

# Water Vulnerability in Arctic Households: A Literature-based Analysis

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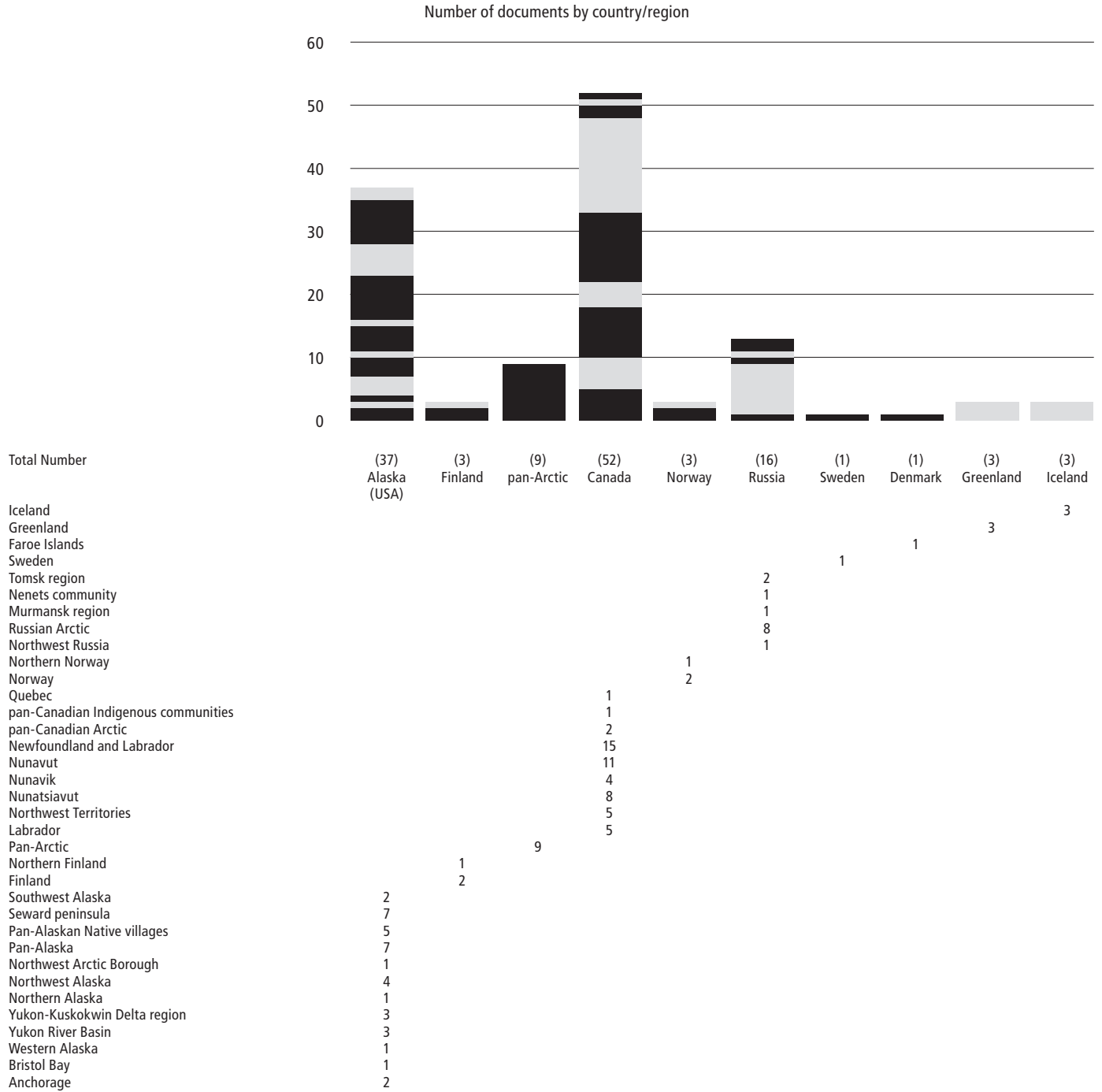


FIG. S1. Regional distribution of reviewed documents.

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TABLE S1. Search terms of the narrative review.

Source	Key word
Database (e.g., ISI Web of Science, SCOPUS)	<p>Household OR Home OR House OR Homestead OR Housing OR Residence OR Village<sup>1</sup> OR Communities OR Community OR “Rural household” OR “Rural society” OR “Household structure” OR Settlement OR Town OR Hamlet OR Domicile OR Dwelling</p> <p>AND</p> <p>“Water security” OR “Water vulnerability” OR “Drinking water” OR “Drinking water quality” OR “Domestic water” OR “Water pollution” OR “Water insecurity” OR “Water accessibility” OR “Water treatment” OR “Water resources” OR “Public water” OR “Water quality” OR “Water qualities” OR “Water quantity” OR “Water quantities” OR “Water access” OR “Water supply” OR “Water planning” OR “Water management” OR “Water system” OR “Tap water” OR “Potable water” OR “Water supply systems” OR “Municipal water” OR “Community drinking water system” OR “Community water” OR “Well water” OR “Groundwater” OR “Ground water” OR “Surfacewater” OR “Surface water”</p> <p>AND</p> <p>Circumpolar OR Polar OR Arctic OR “Arctic Canada” OR “Canadian Arctic” OR Nunavik OR Nunavut OR Nunatsiavut OR Labrador OR Inuvialuit OR Yukon OR “Northwest Territories” OR “Northwest territor” OR Yukon<sup>1</sup> OR Nunavit<sup>1</sup> OR Nunatsiavut<sup>1</sup> OR Newfoundland OR Chukotka OR Yakutia OR “Russi<sup>1</sup> Arctic” OR “Arctic Russia” OR “Magadan Oblast” OR “Kamchatka Oblast” OR “Murmansk Oblast” OR “Komi Republic” OR Murmansk OR Yakutsk OR Norilsk OR “Novy Urengoi” OR “Yamal-Nenets” OR Magadan OR “Arkhangelsk Oblast” OR “Tyumen Oblast” OR “Nenets Autonomous Okrug” OR “Yamalo-Nenets Autonomous Okrug” OR “Krasnoyarsk Krai” OR “Republic of Karelia” OR “Irkutsk Oblast” OR “Chukotka Autonomous Okrug” OR Arkhangelsk OR “Sakhalin Oblast” OR “Khabarovsk Krai” OR Fennoscandia<sup>1</sup> OR Ural<sup>1</sup> OR Siberia<sup>1</sup> OR Beringia<sup>1</sup> OR “Northern Sweden” OR Västerbotten OR Vasterbotten OR Jamtland OR Vasternorrland OR Kiruna OR Lulea OR Skelleftea OR Umea OR Ostersond OR “Northern Finland” OR Iceland OR Lapland OR Lappland OR “Lapland Region” OR “East Lapland” OR “West Lapland” OR “Central Lapland” OR “Barents Region” OR “Northern Norway” OR Finnmark OR Troms OR Tromso OR Svalbard OR Nordland OR “Nordland County” OR “Norrbotten County” OR Norrbotten OR Greenland OR Avannaata OR Kujalleq OR Nuuk OR Sisimiut OR Ilulissat OR Qaqortoq OR Aasiaat OR Ilulissat OR Kangaatsiaq OR Maniitsoq OR Tasiilaq OR Paamiut OR Narsaq OR Nanortalik OR Uummannaq OR Qasigiannuguit OR Qeqertalik OR Qeqqata OR Qeqertarsuaq OR Sermersooq OR Qaanaaq OR Tasiilaq OR Upernavik OR Alaska OR “Seward Peninsula” OR Alask<sup>1</sup> OR “Arctic slope” OR “Bering straits” OR “Western Alaska”</p> <p>NOT</p> <p>Antarctica OR “Southern Ocean” OR Copepod OR Phytoplankton OR Zooplankton OR Diatom OR Pteropod OR Pteropoda OR Cetaceans OR Planktic OR “Fennoscandian shield”</p>

<sup>1</sup> Indicates that word endings can have variations.

TABLE S2. Code book for the narrative review.

Factor type	Proximate factor (Variable name)	Underlying factors
Governance system	Inadequate freshwater policies (NOPOL)	<ul style="list-style-type: none"> <li>• Lack of drinking water guidelines</li> <li>• An absence of rigorous freshwater monitoring</li> <li>• An absence of freshwater policies</li> <li>• Standard volume of water supplied to household despite its particular circumstances</li> <li>• Incomplete consideration of sociopolitical aspects of water, compared to technological</li> <li>• Lack of preparedness for waterborne disease outbreak</li> <li>• Lack of compatibility between place-specific, cultural, and economic variables such as public health trends, living conditions, and water-related behaviors of system users and policies</li> <li>• Layers of governance (local to national to international)</li> <li>• Transnational populations</li> <li>• Overcrowding of homes leading to insufficient water supply</li> <li>• Ownership of water supply system</li> <li>• Alignment of goals</li> </ul>
Governance system	Funding for water systems (FUNDIN)	<ul style="list-style-type: none"> <li>• Residents cannot pay fees because of poverty and the high cost of treatment and distribution</li> <li>• Limited household income</li> <li>• Limited government funding</li> <li>• Access to transportation by ownership of vehicle</li> <li>• Transportation costs are too high, such as snowmobile purchases, ATV purchases, snowmobile maintenance, gasoline</li> <li>• Residents dependent on government transfers</li> <li>• Shortage of qualified operators</li> <li>• Cold/harsh climate</li> <li>• Interrelated resource pricing, increasing energy costs affect water access and rates of consumption, energy price increases price of water, thus affecting affordability, availability, and usage of water</li> <li>• Remote, rural communities</li> <li>• Lack of resident tax base</li> </ul>
Infrastructure system	Inadequate or insufficient infrastructure (NOINFRA)	<ul style="list-style-type: none"> <li>• Lack of water testing for metals, chemicals</li> <li>• Challenges with maintaining chlorine levels from distribution center to household</li> <li>• Lack of access to water</li> <li>• Lack of access to washeteria</li> <li>• Storage in tanks that may become contaminated</li> <li>• Cold War and nuclear disposal sites, managing abandoned mines and mine waste</li> <li>• Levels of education</li> <li>• Deteriorating infrastructure</li> <li>• Wastewater management and sewage runoff compromising drinking water quality</li> <li>• Lack of water data on consumption/access and regional hydrology</li> <li>• Little integration of data across disciplines/knowledge</li> <li>• Little sharing of information about water resources</li> <li>• Inadequate monitoring and record keeping</li> </ul>
Resource system	Biophysical variability (CC)	<ul style="list-style-type: none"> <li>• Climate change impacting the availability, quality, and quantity of water resources</li> <li>• Extreme weather threatening water systems</li> <li>• Water and sanitation infrastructure at risk because of eroding beach and storm surge</li> <li>• Infrastructure damage due to thawing/melting permafrost</li> <li>• Rising temperatures and flooding threatening water sources and water systems</li> <li>• Climate change damaging existing clean water and wastewater infrastructure</li> <li>• Quality and quantity of water supply changes over a year because of climate and hydrologic cycle</li> <li>• With presence of multiple sources of water, communities and individuals were able to employ a coping mechanism of retrieving their own water when there were system failures</li> <li>• Topography and geography of land</li> </ul>
Social system	Cultural changes (CULTUR)	<ul style="list-style-type: none"> <li>• Framings of water security</li> <li>• Perception of freshwater as a finite resource with multiple values</li> <li>• Piped water is considered to be substandard quality and community members continue to rely on traditional water sources</li> <li>• Loss of sensitivity to hydrological changes</li> <li>• Generational differences in familiarity with water resources in time and place</li> <li>• Levels of education</li> <li>• Pollution/changing land = dispossession and loss of health tied to the inability to safely and confidently use water resources</li> <li>• System disruption due to human error, such as truck distribution network, illness</li> <li>• Arctic populations are growing in the warmer climate</li> <li>• Shifting size of communities</li> <li>• Changes in age composition</li> <li>• Rural to urban migration</li> <li>• Rural outmigration</li> <li>• Increasing demand on and threats to freshwater resources because of heightened resource development and industrial activities</li> <li>• Importance of having able-bodied kin to gather water</li> <li>• Kin network affected by length of relationship, employment outside the town, illness</li> <li>• Dependence on fuel-based transportation to gather/access water</li> </ul>