

**4th International Symposium on Flood Defence:**

Managing Flood Risk, Reliability and Vulnerability

Toronto, Ontario, Canada, May 6-8, 2008



# Assessing the Value of Mitigation Strategies in Reducing the Impacts of Rapid-Onset, Catastrophic Floods\*

W.M. Johnstone, P.Eng, PhD Student, UBC Civil Engineering  
B.J. Lence, Ph.D., Professor, UBC Civil Engineering

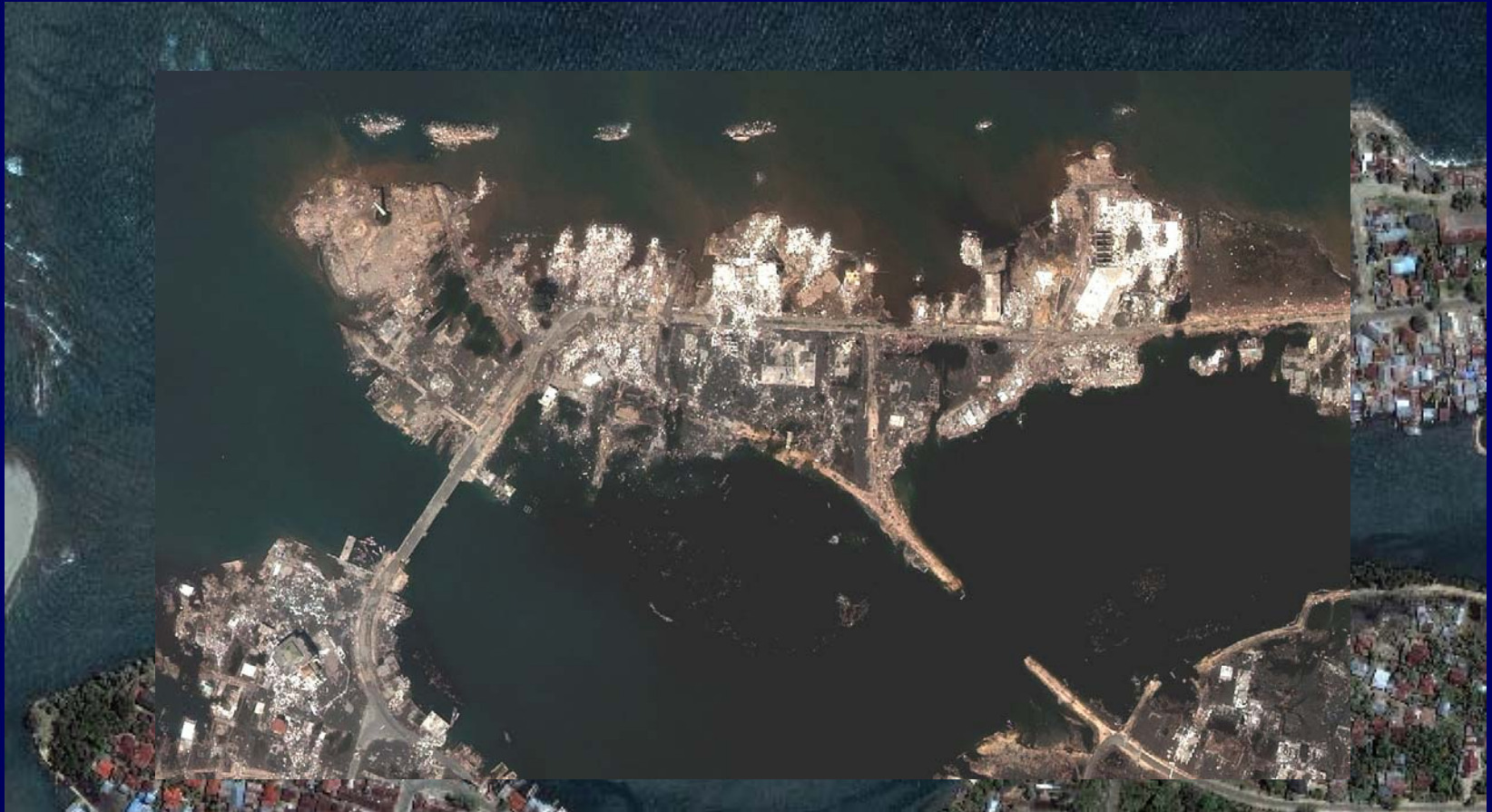


*\* - In terms of Loss of Life*

# Consequences of Rapid-Onset, Catastrophic Floods

## Indian Ocean Tsunami - Dec 2004 (Banda Aceh - Before & After)

---



# Flood Hazard Mitigation

## Shelter-in-place/Tsunami Evacuation Platforms



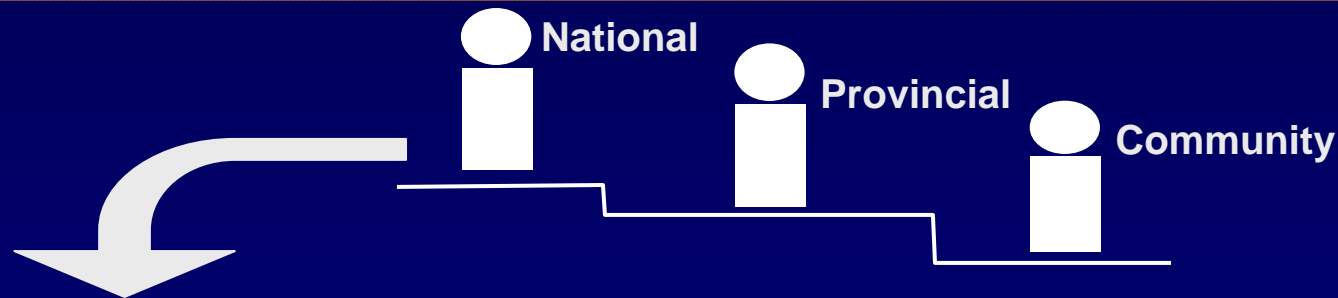
***“Stay”***

## Traffic Management / Evacuation Routes

***“Go”***



# Components of Emergency Planning & Preparedness Questions



Question Subelements			
1 Themes	2 People / Objects	3 Dimensions	4 Outcomes
Hazard Vulnerability Risk	Earthquake Onshore wave	Location Elevation Time	No effect
Mitigation Preparedness Response Recovery	Person Building Vehicle	Flow depth Flow velocity	Injury Damage
	Debris Road, Bridge Safe Haven	Distance Time span Magnitude Intensity Probability	Loss
	Telephone Power		Reach safe haven

***“Where is the hazard most severe?”***

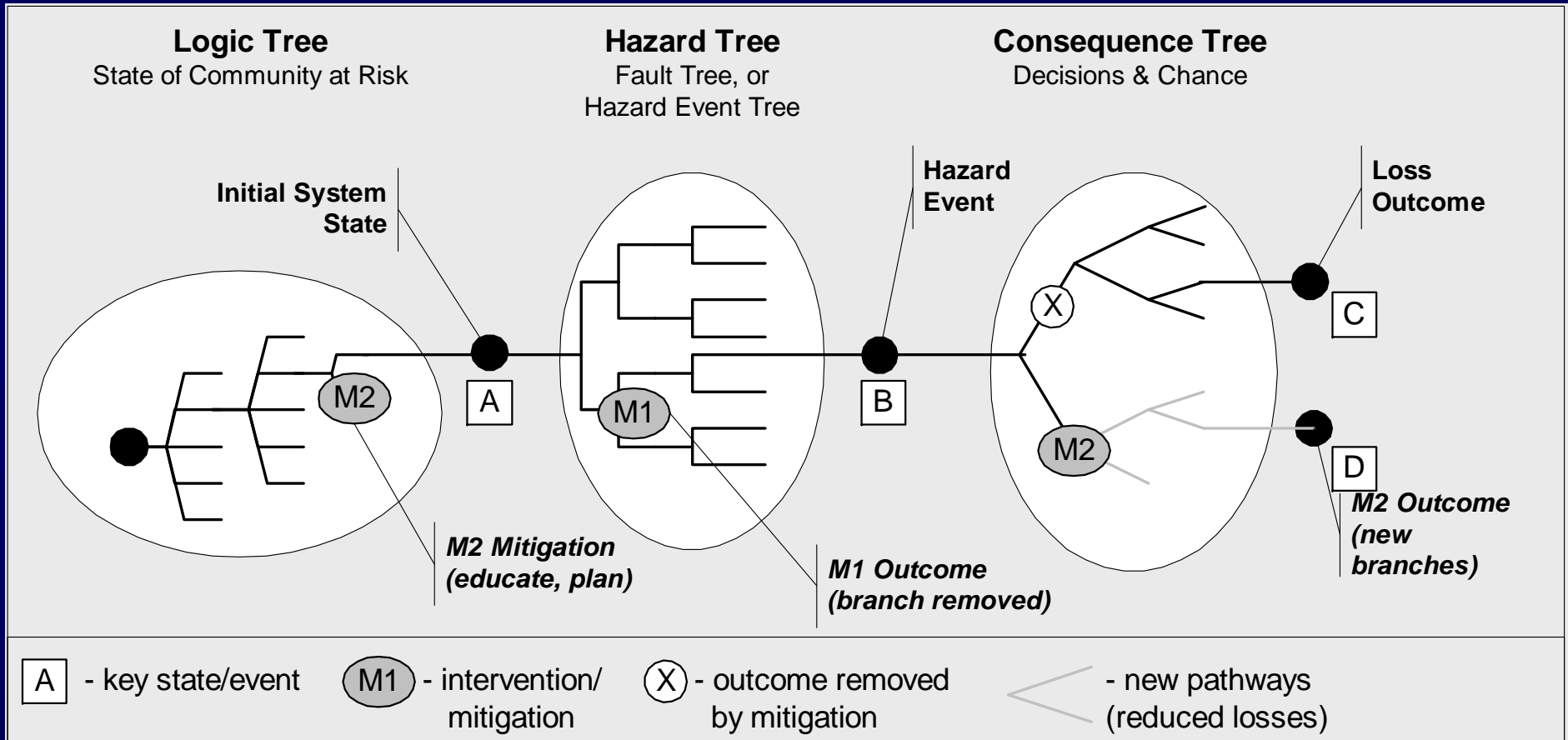
***“How many people could be killed?”***

***“Is evacuation feasible?”***

***“Where are the candidate safe havens?”***

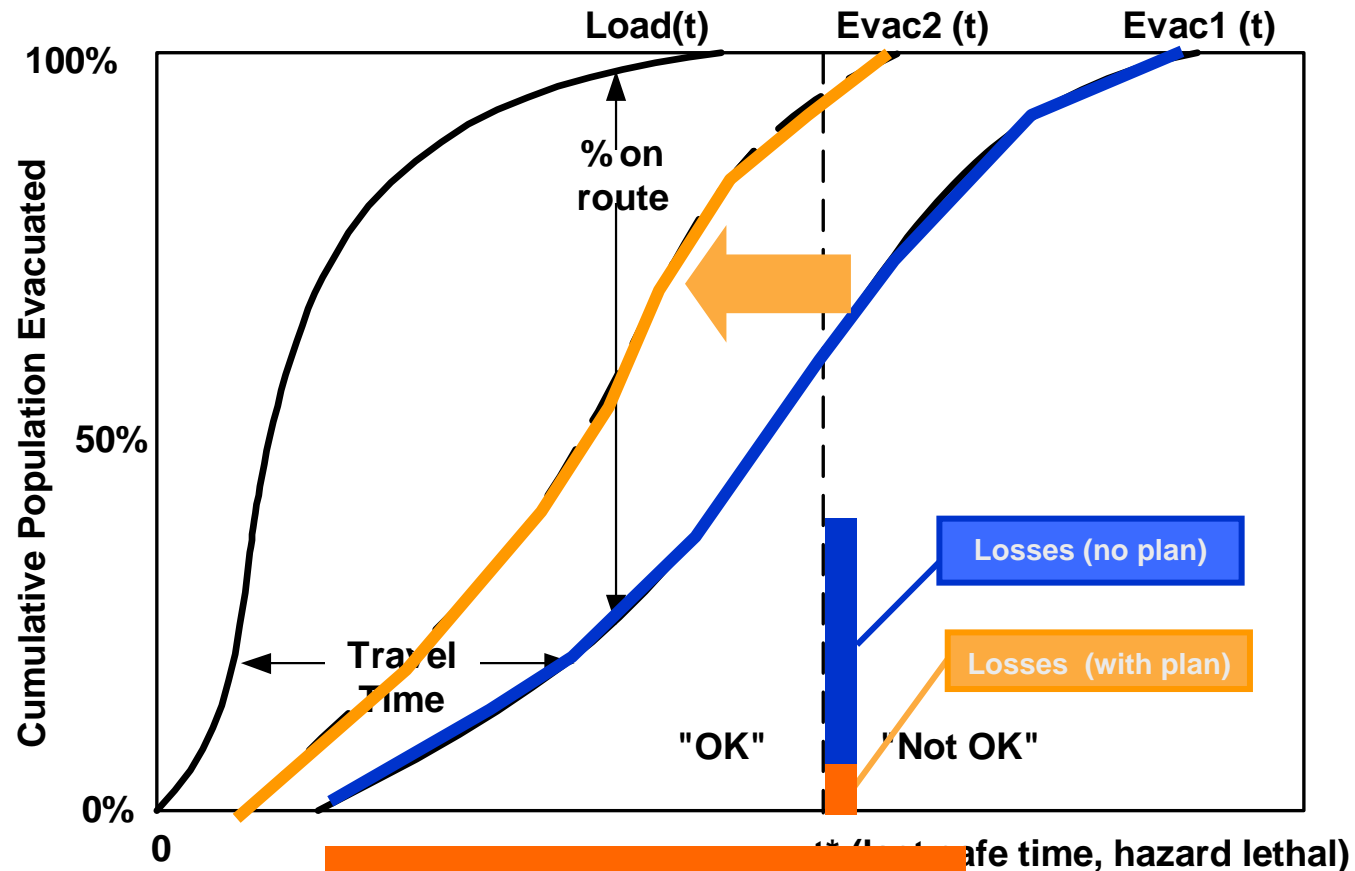
...

# Assessing Mitigation Strategies: Conceptual Framework (after Hartford & Baecher 2002)



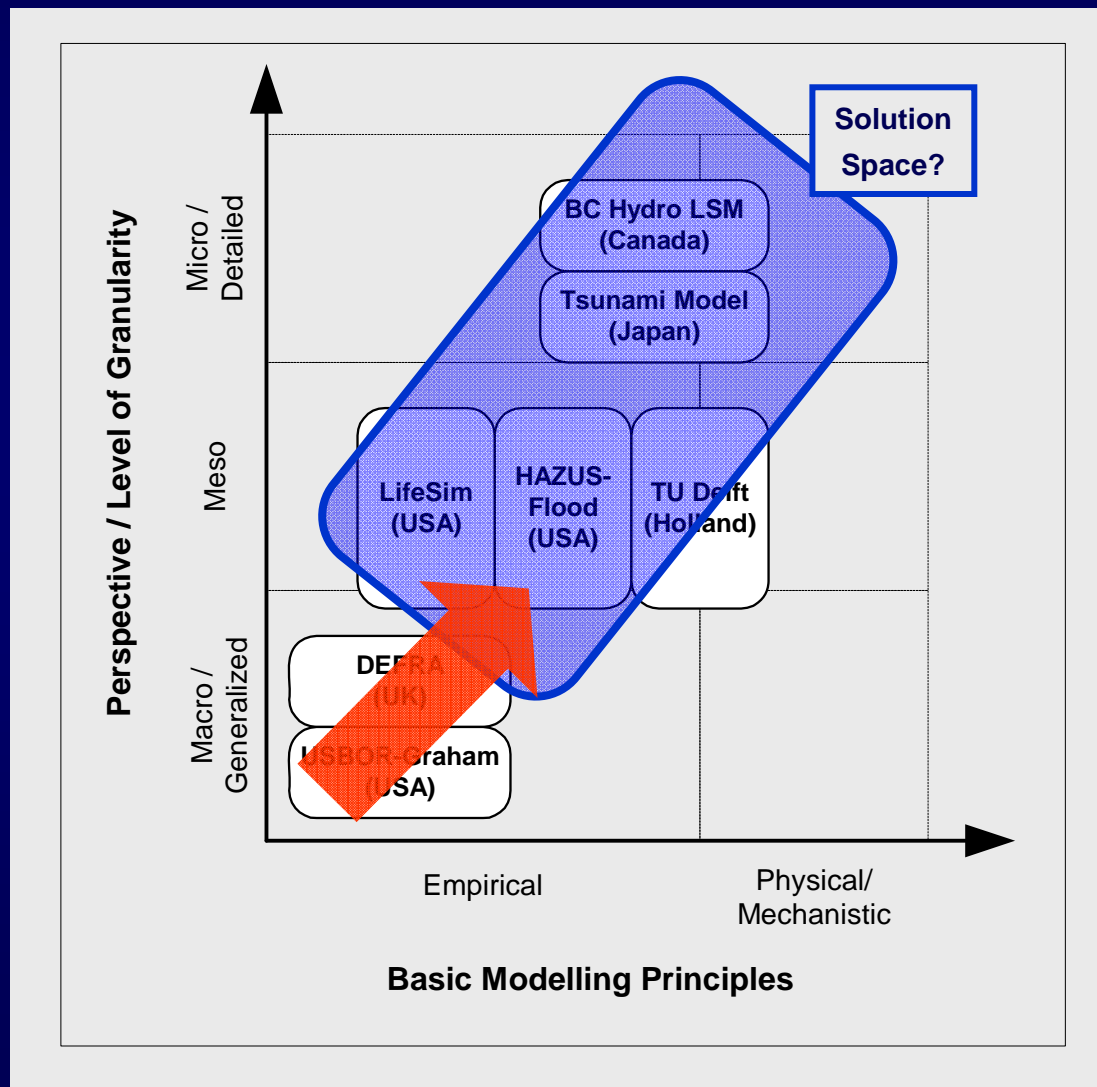
# Evacuation Timing Concepts

(after Han, Yuan, Urbanik - 2007)



... as a function of  
time and space

# Assessment of Current Flood Loss and Evacuation Models (Johnstone & Sakamoto, 2005)





# Community at Risk

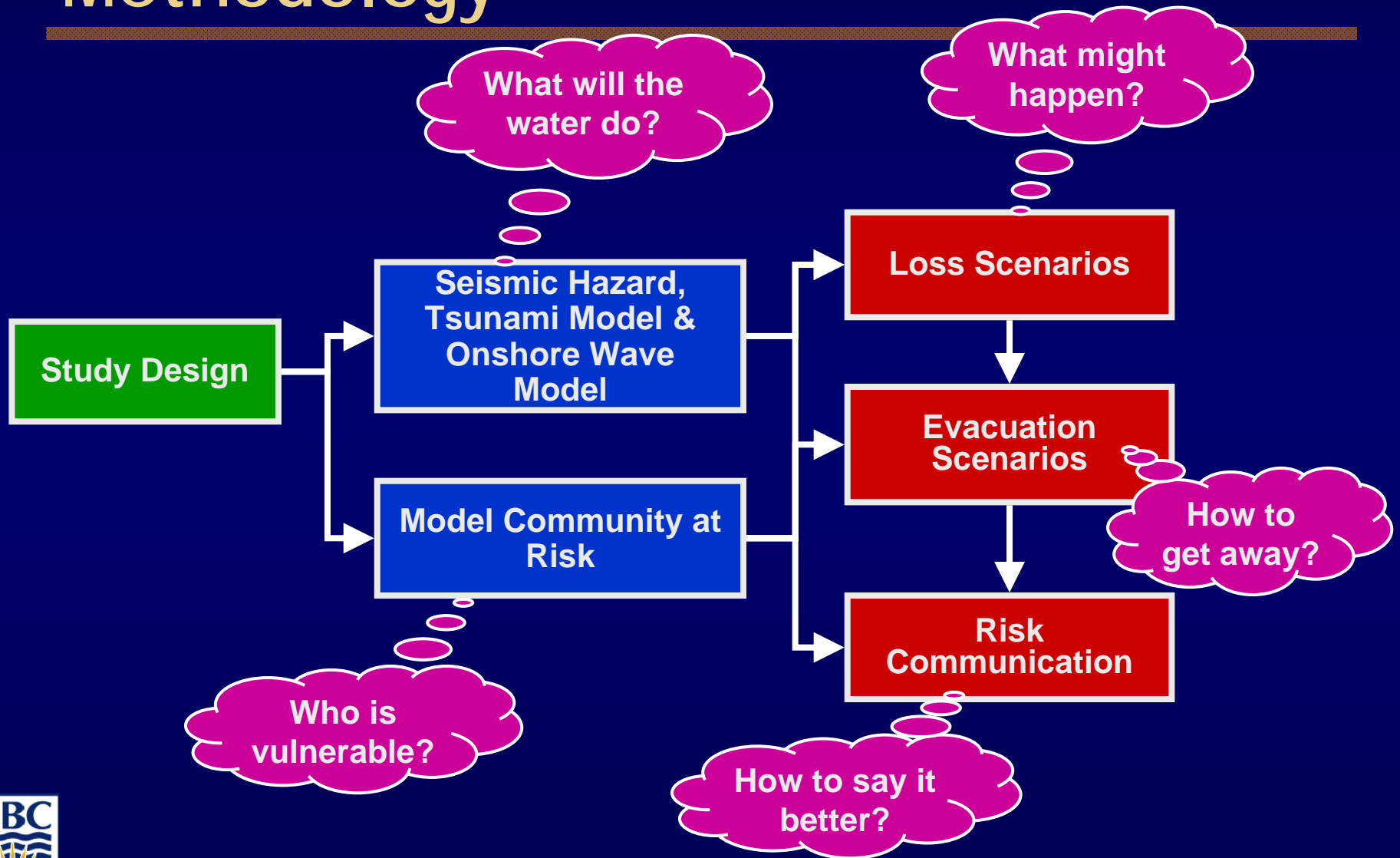


*Ucluelet means “safe harbour”  
in the local  
Nuu-Chah-Nulth (Nootka) language*





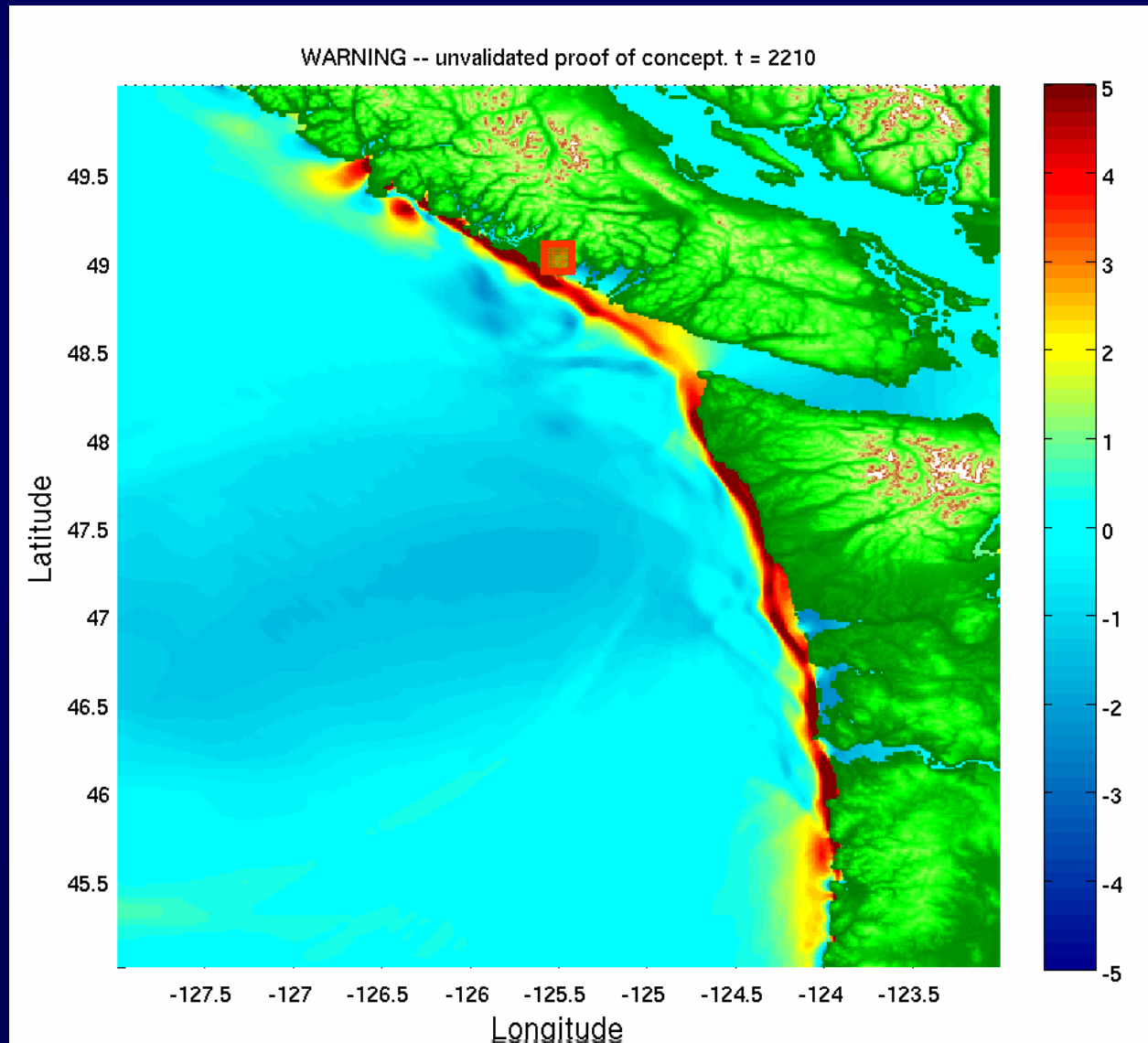
# Methodology



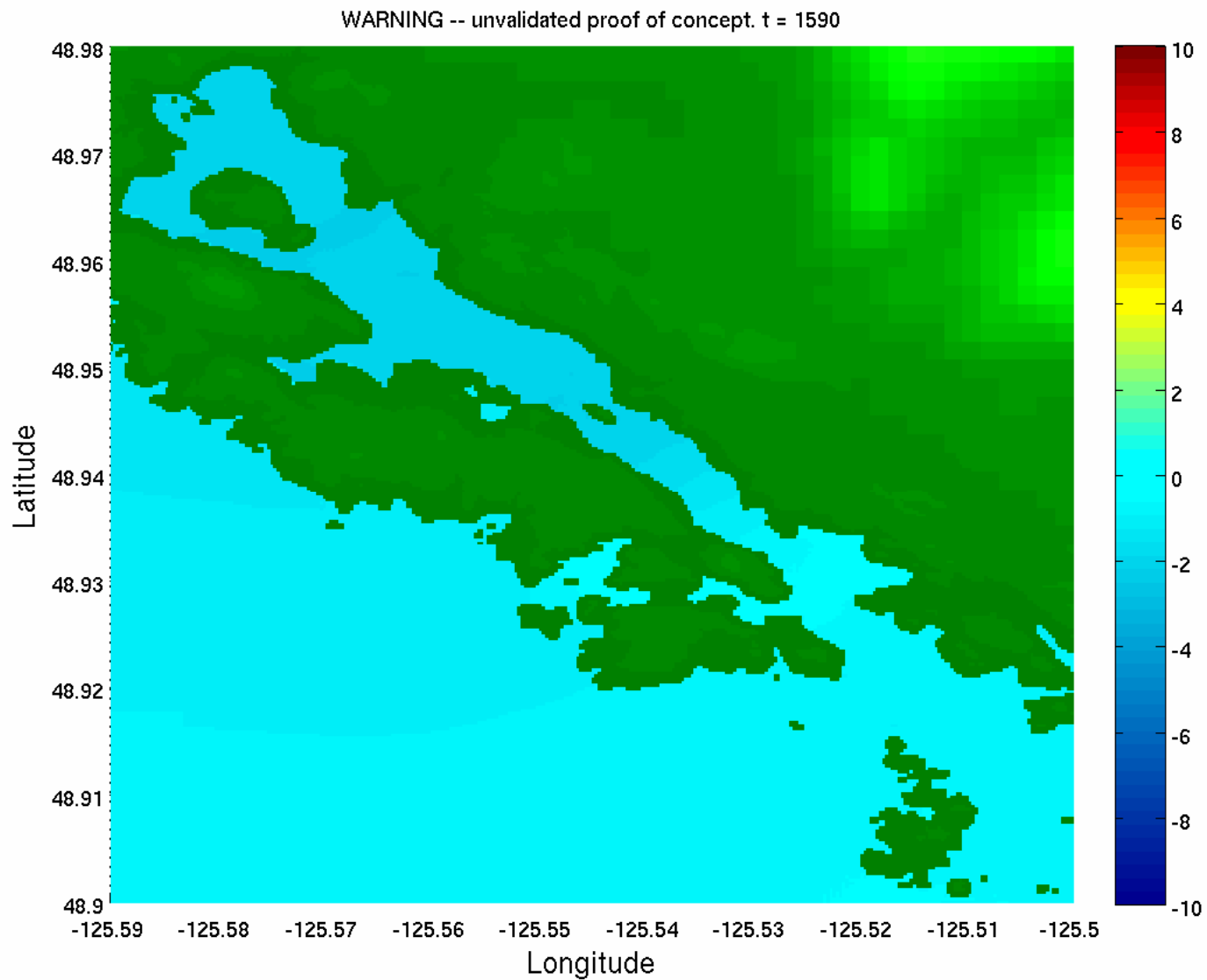
# Building Stock



# Hazard Characterization

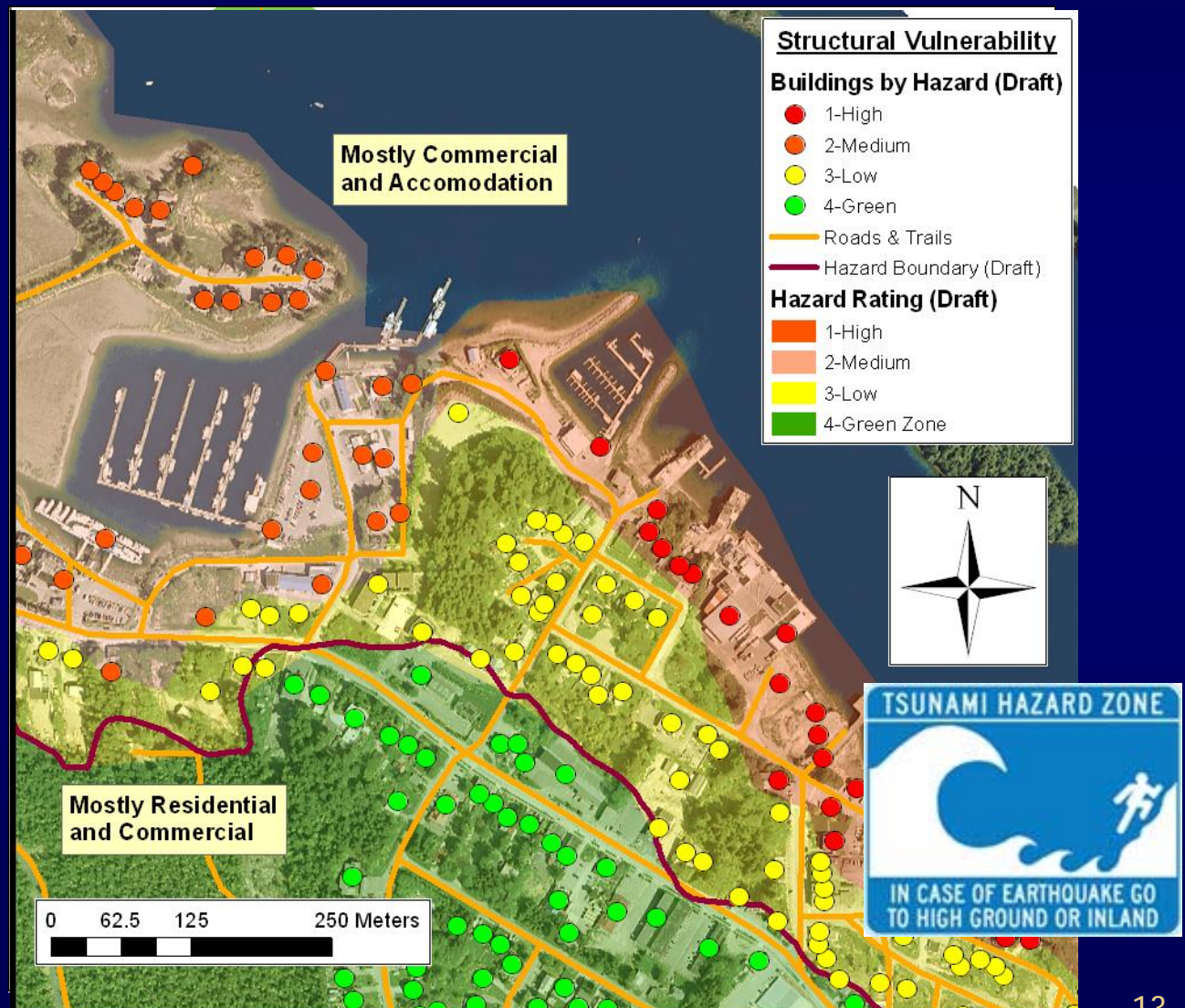
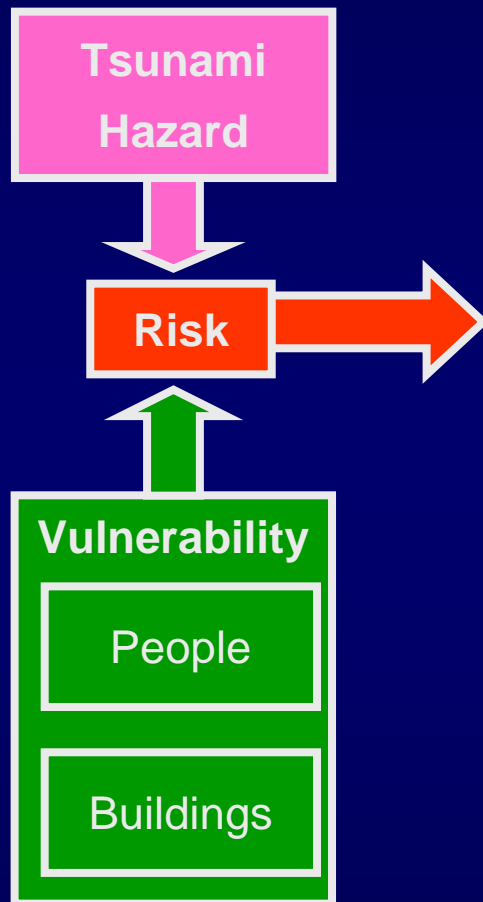


# Hazard Characterization



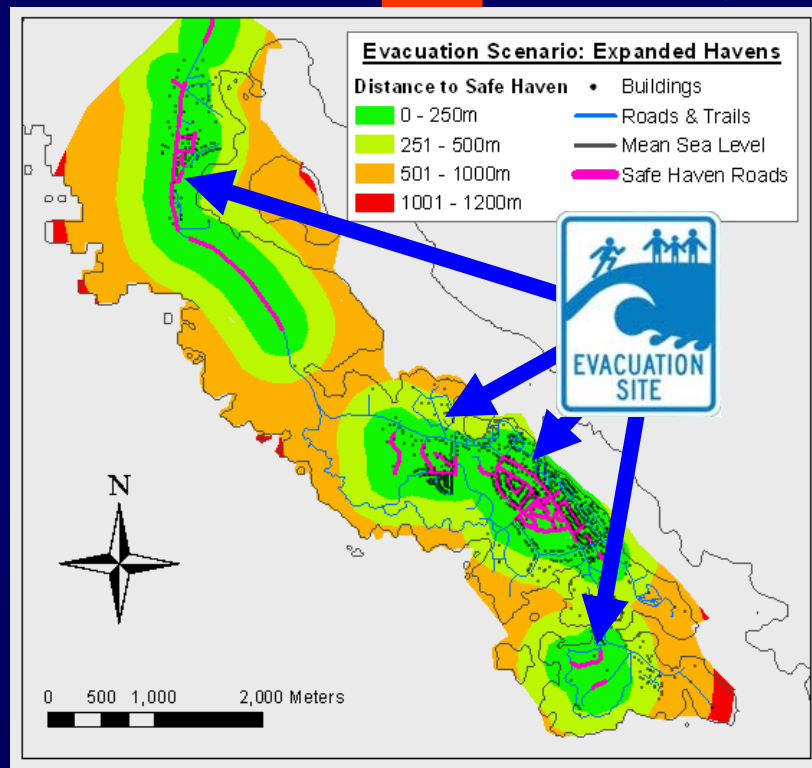


# Vulnerability x Hazard: Potential Consequences

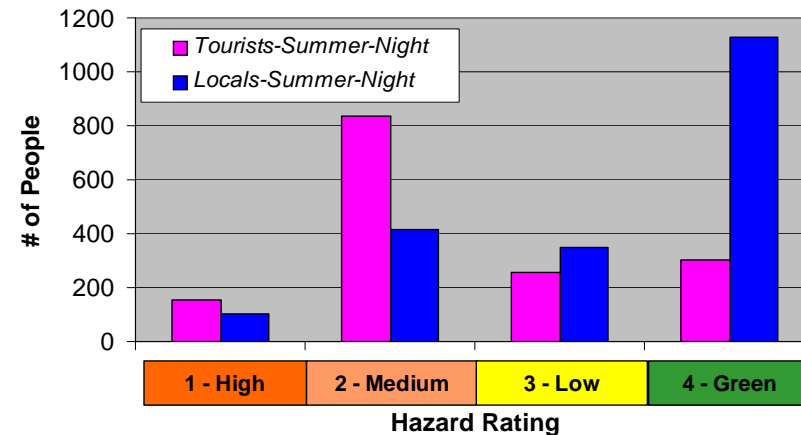


# Vulnerability Analysis: Key Exposures / Evacuation Planning

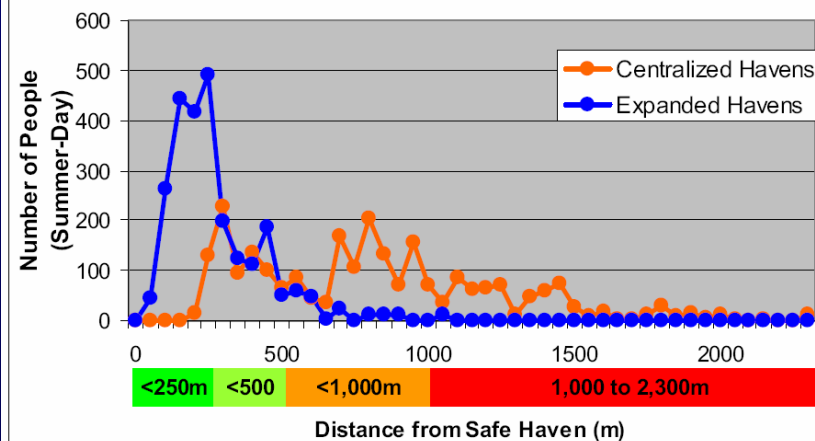
(Johnstone 2007)



**Tourists and Locals by Hazard Rating**



**Number of People by Distance from Safe Haven**





# Contributions / Future Research

- Contributions

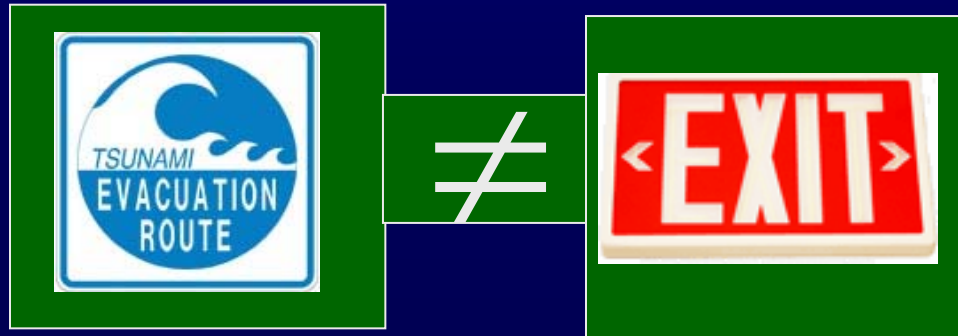
- Movement towards more credible estimates
- Assessment of and improvements to Emergency Response Plans

- Future Work:

- Incorporate interventions into the risk framework
- Measures of effectiveness
- Develop a two-tiered approach
- Naghibi and Lence - Investigating habitat impacts due to rapid-onset flows

- Key Points:

- Importance of spatial & time concepts / level of detail
- Community engagement
- Validity/Credibility



# Acknowledgements

