development of risk and vulnerability research
- To carry out selected risk and vulnerability assessments
- To carry out interactive stakeholder-led research and
- To advance collaborative research and dissemination of knowledge through international partnerships