Dam Risk Assessment under Climate Change in New England

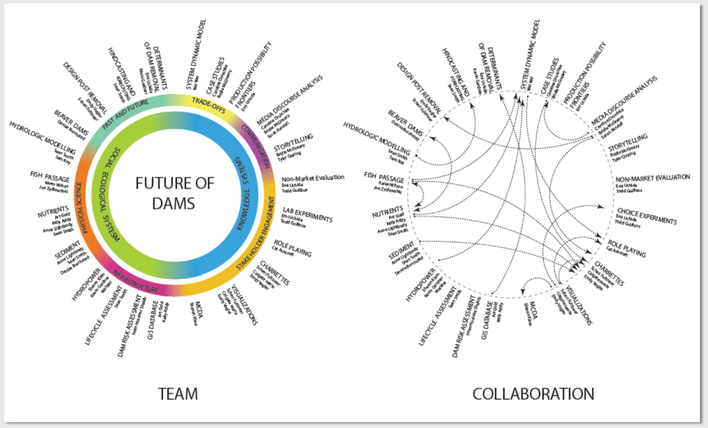
Support for the Future of Dams Project is provided by the National Science Foundation's Research Infrastructure Improvement Award NSF # IIA 1539071.

Iman Hosseini-Shakib| Kevin Gardner | University of New Hampshire Civil & Environmental Engineering Department

The Future of Dams Project

- Supported in part by a $6 million, 4-year NSF EPSCoR grant
- A stakeholder-engaged, solutions-focused, interdisciplinary NEST research initiative
- Collaborators in NH, RI, and ME
- Empowering stakeholders to make complex decisions about dams by combining the best available science with diverse forms of community engagement

Team Expertise & Collaborations



The Future of Dams team considers two primary systems: Social-Ecological Systems and Knowledge Systems. Each of these includes a number of disciplinary domains and a variety of research approaches and methodologies. (Prepared by Emily Vogler)

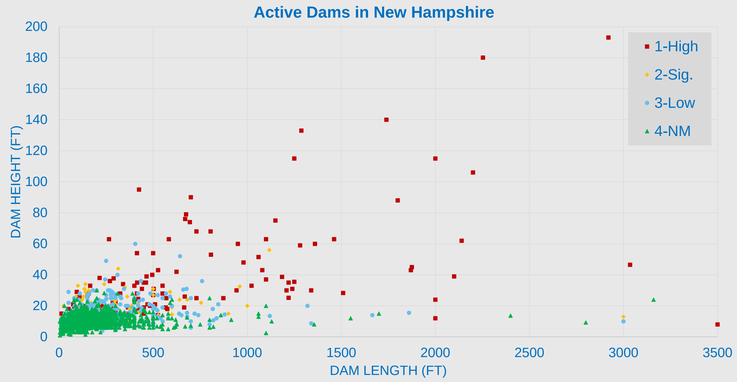
Dam Risk

What is dam risk?

- **Product of *probability* of failure and *consequences* of failure**

Hazard Class	Failure Consequences
Non-Menace	No anticipated loss of property or life
Low	Property loss
Significant	Significant loss of property and possible impacts to occupied structures and roads
High	Loss of life

Dam Risk & Dam Size



Dam Spillway Capacity as Risk Index

- Maximum flood flow a spillway can pass
- Floods exceeding spillway capacity can cause damage to dam
- Most dam failures are caused by flows higher that spillway capacity
- Spillway capacity can be used as a risk index
- Spillway regulations are not identical everywhere

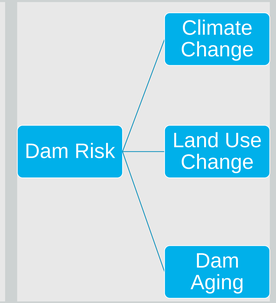
Dam Spillway Capacity Regulations

Hazard Class	Inflow Design Flood*		
	NHDES		FERC
	Existing Dams	New Constructions	
Non-Menace	-	50-yr Flood	-
Low	50-yr Flood	100-yr Flood	100-yr Flood
Significant	100-yr Flood	50% PMF	-
High	2.5x100-yr Flood	PMF	PMF

* NHDES existing dams' regulations are based on Env-Wr 303.11
NHDES new dams' regulations are based on Env-Wr 403.04
FERC regulations are based on Federal Emergency Management Agency's guidelines

Dam Risk Key Impacting Factors

- Climate Change will alter temperature & precipitation patterns
- Land use change will impact runoff coefficient and river flow peaks
- Aging of dams will make them more susceptible to floods



Current Focus: Hydrologic Modelling

- USGS has measured & recorded river flow for over 115 years
- Measurements are performed at gauging stations along the rivers
- For dam risk assessment, flow at dam site is needed
- Majority of dams in NE are small ungauged dams
- The Water Balance Model (WBM) is being used for hydrologic modelling

Near Future Work

- Using a recent downscaled climate model future climate data in NE for river flow modelling at dam sites to assess the impacts of climate change
- Comparing past & future spillway performances

Final Intended Outcome

- Risk estimation for dams in NE considering different scenarios of climate change, land use change and aging infrastructure
- Zoning of risk prone regions in NE by dynamic dam risk assessment where the impacts of each dam failure will be assessed with respect to the risk of other upstream and downstream dams.