

Integrating Indigenous Knowledge to Co-Design more Effective Operations, Maintenance, and Management of Water Infrastructure in the Arctic

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Objective

This project seeks to challenge the core assumption that the understandings used to build an infrastructure system match those of the local social system that uses and maintains such infrastructure.

Methods

Grey literature collection

Collected training, certification, and operations materials used by water system operators in Alaskan communities

Field Research

Traveled to an Alaska hub community and remote villages in April and August 2022

Interviews

Conducted 57 end-user interviews
Conducted 21 stakeholder interviews

Qualitative analysis

Conducted qualitative content analysis of literature and interviews

“If I were to change one thing, I would get people and communities all over the world to think about water as a more precious resource and something that is of greater value. [...] make it more heralded, celebrated. Make it as important as it really is to public health professionals.”

Interviews

- Conducted interviews with 21 water system stakeholders and 57 local water users in rural Alaskan communities
- Local water users indicated mixed preferences regarding water delivery methods, including piped and hauled
- Many water users describe concerns about chemically treated water and prefer collecting drinking water via traditional methods

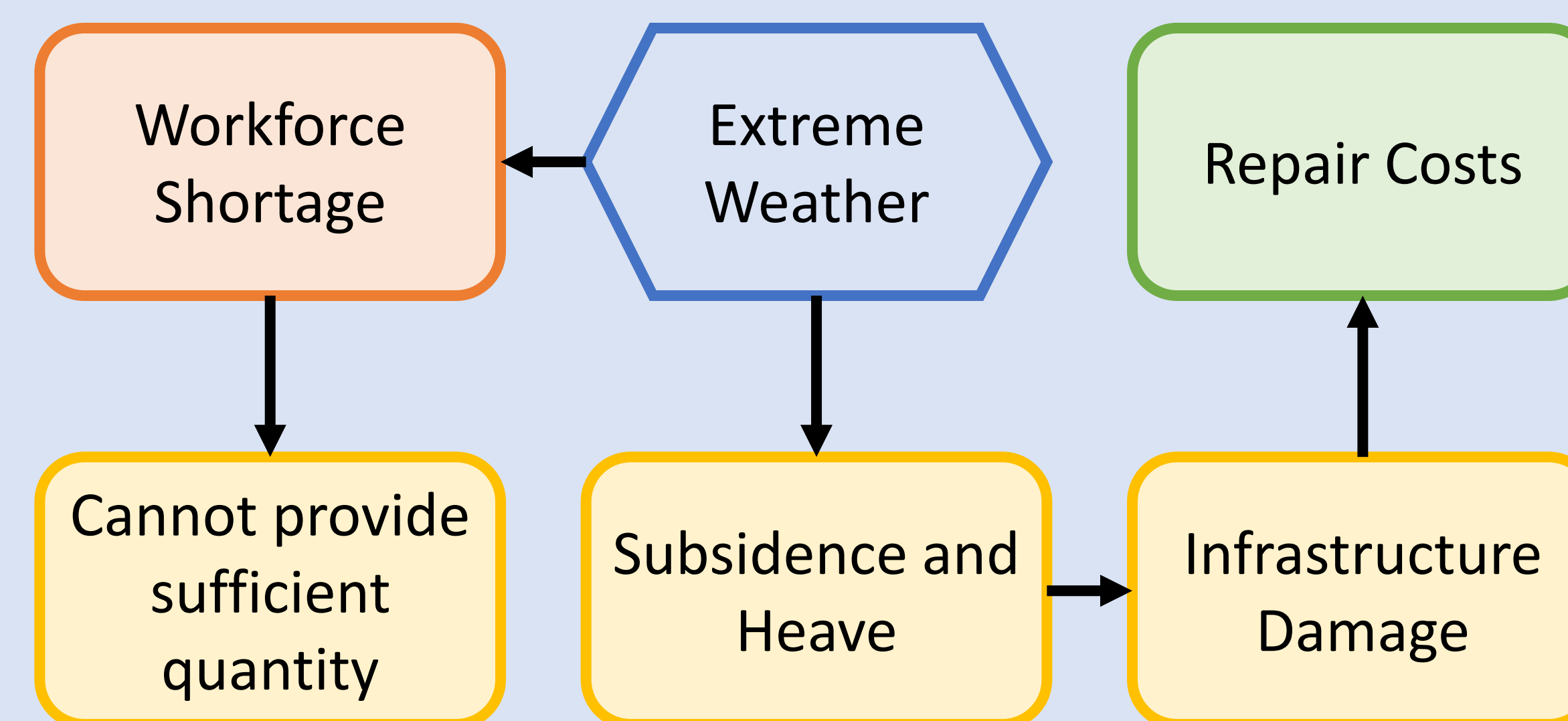


Figure 1. This causal map shows that extreme weather can lead to several cascading impacts, including an inability to provide sufficient water to customers as well as significant infrastructure repair costs.

- Stakeholders helped identify key challenges, solutions, and cascading impacts of system operations
- Interdependencies were mapped according to financial, natural, social, and technical systems
- Causal maps provide context for recommendations regarding policy and operational interventions

Natural Language Processing

- Natural Language Processing (NLP)** uses machine-learning to analyze language text
- NLP will be used to evaluate trends in the interview and literature data
- NLP Progression for Analyses:
 - Manual, no supervision
 - Manual, with topical coding dictionary
 - Deep learning profiles
- Results can be compared across NLP and traditional qualitative content analysis
- Preliminary results show that there are significant relationships between permafrost, infrastructure, and funding

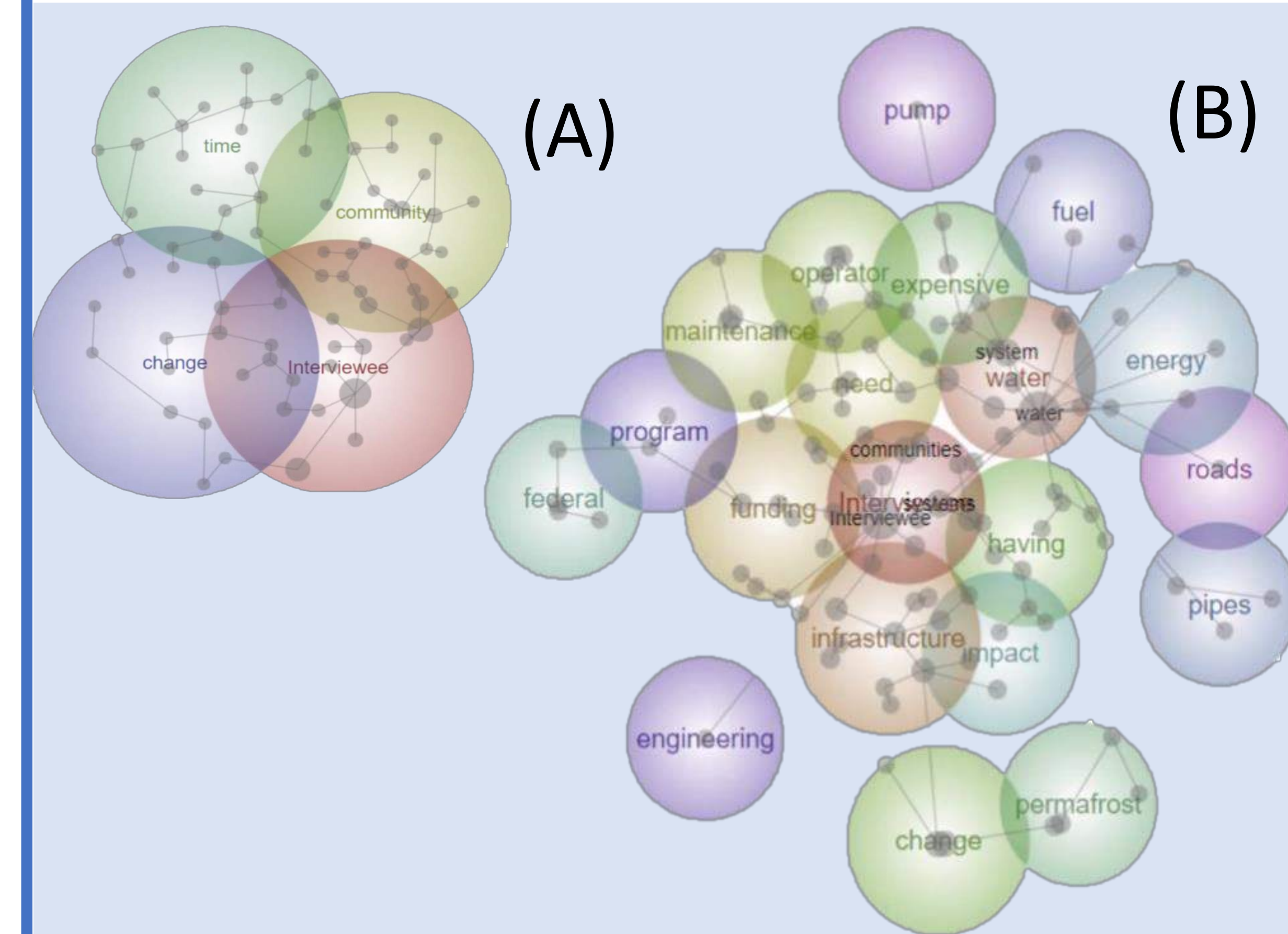
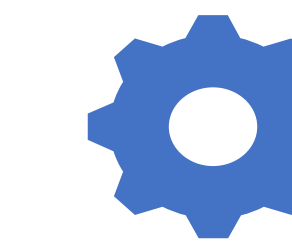


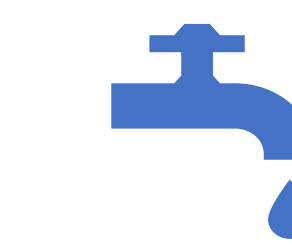
Figure 2. NLP provides differing results based on the amount of supervision and data provided. (A) shows results based on a manual, no supervision analysis of local user interviews. (B) shows results based on an analysis using supervision.

Grey Literature

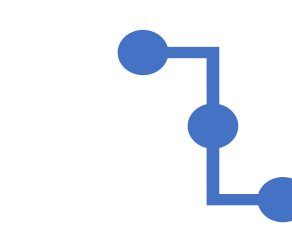
- Data: Training, certification, and operations materials open-source and from stakeholders
- Methods: Mixed inductive/deductive qualitative content analysis
- Documents evaluated for technical and social relevance to rural Alaska operations
- Sets the stage for where our work is situated



Local documents focus on context-specific system management & operations



Regional documents focus on systems specific to Alaska and system threats



State documents bridge federal agencies and regional/local organizations



Federal documents focus on certification and exam preparation

Next Steps

- Fieldwork scheduled for Summer 2023
- Develop materials for operators and trainers
- Maintain relationships with community members and community leaders
- Monitor changes in the communities

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