

Analysis of Avoided Water Utility Costs from Wildfire Risk Mitigation

Principal Investigator – Dr. Monica B. Emelko, University of Waterloo, 2012-2015

Challenge

Forested watersheds are severely threatened by wildfire in western Canada. The eastern slopes of the Rocky Mountains in southwestern Alberta produce the majority of surface water supplies supporting Alberta's population, and recent increases in magnitude and severity of wildfires along with provincial water demand result in a pressing need to evaluate wildfire risk to downstream drinking water supply and treatment. Work from this project will better enable the coordination of land management and utility operations to ensure appropriate protection and treatment of drinking water in Alberta and potentially other wildfire-prone areas such as British Columbia.

Project

This project focuses on wildfire risk mitigation and avoidance of water utility costs. An econometric approach is being utilized. Specifically, a stochastic cost frontier approach is being used to examine and estimate relationships between drinking water source quality, treatment performance efficiencies, and treatment costs to value changes to utility costs arising from incremental changes in source water turbidity (a key driver of treatment plant infrastructure design and performance) resulting from wildfires in source watersheds.

A key gap that was identified by partners during the course of the research was the need to identify and quantify key operational costs related not only to water quality, but the rate with which it changes. Specifically, there are significant inefficiencies and treatment challenges associated with rapidly changing water quality. A case study approach will be utilized to identify and quantify some of these treatment challenges and costs so that they can be used in subsequent analyses.

Project partners are interested in the extent to which wildfire risk mitigation can result in the avoidance of water treatment costs and/or the risks of water supply interruptions. The research will provide the tools, data, and relationships that will enable organizations and drinking water utilities to evaluate the relative costs and benefits of source water protection approaches as an alternative to infrastructure and operations investments. This project will also provide tools, data and knowledge translation that will enable 1) exploration of the possibility of developing post-wildfire response protocols for critical drinking water supply areas and 2) drinking water providers to develop more informed drinking water safety plans and emergency response plans.

Outputs

This research has resulted in scholarly journal publications and end-user reports:

- Manuscript. In review. Price, J.I., Renzetti, S., Dupont, D., Adamowicz, W., Emelko, M.B. Production Costs, Inefficiency, and Source Water Quality: A Stochastic Cost Frontier Analysis of Canadian Water Utilities. *Land Economics*.

Additionally, this research has been disseminated through several presentations:

- Bladon, K.D., Silins, U., Flannigan, M.D., Emelko, M.B., Dupont, D.P., de Groot, B., Kienzle, S.W., Parisien, M.A., Robinne, F., Schroeder, D., Stone, M., Thompson, D.K., Tymstra, C., Wang, X., Waddington, J.M., Woolford, D.G., Wotton, B.M. Minimizing Wildfire Risk to Municipal Water Works by Active Source Water Protection. AWWA Water Quality and Technology Conference, Long Beach, CA, November 3-7, 2013.
- Silins, U., Bladon, K.D., Wang, X., Robinne, F.*, Emelko, M.B., Flannigan, M., Dupont, D., Parisien, M.A., Renzetti, S., Tymstra, C., Schroeder, D., Thompson, D., de Groot, B., Kienzle, S., Wolford, D., Stone, M., Waddington, M., Devito, K., Wotton, M. Management of wildfire risk to downstream municipal drinking water treatment in Alberta. *Wildland Fire Canada: 2014 Conference*, Halifax, NS, Oct. 7-9, 2014.
- Emelko, M.B., Silins, U. Keynote address. Forests, wildfire, and drinking water security: A mandate for active source water protection. *International Wildland Fire Conference*, Halifax, NS, Canada. Oct. 7-9, 2014.

This research project has held several key end-user oriented workshops:

- 11/04/2014: Western Canada Water / Western Canada Water Environment Association workshop: "Surface water quality and watershed protection: What you need to know", Red Deer, AB.
- 3/09/2015: 40th Annual Alberta Water and Wastewater Operators Association (AWWOA) Seminar, Pre-seminar workshop "Fires, floods, and other extreme events: Is your utility ready?", Banff, AB.
- 10/25/2015: Canadian National Conference on Drinking Water. "Fires, floods, and other extreme events: Is your utility ready?", Whistler, BC.

Outcomes

Outcomes include:

- Increased knowledge with the development of a cost function for estimating water treatment costs based on water quality and treatment typologies. The identification and analysis of additional operating costs associated with highly variable and/or rapidly changing water quality are types of costs that are not commonly identified nor quantified.
- Informing investment decisions with the utilization of the project's cost function analysis (for estimating water treatment costs based on water quality and treatment typology) and identification and anticipated analysis of additional operational costs to evaluate the City of Calgary's drinking water treatment master plan.

- Increased opportunity for future research. Both the developed cost function and the new knowledge regarding operating costs associated with highly variable and/or rapidly changing water quality can be integrated into research focused investigations of water treatment reliability and evaluations of source water protection approaches as an alternative to infrastructure investments.
- Informing investment decisions allowing utilities to make more informed decisions regarding investment in specific types of risk management approaches (e.g., treatment infrastructure vs. source water protection) and increase the ability to manage risks. This will also allow the government to better evaluate the potential cost implications associated with promoting and/or requiring pre-emptive risk mitigation in vulnerable drinking water source watersheds to justify the need for pre-emptive risk mitigation planning in regulatory frameworks such as drinking water safety plans.

Research Team and Partners:

Research Team:

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Highly Qualified Personnel (HQP):