

GRADUATE AND POSTDOCTORAL STUDIES

MCGILL UNIVERSITY



FINAL ORAL EXAMINATION
FOR THE DEGREE OF
DOCTOR OF PHILOSOPHY

OF

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DEPARTMENT OF BIORESOURCE ENGINEERING

**THE ROLE OF ECOSYSTEM SERVICES IN CONFLICTS OVER
POTENTIAL DAM REMOVAL – THE CASE OF THE MACTAQUAC DAM,
CANADA**

26th July 2018
13.00

Macdonald-Stewart Building, MS2-022
McGill University, Macdonald Campus

COMMITTEE:

Dr. S. Bayen (Pro-Dean) (Food Science & Agricultural Chemistry Department)
Dr. V. Orsat (Chair) (Department of Bioresource Engineering)
Dr. J. Adamowski (Supervisor) (Department of Bioresource Engineering)
Dr. E. Bennett (Internal Examiner) (Department of Natural Resource Science)
Dr. M. Clamen (Internal Member) (Department of Bioresource Engineering)
Dr. B. Robinson (External Member) (Geography Department)

Dr. Josephine Nalbantoglu, Dean of Graduate and Postdoctoral Studies
*Members of the Faculty and Graduate Students
are invited to attend*

ABSTRACT

Dams across North America are coming to the end of their planned lifespans. Changing societal values and needs, safety concerns, and high maintenance costs are causing their removal to be increasingly considered. Both constructing and removing dams significantly change river ecology and hydrology, and therefore also the provision of ecosystem services. Such changes affect stakeholders differently, according to their needs, values and perceptions of ecosystem services. Understanding these differential impacts is important to ensure effective and equitable decision making, and as a basis for understanding and resolving any resulting conflict. The aims of this thesis, therefore, were to identify and analyse the social demand for ecosystem services, and analyse the extent to which social demand for ecosystem services underlies stakeholder conflict and how the concept of ecosystem services can be used for its resolution.

A new conceptual framework was developed that linked ecosystem services to stakeholder responses to a decision-making process from a wider range of angles than has been studied to date. The framework focused on social demand for ecosystem services, as opposed to their biophysical provision or economic valuation, as the aspect most directly relevant stakeholders and least studied. Frame theory was used to systematically analyse stakeholders' perceptions of the decision and how differences between them contribute to conflict. The strategic implications of how the decision was framed in terms of scale were explored using theory on the politics of scale. Place meanings were used to explore the emotional dimensions of the conflict. Such theories on stakeholder conflict have not been applied to the unique context of dam removal to date.

The framework was used to explore the case of the Mactaquac Dam on the Saint John River, New Brunswick, Canada. At the time of study, a decision-making process was ongoing to determine whether to rebuild or remove it, triggered by problems in the dam's structure. Study of dam removals to date has been limited to small dams – as a large dam, this was an important test case for other large dams approaching the end of their life.

A qualitative approach was taken to allow an initial exploration of the full range of ecosystem services demanded and how they relate to conflict. Fifty stakeholders, selected using non-proportional quota sampling, participated across two research phases. They represented a range of interests and were located both up and downstream of the dam. In the first phase, semi-structured interviews were used to explore how stakeholders used the river and their opinions on the future of the dam. In the second phase, participatory mapping was used to reveal the spatial distribution of ecosystem service demand and place meanings.

Stakeholders demanded a range of ecosystem services in all categories of the Millennium Ecosystem Assessment (2005). Although there were few differences in the services demanded by those who preferred to retain the dam and those who preferred to remove it, there were clear differences in their uses of the same services and their spatial distribution. The combination of interviews and participatory mapping to elicit ecosystem service demand

allowed potential conflicts of interest to be revealed in ways that would not have been possible using alternative quantitative approaches. Furthermore, participatory mapping was used for the first time to test whether stakeholders could map ecosystem services under future scenarios. Although few individuals could map the locations of ecosystem service change if the dam were removed, the maps served as useful prompts to uncover perceptions of change and its causes.

Stakeholders' interactions with the river through ecosystem services informed how they framed its current state and the decision-making process. Their frames showed loss aversion, as they were less willing to experience a loss than to give up a potential gain. Those who opposed dam removal framed the decision using spatial and temporal scales differently to those who supported it in ways that included or excluded certain arguments from being valid in the decision-making process, and deemed certain groups of people as irrelevant to the decision. The temporal scale was newly revealed as important in scale framing in this context. Stakeholders held numerous intangible place meanings, suggesting a strong connection to specific locations in and around the river, many of which were shared between the two groups and were linked to the biophysical characteristics of the river.

Overall, the study found that a range of ecosystem services were highly important locally and would be affected differently if the dam were removed. Theories of stakeholder conflict revealed that the differing demand for services contributed to conflict development, but also suggested opportunities for its resolution. There was widespread agreement about the importance of ecosystem protection and many shared place meanings. Participatory approaches centred around ecological protection and shared place meanings have the potential to allow stakeholders to be heard, build trust, and potentially resolve conflict.

CURRICULUM VITAE

UNIVERSITY EDUCATION

- 2013-2018** **Ph.D. Bioresource Engineering**
McGill University, Canada
- 2011-2012** **M.Sc. Bioresource Engineering (Integrated Water Resources Management)**
McGill University, Canada
- 2005-2009** **B.Sc. Ecological Science**
University of Edinburgh, UK

EMPLOYMENT

- 2017 – present** **Programme Officer Nature-Based Solutions**
International Union for the Conservation of Nature European Regional Office, Belgium
- 2013-2014** **Course Instructor, Course Lecturer, Teaching Assistant**
McGill University, Canada
- 2012-2013** **Consultant Aquatic Scientist**
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- 2009-2011** **Junior Consultant**
Bio Intelligence Service, France

AWARDS

- 2013-2016 McGill Graduate Excellence Award Bioresource Engineering
2013 Schulich Graduate Fellowship

PUBLICATIONS

- Reilly, K.H.** and Adamowski, J.F., 2017. Stakeholders' frames and ecosystem service use in the context of a debate over rebuilding or removing a dam in New Brunswick, Canada. *Ecology and Society*, 22(1): 17.
- Reilly K.H.** and Adamowski, J.F., 2017. Spatial and temporal scale framing of a decision on the future of the Mactaquac Dam in New Brunswick, Canada. *Ecology and Society*, 22(3): 21.
- Reilly, K.H.**, Adamowski, J.F., John, K., 2018. Participatory mapping of ecosystem services to understand stakeholders' perceptions of the future of the Mactaquac Dam, Canada. *Ecosystem Services*, 30: 107-123.
- Reilly, K.H.**, Adamowski, J.F., John, K. The role of place meanings in opposition to water-related infrastructure projects – the case of the Mactaquac Dam, New Brunswick, Canada. Submitted to *Ecology and Society*.