GROUNDWATER VULNERABILITY IN SOCIAL-HYDROLOGICAL SYSTEMS

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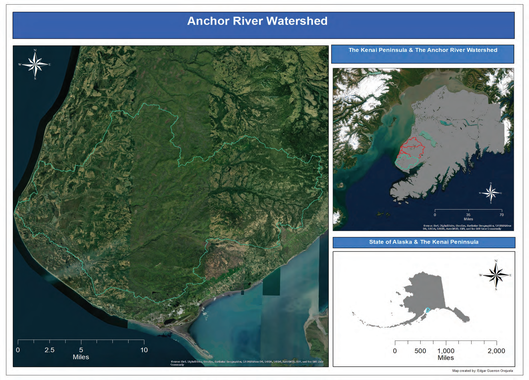
The Kenai Peninsula has salmon, people and groundwater



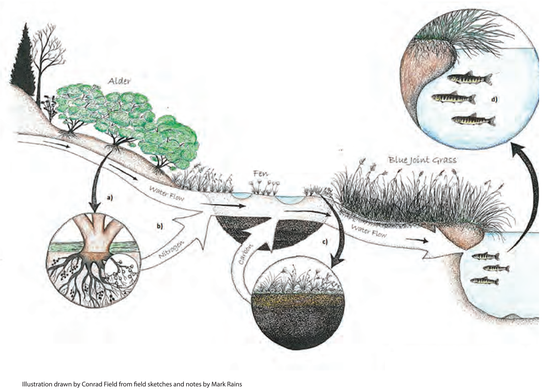
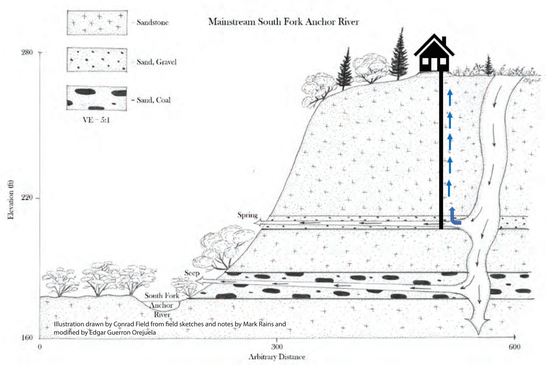


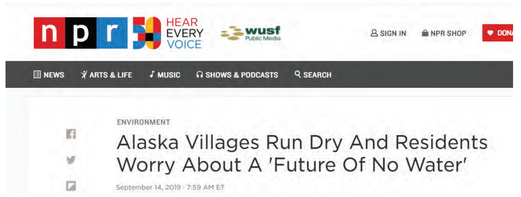
Illustration drawn by Conrad Field from field sketches and notes by Mark Rains

Groundwater connects the landscape

Groundwater supports people



Groundwater is a limited resource

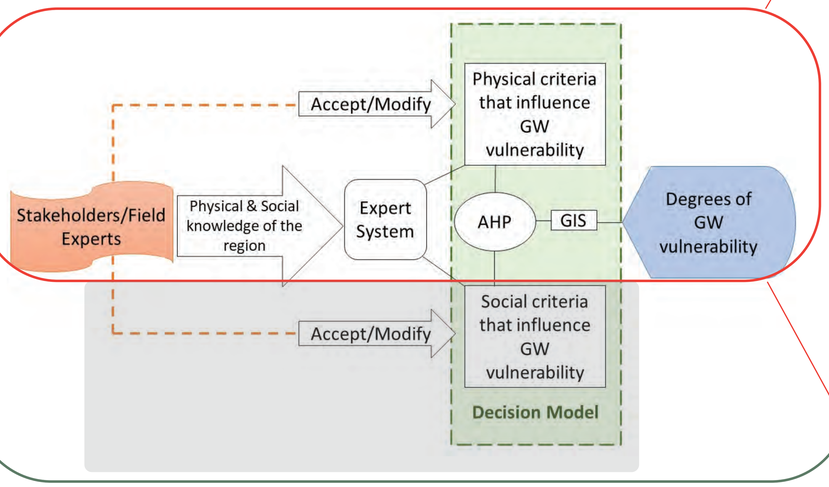


Tota Population	City of Homer	Kenai Peninsula Borough	USA
2020 Census	5522	58799	3.31E+08
2010 Census	5003	55400	3.09E+08
Percent Change	10%	6%	7%

Population is growing

Where is groundwater more vulnerable to anthropogenic impacts?

Collaborative Science using Analytic Hierarchy Process



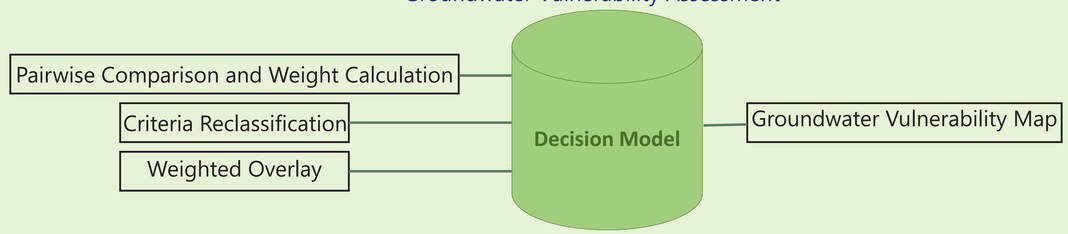
Field work and stakeholder coordination




Drivers of Groundwater Vulnerability

Topography | Land | Climate | Geology | Soils | Hydrology

Groundwater Vulnerability Assessment

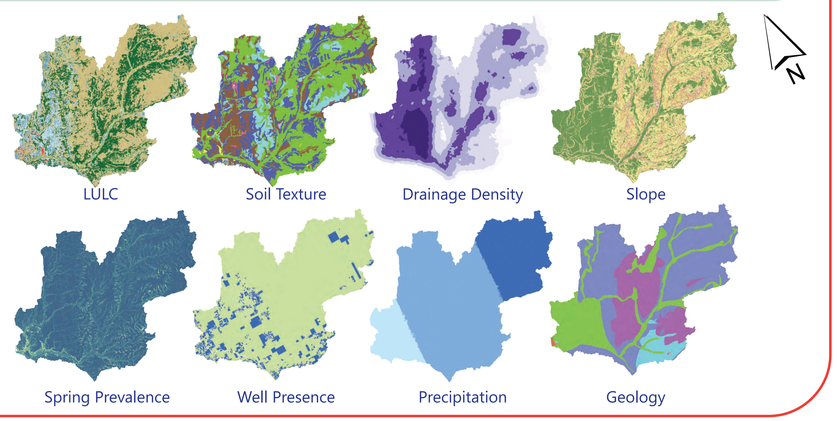


Pairwise comparison and weight calculation

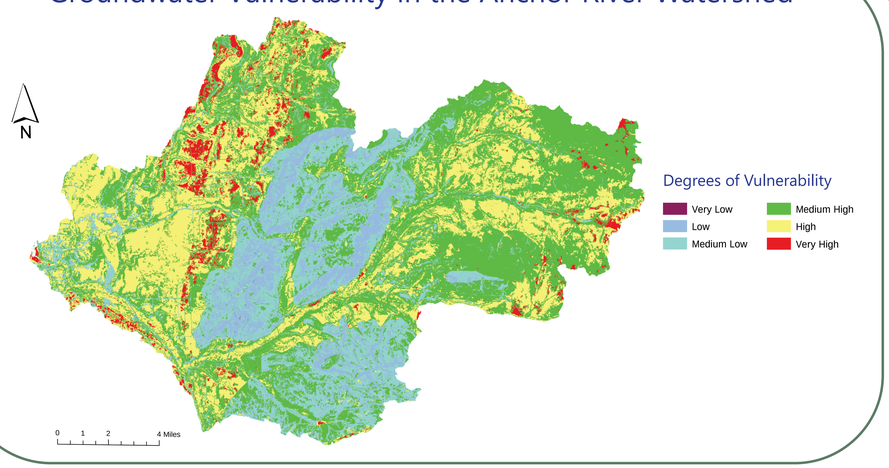
Criteria	LULC	Geology	Soil Texture	Drainage Density	Slope	Precipitation	Well Presence	Spring Prevalence	Priority Vector (%)
LULC	1.00	3.00	5.00	3.00	3.00	1.00	1.00	1.00	19
Geology	0.33	1.00	3.00	1.00	0.33	0.33	0.20	0.20	5
Soil Texture	0.20	0.33	1.00	1.00	0.33	0.14	0.14	0.14	3
Drainage Density	0.33	1.00	1.00	1.00	0.20	0.20	0.33	0.33	5
Slope	0.33	3.03	3.03	5.00	1.00	1.00	1.00	1.00	15
Precipitation	1.00	3.03	7.14	5.00	1.00	1.00	1.00	1.00	18
Well Presence	1.00	5.00	7.14	3.03	1.00	1.00	1.00	1.00	18
Spring Prevalence	1.00	5.00	7.14	3.03	1.00	1.00	1.00	1.00	18

Principal Eigen Value (lambda max)	8.34

Consistency Index (CI)	0.05



Groundwater Vulnerability in the Anchor River Watershed



According to our expert system model, the physical parameters that drive Groundwater Vulnerability in the Anchor River watershed are: **LULC, Slope, Precipitation, Well Presence, and Spring Prevalence**

Acknowledgments:

This research was funded primarily by NOAA's Office of Coastal Management. This project benefitted immeasurably from in-kind support provided by the Kachemak Bay National Estuarine Research Reserve, which provided lodging, local knowledge, introductions to stakeholders, the coordination of formal stakeholder engagements, and more. Coowe Walker and Syverine Bentz were particularly instrumental. A special thank you to all of the many stakeholders who provided their time, local knowledge, and access to private properties.

References:

1. Callahan et al., 2015, Controls on Temperature in Salmonid-Bearing Headwater Streams in Two Common Hydrogeologic Settings; 2. Callahan et al., 2017, Nitrogen Subsidies from Hillslope Alder Stands to Streamside Wetlands and Headwater Streams; 3. Dixon & Uddameri, 2015, GIS and Geocomputation for Water Resource Science and Engineering; 4. Gerlach et al. 2021, Using Remote Sensing and Machine Learning to Locate Groundater Discharge to Salmon-Bearing Streams; 5. Gross. R. 2019, Alaska Villages Run Dry And Residents Worry About A 'Future Of No Water'; 6. Guitouni & Martel, 1998, Tentative guidelines to help choosing an appropriate MCDA method; 7. National Land Cover Dataset (NLCD); 8. Soil Survey Geographic Database (SSURGO); 9. U.S. Census 2021

Next Steps:

- Incorporate Social criteria to the model
  - Conservation status of land
  - Management capabilities and will
  - Regulatory oversight
  - Land ownership status
  - Proximity to road system
- Field verification of model results
- Stakeholders and Expert model validation
- Model different plausible future scenarios