



Research article

Diagnosing water security in the rural North with an environmental security framework



Henry J.F. Penn, Ph.D. ^{a,*}, Philip A. Loring, Ph.D. ^b, William E. Schnabel, Ph.D. ^c

^a University of Alaska Fairbanks, Water and Environmental Research Center, 306 Tanana Loop, PO BO 755860, Fairbanks, AK 99775, USA

^b University of Saskatchewan, School of Environment and Sustainability, 117 Science Place, Saskatoon, SK S7J 1X7, Canada

^c University of Alaska Fairbanks, Institute of Northern Engineering, 539 Duckering Building, 306 Tanana Loop, Fairbanks, AK 99775-5910, USA

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ABSTRACT

This study explores the nature of water security challenges in rural Alaska, using a framework for environmental security that entails four interrelated concepts: availability, access, utility, and stability of water resources. Many researchers and professionals agree that water insecurity is a problem in rural Alaska, although the scale and nature of the problem is contested. Some academics have argued that the problem is systemic, and rooted in an approach to water security by the state that prioritizes economic concerns over public health concerns. Health practitioners and state agencies, on the other hand, contend that much progress has been made, and that nearly all rural households have access to safe drinking water, though many are still lacking 'modern' in-home water service. Here, we draw on a synthesis of ethnographic research alongside data from state agencies to show that the persistent water insecurity problems in rural Alaska are not a problem of access to or availability of clean water, or a lack of 'modern' infrastructure, but instead are rooted in complex human dimensions of water resources management, including the political legacies of state and federal community development schemes that did not fully account for local needs and challenges. The diagnostic approach we implement here helps to identify solutions to these challenges, which accordingly focus on place-based needs and empowering local actors. The framework likewise proves to be broadly applicable to exploring water security concerns elsewhere in the world.

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1. Introduction

Water security is generally defined as involving stable and affordable access to clean water in sufficient quality and quantities for maintaining health and enacting livelihoods (Cook and Bakker, 2012). In rural Alaska, water security at the household and community level has emerged as an important societal problem, though there's growing debate about both the nature and the relative scale of the issue, and these disagreements have led to different perspectives on the most appropriate solutions (Marino et al., 2009; US Arctic Research Commission, 2015). In contrast to many areas of the world where local communities are challenged by water shortages and changing hydrological cycles (Vörösmarty et al., 2010; Wheeler and Gober, 2015), the problem facing household water security in

rural Alaska relates primarily to infrastructure (i.e., water and wastewater treatment facilities) (Eichelberger, 2010; US Arctic Research Commission, 2015) and community development policies (Eichelberger, 2012). Reports about the severity and extent of the problems vary, however; it has become a regular anecdote, for example, to claim that it is not uncommon for homes in rural Alaska to lack piped water and sewer (Eichelberger, 2014). Conversely, official sources show that as of 2000, 93.7% of all Alaskan households had access to complete sanitation¹ (US Census Bureau, 2000; Hennessy et al., 2008), and health practitioners in the state contend that "nearly all villages have access to safe drinking water" (Hennessy et al., 2008). These findings notwithstanding, public health outcomes such as rates of water washed diseases remain high (Hennessy et al., 2008; Gessner, 2008). Climate-change too is also impacting water infrastructure in new ways that threaten its sustainability (see Brubaker et al., 2011; Brubaker et al., 2014). For

* Corresponding author.

E-mail addresses: hjpenn@alaska.edu (H.J.F. Penn), phil.loring@usask.ca (P.A. Loring), weschnabel@alaska.edu (W.E. Schnabel).

¹ Potable drinking water and safe wastewater disposal (Hennessy et al., 2008).

example, communities are encountering system failures due to permafrost thaw, which can break buried pipelines (US Arctic Research Commission, 2015), and accelerate bank erosion undermining and damaging infrastructure, which is often located close to river and shore edges (Brubaker and Chavan, 2011; Brubaker et al., 2012). As such, water security remains, at least to some extent, a problem.

The purpose of this paper is to tease apart these divergent narratives regarding the state of water security in rural Alaska, and diagnose existing challenges such that effective and sustainable solutions can be identified. To this end, we apply a four-dimensional framework for environmental security proposed by Loring et al. (2013) (See also Grumbine, 2014; Hossain et al., 2016) to synthesize ethnographic research on water security in rural communities in the Bristol Bay and Kotzebue Sound regions of Alaska (Penn et al., 2016). We identify key points of intervention for improving water security in the region, and propose a paradigm shift away from large-scale infrastructure projects, and instead toward community empowerment and stewardship as ways to improve the efficiency and stability of water systems, whether old or new. We specifically identify the importance of the Utility—the social institutions and organizations responsible for maintaining infrastructure, providing water services, ensure people's needs are met—as the foundation of sustainable community water system management. Our analysis highlights key human dimensions such as the role of policy and social narratives regarding modernization. Our analysis also illustrates the effectiveness of this environmental security framework for unpacking the endogenous human dimensions of water security at the community and household level, which Wheater and Gober (2015) identify as a priority for water security research. As such, we conclude with a discussion of the relevance of this work to water security issues around the world.

2. Water security in rural Alaska

Rural Alaska is characterized by over 280 isolated villages, which are spread across Alaska, but concentrated along major river basins and the coast line. Populations in these communities are predominantly Native and range between 25 and 6000 residents, averaging about 300 residents per village. Most residents practice a subsistence lifestyle and depend heavily on moose, caribou, walrus, whale, seal and fish for their food supply. Typically, there is a limited cash economy in these communities, and unemployment rates can frequently exceed 50%. Communities are 'islanded' in the respective that they are geographically isolated, not connected to a traditional grid system, and are solely responsible for basic provisions such as power, heat, water and sanitation. Nearly all villages are accessible by air and water only, which add significant costs and transit time to the distribution of goods and materials.

In rural Alaska, household and community water security is an ongoing and possibly worsening concern, albeit a relatively new one considering that until the last 50 years or so, Alaska Natives were generally environmentally secure (Gerlach et al., 2011; Eichelberger, 2014; Hossain et al., 2016), and had free access to plentiful clean water (Berardi, 1999b). Now that life in these regions is less mobile, based in fixed and in some cases densely populated small villages, water and wastewater management systems are essential (Berardi, 1999b). Contemporary water security issues are in part due to the engineering challenges associated with developing water systems suitable for remote arctic conditions, which have driven even expensively engineered systems into disrepair (Berardi, 1998, 1999a). Inadequate and/or failing facilities and infrastructure, and the impacts of climate change on infrastructure rather than on the availability of water, are likewise principle challenges (Brubaker et al., 2011, 2014; Cozzetto et al., 2013).

As noted above, the vast majority of Alaskan households have access to complete sanitation (US Census Bureau, 2000; Hennessy et al., 2008). The systems that provide these utilities vary in design and source of water; some communities have pressurized piped water to homes, and those that do not, typically haul their water in 5-gallon (19-L) plastic containers, or receive water delivery via small truck or ATV-pulled tank from community-based "washeterias", which also often offer shared laundry and showers. As of 2000, approximately one third of rural Alaska residents obtained water this way (Alaska DEC, 2000, 2015b). This is a common practice for many urban residents as well, and indeed all three authors have hauled water in this manner while living in Fairbanks.

There are still gaps in service, however; 33 communities in rural Alaska lack any sanitation services at the time of writing (Alaska DEC, 2015a). These communities, and the approximately 3000 households they represent, account for 17.2% of the total number of rural communities statewide (Alaska DEC, 2015b). In several of the rural communities that do have water systems, climatic change is interfering with this infrastructure (Brubaker and Chavan, 2011; Brubaker et al., 2012), which is often aging, and increasing both operating costs and the incidences of temporary losses of service (Cozzetto et al., 2013). Thus, despite Alaska making huge strides to address rural water insecurity since the 1980s, water insecurity remains a problem. Moreover, public health outcomes such as high infection rates, and particularly among infants, children and the elderly, underscore this problem (Gessner, 2008), as the absence of in-home water service is generally associated with high rates of water washed diseases, including respiratory tract and skin infections (Chambers et al., 2008; Gessner, 2008; Hennessy et al., 2008; Laderach, 2006).

State-led water and sanitation infrastructure improvement projects have been the *du jour* approach for attending to issues of water insecurity in Alaska since 1972 (Village Safe Water, 2015), supported by both by health practitioners and politicians. However, in the last 10 + years, infrastructure projects have faced a growing funding deficit that now exceeds \$660M USD (Alaska DEC, 2015a), and this makes it increasingly unlikely that the existing, capital-projects based approach to water security will continue. Indeed, the state is exploring alternative, lower cost approaches such as in-home water treatment (Alaska DEC, 2015a). This has led some to critique the state for possibly prioritizing solutions for local water challenges that are fiscally sustainable, but which sacrifice public health and social justice (Eichelberger, 2014). Nevertheless, approaches that focus on efficiencies in household water management, even in the absence of 'modern' piped systems, are producing improved health outcomes in the state (Laderach, 2006).

3. Conceptual framework and methods

This report is a research synthesis of information and data drawn from existing literature and research conducted by the authors from 2014 to 2016 in the Bristol Bay and Kotzebue Sound regions of Alaska (see Penn et al., 2016; Loring et al., 2016), and informed by our combined experiences in rural communities in the North. Communities we visited in the study to which this work is a part range in population from 50 to 3000. Every community operates some form of centralized water distribution and sanitation system, though not all community members in each community had access. Equally, each community operated a comparably unique and distinctive system, with some involving chemical water treatment techniques while others involved simpler cartridge filters (see also US Arctic Research Commission, 2015).

Over the study period, we conducted semi-structured interviews, participated in community tours, and observed municipal

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