

## OPINION

# Integrating data within watershed management and public health

Lars K. Hallstrom \*

Professor of Political Science and Director, Prentice Institute for Global Population and Economy, University of Lethbridge, Lethbridge, Alberta, Canada

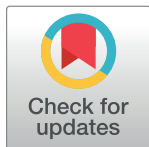
\* [lars.hallstrom@uleth.ca](mailto:lars.hallstrom@uleth.ca)

Although scholars have long drawn attention to the profound social, political and security implications created by changes in water supply, quality, and access [1, 2] in many parts of the world (and particularly Western Canada, where the author currently sits) both the public and policy-makers have historically considered water from the standpoint of perpetual abundance, availability, and quality [3]. However, as very recent events have demonstrated along the Eastern Slopes of the Rocky Mountains have shown, that myth is increasingly, and quickly, dispelled. Many areas of the world are now intimately aware of the immediate effects of anthropogenic climate change, and much of Alberta (for example) is already anticipating severe drought conditions in the summer of 2024, if not already experiencing them.

Beyond the key questions of both water supply and demand that tend to permeate political and policy discussions at both the very local, and very global, levels, water is also a natural resource that provides critical linkages and connections to, and between, ecosystems, human populations, and the activities that take place within our catchments. As a result, while we are inherently aware of the need for water once we don't have it, we are also increasingly aware of how water is a critical input for life (the water resource strategy in the Province of Alberta is actually called "Water for Life") in ways that extend beyond biological functionality, and into the linkages between community development, economic growth or depression, resource extraction, urban planning and design, of recreation, and of course, into questions of ecological, social, political and particularly health equity.

Water has been a critical element for public health since the "Great Sanitary Awakening" of the 19<sup>th</sup> Century [4], and that new emphasis corresponded to a significant change in the way that society thought about cleanliness (including clean drinking water and waste water systems) as a key factor in physical health. When coupled with industrialization, urbanization, crowded living conditions, high levels of population density and socio-economic inequities, the provision of clean water and the necessary infrastructural growth was a major factor in the evolution of public health, and in the realization that issues such as poverty and mental health were not simply individual failings.

Recent years have seen a body of scholars, often working in concert with watershed management and public health practitioners, examine and expand both the data that inform practitioner-knowledge, and the socio-political norms and values that inform both data collection and its use. In addition to the analyses of different ways that public health, health equity and natural resource management can align and trigger both positive feedback for knowledge and practice, as well as potentially negative or attenuating feedback for both ecological and social effects, work in the last few decades has identified watersheds as: (1) a viable, if not desirable setting for public health [5]; (2) a functional variable that can facilitate the integration of health



## OPEN ACCESS

**Citation:** Hallstrom LK (2024) Integrating data within watershed management and public health. *PLOS Water* 3(4): e0000237. <https://doi.org/10.1371/journal.pwat.0000237>

**Editor:** Guillaume Wright, PLOS: Public Library of Science, UNITED KINGDOM

**Published:** April 16, 2024

**Copyright:** © 2024 Lars K. Hallstrom. This is an open access article distributed under the terms of the [Creative Commons Attribution License](https://creativecommons.org/licenses/by/4.0/), which permits unrestricted use, distribution, and reproduction in any medium, provided the original author and source are credited.

**Funding:** The authors received no specific funding for this work.

**Competing interests:** The authors have declared that no competing interests exist.

with environmental considerations [6]; (3) a space in which to link social, ecological and health governance [7]; and (4) an opportunity for watersheds and education to respond to Truth and Reconciliation for Indigenous Peoples [8].

A recurring theme in the increasingly complementary worlds of public policy, social policy, public health, and natural resource management, is one of integration: of getting beyond scientific and bureaucratic silos, of thinking and engaging “holistically”, of recognizing root causes, symptoms, and downstream effects. Despite this need, what is often lacking is a theoretically sound base from which to do so—a starting point from which the cascade, spillover and feedback effects can be both understood and measured. There is no singular answer for this point—it will vary based upon region, population, history and economy. And yet, water may provide one increasingly useful entry point into this question—it not only may help explain the developmental and social dynamics of a region or place, but it may also be the point from which to frame the counter-factual, the pre-requisite “what if” that is required for adaptive governance and decision-making. In other words, “what if” we considered our policy design from the standpoint of water, watersheds and their occupants as a starting point (much in the same way that the European Coal and Steel Commission began “European integration” under the Schuman Plan through the harmonization of infrastructure and transport across state borders.

Doing so requires more than simply having the right data, “thinking about water” and providing those data to the public or to public decision-makers [9]. In order to be “policy useful” such data usage requires an explicit consideration of integration and systems within policy design (including their inclusion in identifying values, audience and context). That inclusion, therefore, can help to underpin our understanding of the “Social Mess,” where waterways and their related sub-systems fall, and in turn how that inclusion shapes our democratic deliberations how to manage that mess [10]. As both Head (recently) and Ehrenfeld (50 years ago) noted, as we engage with policy issues and dynamics that are complex and potentially intractable, we should no longer anticipate that science will provide us with “the answer” [11]. Rather, we must focus upon the management of wicked problems as fundamentally social problems, and therefore understand both problems, and the data with which we assess them, as having inherently political and value-laden dynamics. “Adding water” [6] is perhaps one way of expanding the political and value-based scope of our policy-based discourses.

Recent work in Canada [12] demonstrated that although there are significant data assets across environmental, health and population data (there are, for example, over 500 datasets focused on environment, community, and/or health that are publicly available in the Province of Alberta alone), in many cases the “data landscape” is neither uniform nor comprehensive. Much of the response to the sustainability challenge for Canada, despite openly acknowledging the inter-connection of ecological limits, population change and economic growth, is often driven by localized problems or priorities (such as invasive or highly vulnerable species). The national and provincial responses to Sustainable Development Goals are also driven by, and characterized by, funding and research dynamics that prioritize scientific feasibility, implementation, and locality within key geographic zones over the geographic size, and ecological diversity of Canada. In other words, neither data nor policy responses are necessarily systemic, nor systematized within, let alone across, sectors—water and watershed-based analyses may provide one avenue toward becoming so.

Similarly, while state of the watershed reporting often requires an accounting for condition, pressure and response-based indicators [13], much of the data that informs management and decision-making do not reflect an integrated or integrative approach. Such an approach needs a recognition of the real and meaningful interactions and effects across indicators, measures, and/or indicator suites, that reflect changes in condition, the introduction of new pressures (whether anthropogenic or otherwise), and the introduction of policy-based or economic

responses. While we may be aware of the need to perhaps collect and measure “more” and measure and analyze “better,” we must also be aware of the need to think systemically, across scales of causation and effect, and to consider the values and assumption that underlie our work. In other words, data and the policy sciences (including public health) must consider both axiology and epistemology if we are to move forward in a sustainable and equitable fashion in the 21 Century.

It is important to consider this reconciliation of knowledge and values, axiology and epistemology, within a more practical lens. This call is not simply a request for a return to philosophy and moral theory. It aligns with three core challenges that are often left unacknowledged—the paradoxical need for both specialized knowledge, and collaboration, as complexity increases, and the challenge of both theoretically and operationally manifesting that integration. Such an effort includes work within and across policy sectors, research disciplines, data sources, and decision-making/political units. Perhaps more importantly, it requires an innovative form of thinking—an integrative, rather than bureaucratic, scientific, or political rationality.

## References

1. Schindler DW, Donahue WF. An impending water crisis in Canada’s western prairie provinces. *Proceedings of the National Academy of Sciences*. 2006 May 9; 103(19):7210–6. <https://doi.org/10.1073/pnas.0601568103> PMID: 16606829
2. Hampson FO. Human security. In *Security studies* 2012 May 23 (pp. 301–316). Routledge.
3. Hatt K, Davidson D, Lock I. Power and sustainability. *Consuming sustainability: Critical social analyses of ecological change*. 2005:8–46.
4. Institute of Medicine (US) Committee for the Study of the Future of Public Health. *The Future of Public Health*. Washington DC: National Academies Press (US); 1988. <https://www.ncbi.nlm.nih.gov/books/NBK218218/toc/?report=reader>.
5. Morrison K, Parkes M, Hallstrom L, Neudoerffer C, Bunch M, Venema H. *Ecohealth and watersheds: Watersheds as settings for health and well-being in Canada*. Publication Series No. 3. Winnipeg: Network for Ecosystem Sustainability and Health, the International Institute for Sustainable Development; 2012. <https://www.iisd.org/publications/report/ecohealth-and-watersheds-watersheds-settings-health-and-well-being-canada>.
6. Hallstrom LK, Parkes MW, Guelstorf N. Convergence and diversity: Integrating encounters with health, ecological and social concerns. *Ecosystems, society and health: Pathways through diversity, convergence and integration*. 2015:3–28.
7. Parkes MW, Morrison KE, Bunch MJ, Hallström LK, Neudoerffer RC, Venema HD, et al. Towards integrated governance for water, health and social-ecological systems: The watershed governance prism. *Global Environmental Change*. 2010 Oct; 20 (4): 693–704. <https://doi.org/10.1016/j.gloenvcha.2010.06.001>
8. Integrated Watershed Research Group. Koh-learning in our Watersheds: Transforming education by connecting students, communities and waterways. n.d. (cited 13 October 2022). In: Integrated Watershed Research Group Home (Internet). Prince George: University of Northern British Columbia. <https://www2.unbc.ca/integrated-watershed-research-group/koh-learning-our-watersheds-transforming-education-connecting-students-communities-and-waterways>.
9. Lawton JH. Ecology, politics and policy. *Journal of Applied Ecology*. 2007 June; 44 (3): 465–474. <https://doi.org/10.1111/j.1365-2664.2007.01315.x>
10. Head BW. *Wicked Problems in Public Policy: Understanding and Responding to Complex Challenges*. Cham: Palgrave Macmillan Cham; 2022. <https://link.springer.com/book/10.1007/978-3-030-94580-0>.
11. Ehrenfeld DW. *The Arrogance of Humanism*. New York: Oxford University Press; 1981.
12. Hallstrom LK, Haugen S, Grant P, Emilioju T. *Carrying Capacity Surveillance: Indicators and Frameworks for Equitable Sustainability*. Lethbridge: The Prentice Institute for Global Population and Economy; 2021. [https://www.ulethbridge.ca/sites/default/files/2021/09/report\\_carrying\\_capacity\\_surveillance\\_-\\_indicators\\_and\\_frameworks\\_for\\_equitable\\_sustainability\\_.pdf](https://www.ulethbridge.ca/sites/default/files/2021/09/report_carrying_capacity_surveillance_-_indicators_and_frameworks_for_equitable_sustainability_.pdf).
13. Alberta Environment. *Handbook for State of Watershed Reporting: A Guide for Developing State of the Watershed Reports in Alberta*. Edmonton: Alberta Environment; 2008. <https://open.alberta.ca/dataset/b149604a-28d6-46bd-8618-c283d36f1c0b/resource/1d095661-c668-4cf0-bd46-de81f0fd1cc7/download/handbookstatewatershedreporting-nov2008.pdf>.