CONVERGING ON WATER DISASTERS

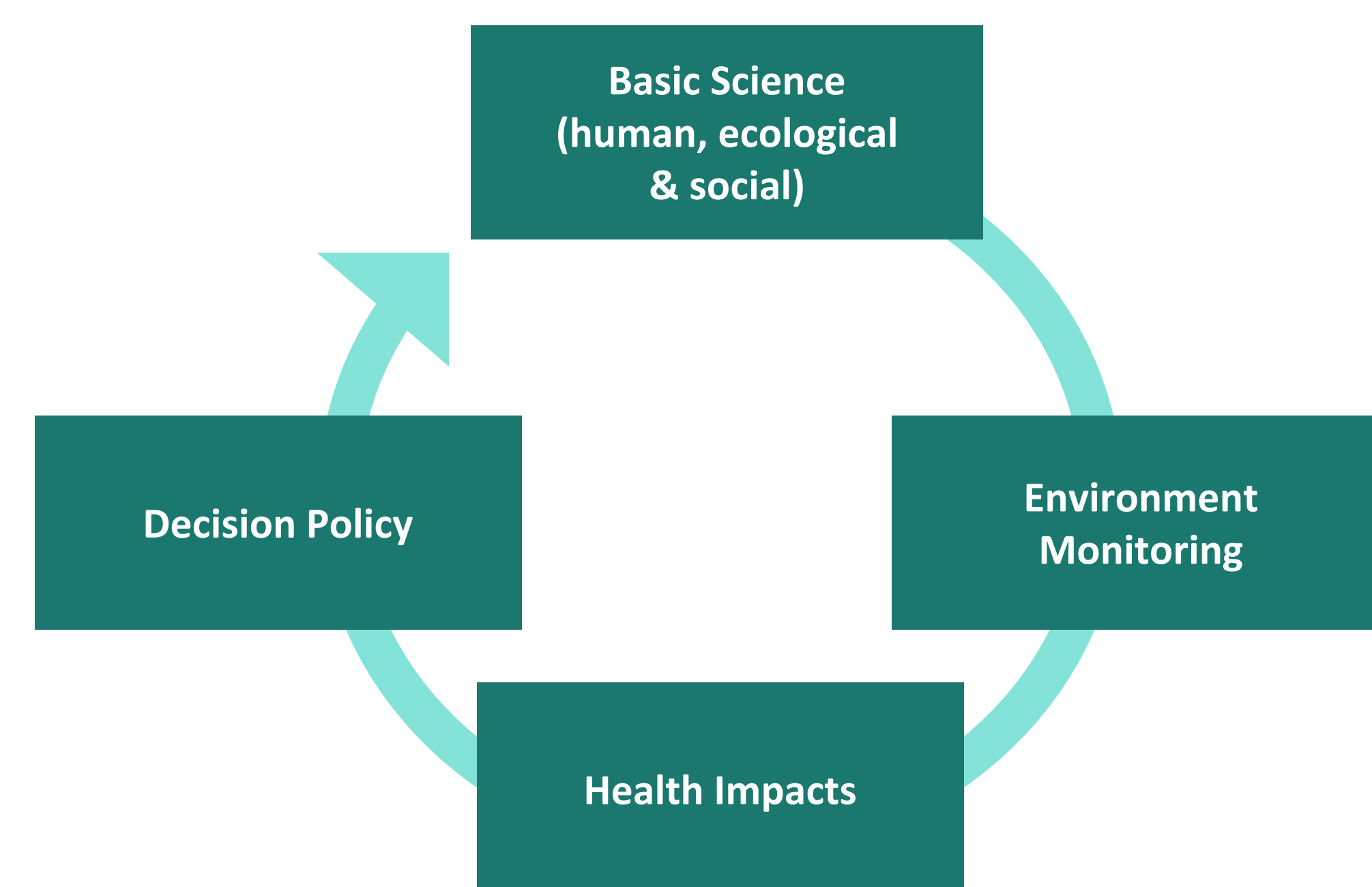# Operational data provenance and cybersecurity for anticipatory disaster planning

Use digital infrastructure to understand hazards

Figure 1. "Risk chain" showing the integration of how drinking water quality causes public health risks, by Elaine Faustman. Ongoing work with NSF RAPID funding after Hurricane 2017 and 2018 season are generating new data products, training curriculum, and outreach events to advance our understanding on the organizational and information needs of natural disaster researchers, population health researchers, communities, and private household decision-makers to support ongoing data collection.

Project Overview

A ongoing partnership with CUAHSI Hydroshare and Water Data Services working to make data accessible to the research community and the public, while protecting privacy. Data owners control the publication and sharing of digital information resources.
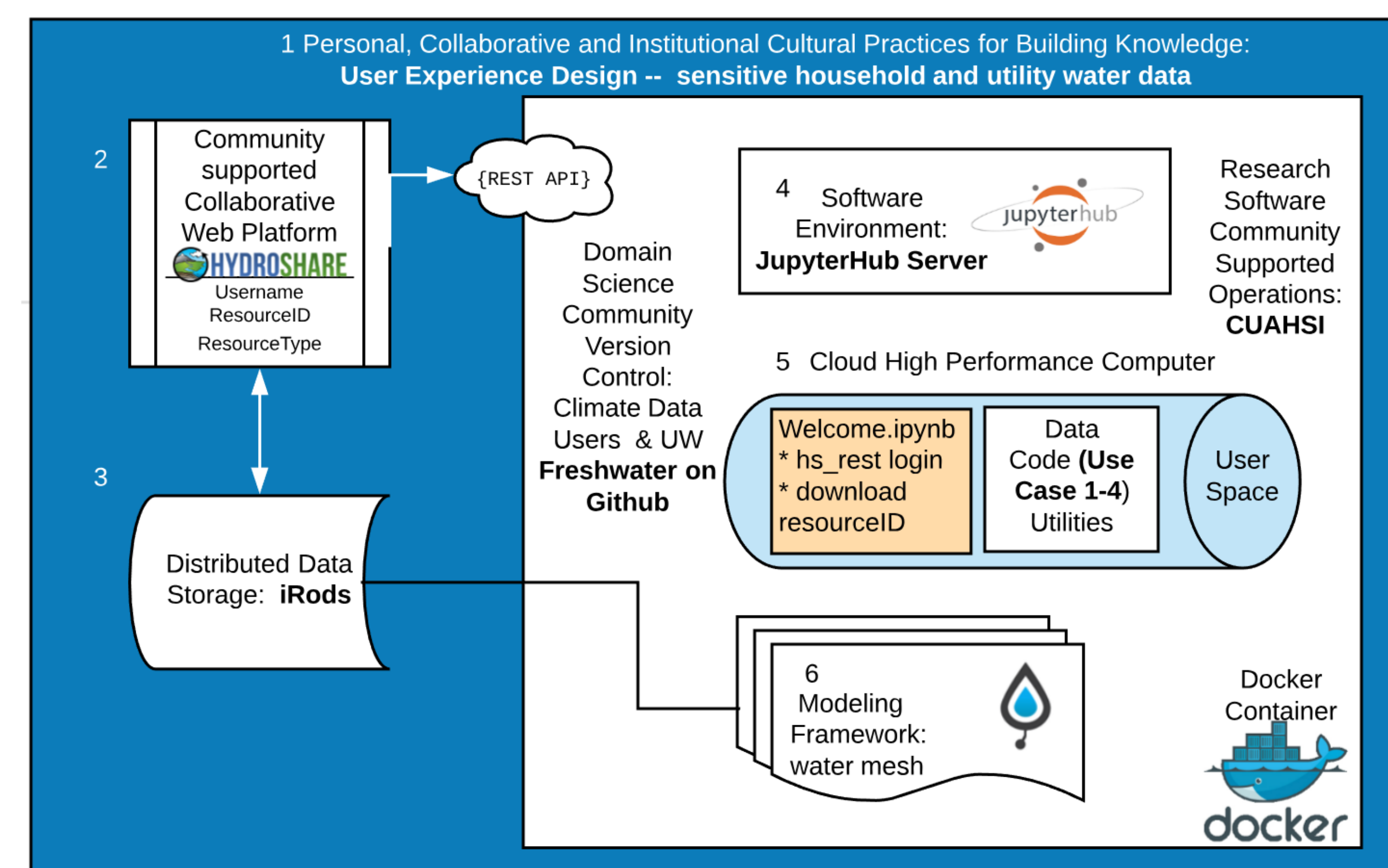

Figure 2. There are six interchangeable components to knowledge infrastructure (Bandaragoda, et al., 2018).

Waterhackweek cyber training will use HydroShare for computing, archiving and collaboration.

What data do you use?
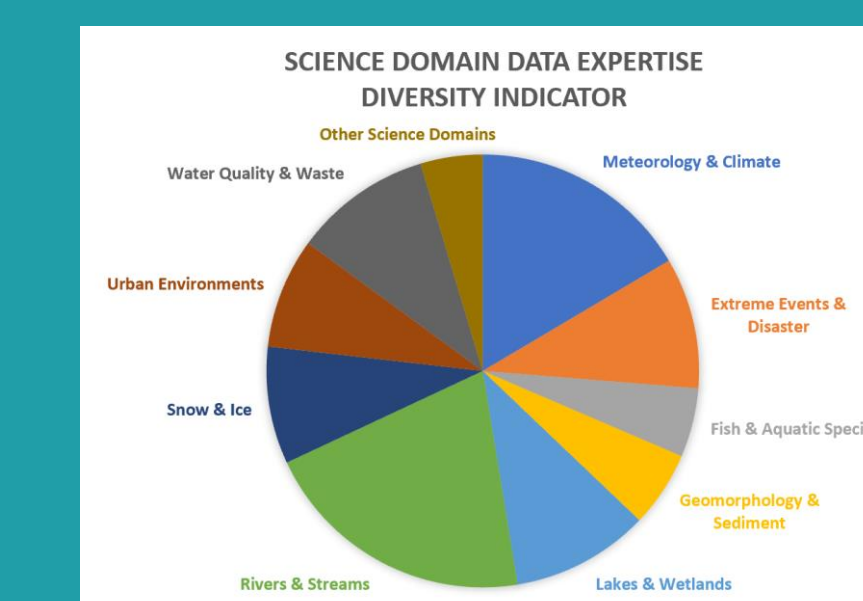
What do you want to learn?

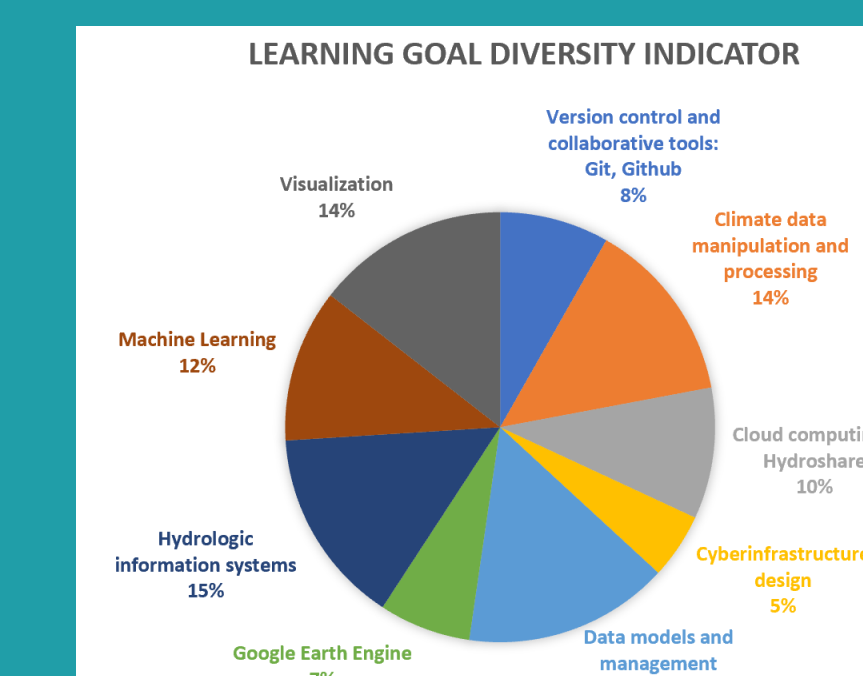Figure 2. Science domain experience for Waterhackweek 2019 applicants.

Figure 3. Learning goals of Waterhackweek applicants.
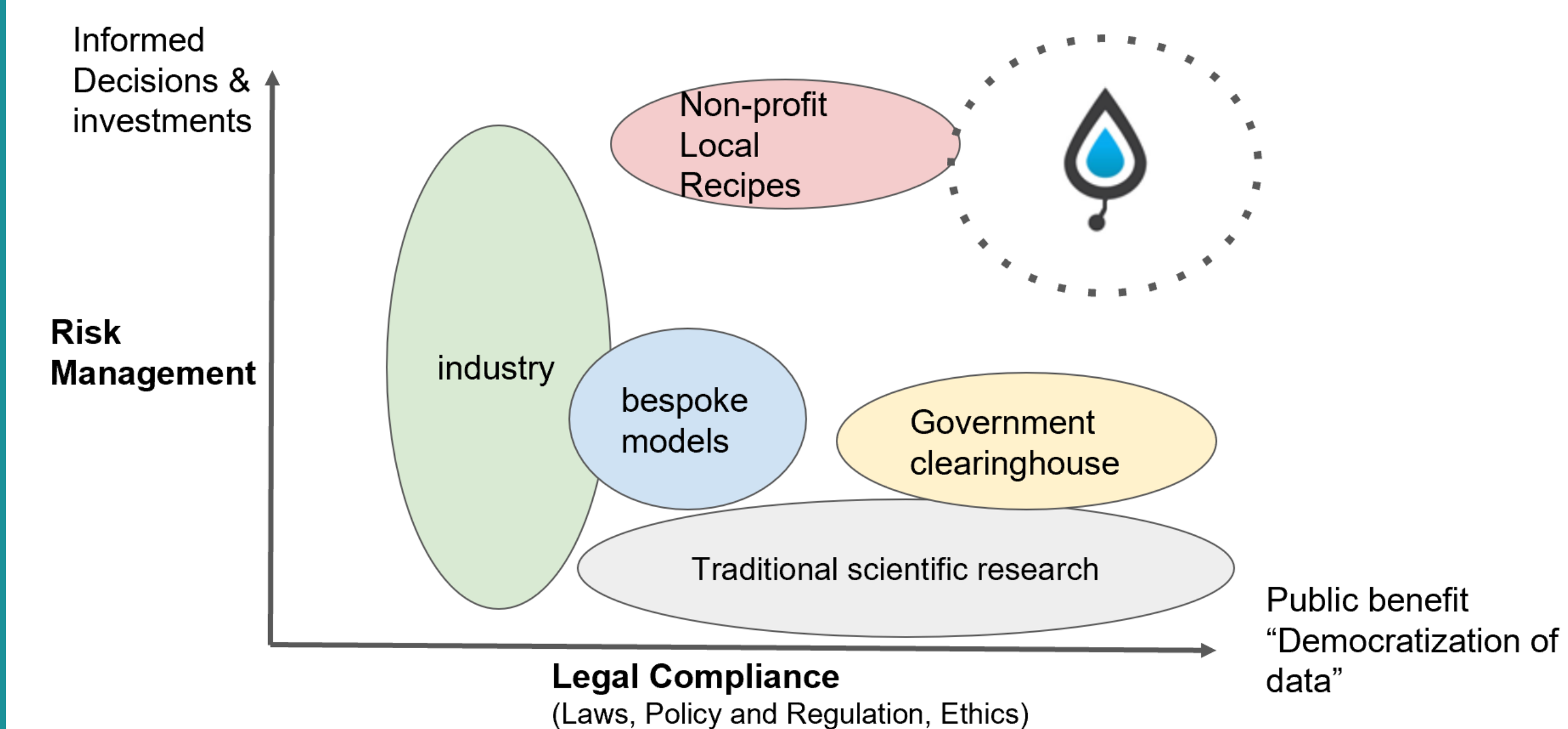
mesh user design

Figure 3. Data provenance can bridge traditional scientific research to increase the uses of data for household to public scale risk management to improve decision-making and investment in preventing disaster. Water mesh is a set of organizational and software tools for protecting sensitive geographic information for high resolution water data (e.g. household drinking water samples).

water mesh

Figure 4. "Water Mesh" is a set of tools for supporting branded open source software development and data sharing. We are exploring the organizational components of maintaining mesh networks with the support of the Earth Science Information Partnership (ESIP). By generating computational workflows that archive, publish and distribute data based on information needs shown in Figure 1 and data shown in Figure 3, households and community water providers can privately manage their own household or public utility drinking water data (red), while sharing it with trusted advocates who geospatially anonymize the datasets for public use and planning (green).

Collaborative RAPID
BUILDING INFRASTRUCTURE TO PREVENT DISASTERS LIKE HURRICANE MARIA

	OBJECTIVE 01 **Water Quality Sampling Campaign**	OBJECTIVE 02 **Data Archive**	OBJECTIVE 03 **Cyberinfrastructure Advances**	**Expected Science Outcomes**
PUBLIC ACCESS INFORMATION	Drinking water samples from public streams. Spatially aggregated anonymized information of the impact zone	Baseline assessment: Population Health Data, Healthcare Providers and supporting organizations, natural system environmental variables, Public Water System location and infrastructure status. Hurricane Maria health and environmental data from public data repositories and Luquillo CZO instruments in El Yunque National Park	LANDLAB raster model grid and diverse data formats. Observation Data Model (ODM2)	**DISASTER:** Contamination, drought, landslides, bio-diversity. **DRINKING WATER:** Geographic location and use data
PRIVACY PROTECTED INFORMATION	PRASA Utility, community operated tank system, household data. Teacher collection of student health data (IRB)	Water samples with personal information. De-identified water samples that can be geo-located	Population health researcher user-testing. Water quality professionals and researchers user testing. Individual data owners user testing	**HUMAN IMPACT:** Spatial distribution of contamination or drought

Christina Bandaragoda[1], Miguel Leon[2], W. Christopher Lenhardt[3], Jimmy Phuong[4], Jeffery S Horsburgh[5], Amber Spackman Jones[5] and Collaborative RAPID Team Building Infrastructure to Prevent Disasters like Hurricane Maria, (1)University of Washington, Seattle, WA, United States, (2)University of Pennsylvania, Earth & Environmental Science, Philadelphia, PA, United States, (3)Renaissance Computing Institute, Chapel Hill, NC, United States, (4)University of Washington, Biomedical Informatics and Medical Education, Seattle, WA, United States, (5)Utah State University, Logan, UT, United States

Infrastructure for protecting geo-sensitive online resources
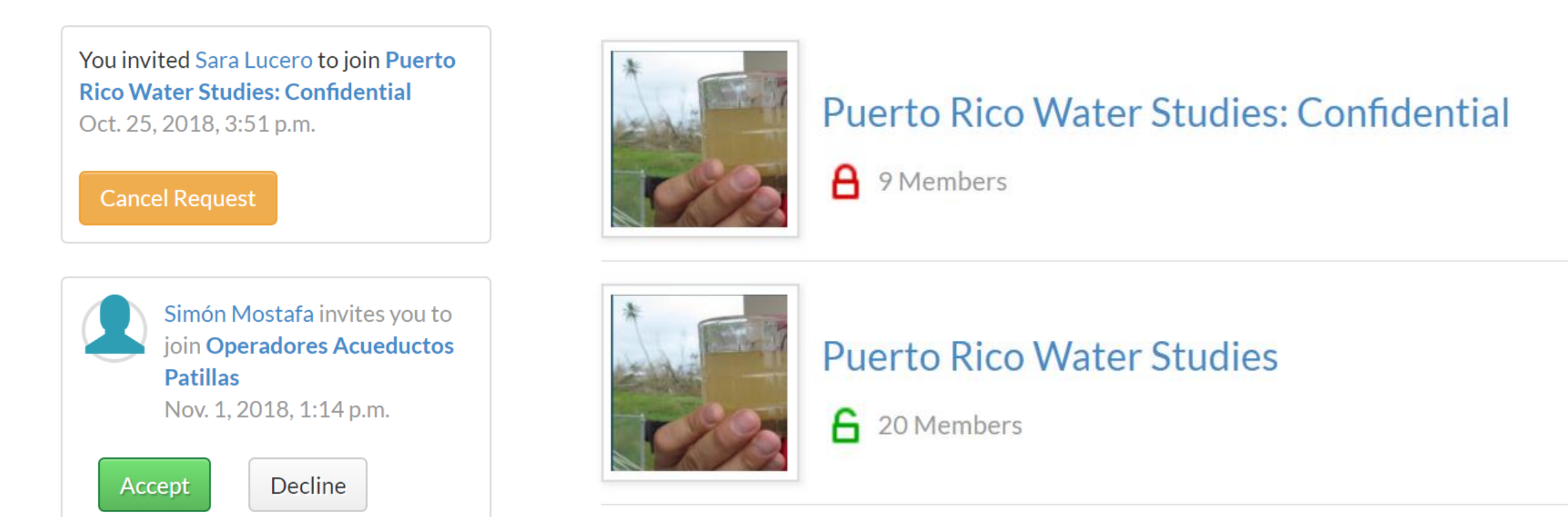

Figure 5. Hydroshare web page features for controlling groups and resource sharing of geographic locations of water samples in southeastern Puerto Rico. Sharing can be managed with HydroShare Groups and Responsible Use Agreements. These methods are designed to be usable for mesh networks collecting any kind of sensitive or high resolution environmental and water data.

Figure 6. Hydroshare is a web-based information system that allows users to contribute and publish citable, data in various formats. As the cyber-infrastructure grows to be more diverse and accessible to communities subject to disasters, there is a need for organizational systems that promote water security amidst disaster. Hydroshare is moving towards a fully web based innovation environment. This aligns with the new data sharing guidelines, making data FAIR - Findable, Accessible, Interoperable, and Reusable.