

UNDERSTANDING LANDSCAPE VALUES AND BASELINES OF ACCEPTABILITY ON
THE MACTAQUAC DAM AND HEADPOND, NEW BRUNSWICK

by

Kristina Keilty

Submitted in partial fulfilment of the requirements
for the degree of Master of Environmental Studies

at

Dalhousie University
Halifax, Nova Scotia
August 2015

© Copyright by Kristina Keilty, 2015

TABLE OF CONTENTS

LIST OF TABLES	vi
LIST OF FIGURES	vii
ABSTRACT	ix
LIST OF ABBREVIATIONS USED	x
ACKNOWLEDGMENTS	xi
CHAPTER 1 INTRODUCTION	1
1.1 STATEMENT OF THE PROBLEM	1
1.2 CONCEPTUAL FRAMEWORK	2
1.3 CONTEXT: THE MACTAQUAC DAM AND HEADPOND	5
1.4 SITE RATIONALE	8
1.5 PURPOSE OF THE STUDY	10
1.6 RESEARCH QUESTIONS	10
1.7 CHAPTER SUMMARY	11
1.8 LIMITATIONS	11
1.9 THESIS OUTLINE	12
CHAPTER 2 LITERATURE REVIEW	13
2.1 INTRODUCTION	13
2.2 RENEWABLE ENERGY	13
2.3 ENERGY LANDSCAPES	14
2.4 SOCIAL IMPLICATIONS OF RENEWABLE ENERGY	15
2.5 LANDSCAPE AND AESTHETICS	18
2.6 PLACE	21
2.7 HYDROPOWER DAMS	24
2.7.1 Dam Construction	24

2.7.2 Dam Removal	26
2.8 GAPS IN THE LITERATURE	28
2.9 CONCEPTUAL FRAMEWORK	29
2.10 CHAPTER SUMMARY	30
CHAPTER 3 RESEARCH METHODS	32
3.1 RESEARCH DESIGN AND METHODS	32
3.2 CONSTRUCTIVIST FRAMEWORK	32
3.3 VISUAL RESEARCH METHODS	33
3.4 THE STUDY AREA: THE MACTAQUAC DAM AND HEADPOND	36
3.5 RECRUITMENT	38
3.5.1 Recruitment Challenges	42
3.5.2 Recruitment Summary	43
3.6 DATA COLLECTION METHODS	45
3.6.1 The interview guide	45
3.6.2 Map elicitation	47
3.7 DATA ANALYSIS METHODS	49
3.7.1 Deductive coding stage	50
3.7.2 Inductive coding stage	51
3.7.3 Semi-quantitative matrix analysis	52
3.8 CHAPTER SUMMARY	53
CHAPTER 4 ADAPTIVE BASELINES OF ACCEPTABILITY ON THE MACTAQUAC HYDROELECTRIC DAM AND HEADPOND, NEW BRUNSWICK, CANADA	55
4.1 ABSTRACT	55
4.2 INTRODUCTION	56
4.2.1 Conceptual Framework	59

4.2.2 Research Questions	62
4.3 METHODS	63
4.3.1 The Case	63
4.3.2 Data Collection	67
4.3.3 Data Analysis.....	71
4.4 RESULTS	75
4.4.1 Results by Cohort	77
4.4.2 Results by Theme	85
4.5 DISCUSSION	89
4.5.1 Perceptions of the dam and headpond landscape today and in the future	90
4.5.2 How do baselines of acceptability help to explain one’s acceptance or rejection of landscapes associated with hydroelectric energy?	93
4.5.3 Implications for management	95
4.5.4 Limitations.....	98
4.6 CONCLUSION.....	99
CHAPTER 5 THE MACTAQUAC DAM AND HEADPOND: UNDERSTANDING RESILIENCY AND ADAPTATION TO LANDSCAPES OF ENERGY	100
5.1 PREAMBLE	100
5.2 PLACE	101
5.3 RESILIENCE.....	102
5.4 THE ADAPTIVE CYCLE.....	104
5.5 THE CASE OF THE MACTAQUAC DAM AND HEADPOND.....	107
5.6 LIMITATIONS.....	117
5.7 IMPLICATIONS FOR MANAGEMENT.....	118
5.7.1 Adaptability and resilience of the community and lifestyle	118
5.7.2 Landscape Implications	119

5.8 RECOMMENDATIONS FOR FURTHER RESEARCH	124
5.9 CONCLUSION.....	125
CHAPTER 6 CONCLUSION.....	128
REFERENCES	131
APPENDIX A RECRUITMENT FLYER.....	148
APPENDIX B TELEPHONE SCRIPT	149
APPENDIX C SCREENING QUESTIONS	150
APPENDIX D INFORMATION LETTER.....	151
APPENDIX E INFORMED CONSENT	155
APPENDIX F INTERVIEW GUIDE.....	156
APPENDIX G SCATTERPLOT DIAGRAM.....	159

LIST OF TABLES

Table 1. Summary of participants and their gender per cohort.....	41
Table 2. Summary of participants per cohort.....	75
Table 3. Themes of sentiment or observation derived through inductive coding paired with the themes description of how each was recognized in the data.	76
Table 4. Example quotes showing positive and negatives views across the different cohorts and time periods related to the six broad themed areas (Figure 11).....	88

LIST OF FIGURES

Figure 1. Baselines of Acceptability Model	3
Figure 2. The Development of public attitudes towards wind, often termed the U-curve of acceptability (Wolsink, 1994, 2007).	18
Figure 3. Viewshed map of the study area (created by Kate Sherren, 2013). The light grey shading shows the areas, between the dam and Nackawic, that are visible from the headpond.....	38
Figure 4. GSC Preliminary Geology Series map of Woodstock-Fredericton, NB based on surveys compiled by F.D Anderson and W.H Poole (1959), accessed via Geogratias and georeferenced by Kate Sherren (2013). The original map has been overlaid with the dam, water bodies, provincial parks, highways and municipal areas (2014) (GeoNB).	49
Figure 5. Baselines of Acceptability Model	60
Figure 6. The study area (shown in yellow) was between Hawkshaw and French Village and included those who are able to see the headpond, based on viewshed analysis in GIS (created by Kate Sherren, 2013).....	66
Figure 7. Cohort descriptions.....	67
Figure 8. Map used during interviews, printed at a size of 60cm x 90cm GSC Preliminary Geology Series map of Woodstock-Fredericton, NB based on surveys compiled by F.D Anderson and W.H Poole (1959), accessed via Geogratias and georeferenced by Kate Sherren (2013). The original map has been overlaid with the dam, water bodies, provincial parks, highways and municipal areas (GeoNB 2014).	70
Figure 9. Matrix of themes elicited and number of passages coded in the intersection of cohort and time period (rows) and themes (+/-) (columns). Bolded numbers indicate a theme expresses by 75% or more participants in the cohort. These bolded items are represented diagrammatically in Figures 10 and 11.....	74
Figure 10. Themes elicited by each cohort per time period. Red shapes indicate negative themes and blue shapes indicate positive themes. Rectangles represent themes shared by multiple cohorts in a given time period and ovals represent themes unique to the cohort in a given time period. Note only themes expressed by 75% or more of the cohorts are illustrated.	78
Figure 11. Positive (bold) and negative (pale) themes associated with each time period of the Mactaquac landscape by theme:	79
Figure 12. The adaptive cycle. The fore loop is indicated by the light grey and the back loop is indicated by the dark grey. (Gunderson & Holling, 2002)	105

Figure 13 The Panarchy model, illustrated through nested adaptive cycles (Gunderson & Holling, 2002)..... 106

Figure 14. The adaptive cycle illustrating the Mactaquac area as the community and landscape faced dam construction. Phases 1 and 2 indicate pre-dam periods. Phase 3 is defined by the upheaval of dam construction. Phase 4 is characterized by the community’s successful re-establishment post dam construction..... 108

Figure 15. Newspaper advertisement from APDSJR in opposition of the construction of the dam (1966) from the Provincial Archives of New Brunswick (Public Archives of New Brunswick, scrapbook entry including glue damage). 110

Figure 16. The adaptive cycle illustrating the community and landscape post dam construction. A new equilibrium, state of stability has been found (Phases 1 and 2) and the dam’s potential removal is being view as having the potential to push the system in the back loop again (as the dam construction did in the 1960s)..... 113

Figure 17. Visualizations of the three options for the future of the Mactaquac Dam and headpond landscape..... 122

ABSTRACT

Due to the growing interest in sustainable energy futures, jurisdictions at all scales are exploring options to reduce dependencies on dwindling fossil fuel reserves and moving forward with renewable energy generation. In the pursuit of a sustainable energy future, we have to understand not only the economic and environmental implications that renewable energy infrastructure will have but also the social implications of such changes. The purpose of the study was to understand how local residents can come to accept utilitarian energy infrastructure in their landscape. The study used a hydroelectric dam and headpond facing potential removal to understand public perception and landscape values. Dam removal and rebuilding decisions are going to increase as dams continue to age and the Mactaquac Dam offers us a case study to understand the emotions and values that citizens have felt throughout the current lifespan of the dam and what this means for renewable energy transitions.

The Mactaquac Dam is the Canadian Maritime Provinces' largest dam, producing 670 MW of power and creating a 96-kilometre headpond. Communities, roads, and farms were flooded during its construction in 1967, displacing many families and businesses. Unfortunately, the Dam has now reached the end of its lifespan (earlier than expected due to compromised aggregate in its cement structures) and the utility (and province) face a major decision. The Dam will either be removed, (allowing the river to flow freely), rebuilt (maintaining the headpond and power generation), or left in place without producing power (maintaining only the headpond).

In the study, twenty citizens from four demographic groups were interviewed to understand their views towards the landscape in the past, present, and future to determine if generational change was required to accept the headpond landscape. The cohorts consisted of residents who: (1) lived and owned property prior to dam construction; (2) were children during construction; (3) grew up in the new headpond landscape; and (4) moved into the area to live in the headpond landscape. This project adapted the Baselines of Acceptability Model to understand how individuals valued the landscape through time.

The project found that most individuals, across all four cohorts, presently value the headpond landscape, a landscape many term as 'normal' or 'natural'. Citizens noted that the headpond landscape provides recreational benefits, offers an ideal lifestyle and overall, is aesthetically pleasing. This pattern of perceiving new benefit indicates that baselines of acceptability, in the context of energy landscapes, are adaptable based on experience in the landscape. The study found that baselines of acceptability are fluid, not generational (set based on first experience). An alternative explanation may lie in the adaptive cycle framework. The thesis describes the process by which attachment is formed to the landscape following such large-scale disruption, drawing links to renewable energy transitions more broadly.

LIST OF ABBREVIATIONS USED

AAR – Alkali-Aggregate Reaction

APDSJR - Association for the Preservation and Development of the St. John River in its Natural State

GIS – Geographic Information System

GSC – Geological Survey of Canada

NSERC –Natural Sciences and Engineering Research Council of Canada

PPGIS – Public Participation Geographic Information System

SES – Social-Ecological Systems

WWF – World Wildlife Fund

ACKNOWLEDGMENTS

I need to thank many people for their support and dedication to my research and this thesis. I am grateful to my supervisor Kate Sherren for welcoming me onto this project and for her guidance and support with my research goals from the first day on the ‘flocus’ group houseboat tour to the very end of my own research. Kate, you pushed me to keep my work my own and ensure I meet my own goals throughout the research process. I have truly enjoyed my work with you and my experience as a Masters student. I am also thankful to my committee member Tom Beckley for his continued support and ideas throughout the proposal and writing processes. Thanks, Tom, for always bringing new ideas to the table. I must also thank the entire ‘energy team’ for their interest in my work and pushing my research forward. Our research retreats and conferences together were both academically and socially enriching.

I have to thank my SRES family, and all my grad school friends, who got me through the roller coaster of grad school. Thank you for all your help and support through the ups and downs, and for all the potlucks, card games, and ‘fireworks’ that made our time together that much more.

Next I have to thank Beth for her patience, motivation and support; I know I would not have gotten through the long days without you by my side.

And finally to my parents whose support has never wavered no matter what challenge I have decided to take on throughout my life. You have made me the person I am today and I am so thankful for your love and constant support.

CHAPTER 1 INTRODUCTION

1.1 STATEMENT OF THE PROBLEM

Due to the growing interest in renewable energy, for reasons of climate change mitigation and sustainable energy production, jurisdictions at all scales are exploring options to reduce dependencies on dwindling fossil fuel reserves. Renewable energy is often acknowledged as a means to a secure energy supply, a positive production method for environmental concerns and sustainability, and a practical method for economic growth related to technological innovation, employment, and community prosperity (Edenhofer et al., 2013; IRENA, 2015; Onat & Bayar, 2010). However, despite the benefits of renewable energy, the path forward is not without its challenges (Cohen, Reichl, & Schmidthaler, 2014). Despite global policy goals in place to increase sustainable energy, it is important to acknowledge and understand the complexities of this transition, specifically the social implications that commonly go unrecognized or are underappreciated (Miller, Richter, & O’Leary, 2015; Sovacool et al., 2015). In fact, societal resistance is often one of the greatest impediments to renewable energy implementation (Karimi, 2005).

Renewable energy infrastructure is often smaller and lower in net gain compared with non-renewable energy infrastructure, meaning that the number of required physical infrastructure units to produce sufficient energy are greater in number, affecting more people and more landscapes (Firestone, Bates, & Knapp, 2015; Nadaï & van der Horst, 2010; Wolsink, 2012).

Renewable energy production infrastructures, specifically solar, wind and hydro, require the use of non-transportable natural resources for energy production, meaning the associated infrastructure may also be more geographically distributed in order to make use of the non-transportable resources required. The actual and perceived impacts of these diverse and

distributed energy installations has driven an interest in understanding the landscape implications of energy relationships and the social opposition that continues to arise as a result (Pasqualetti, 2011; Walker, Wiersma, & Bailey, 2014).

Humans often become attached to their surrounding landscapes irrespective of their aesthetic, ecological, or cultural values to an outside observer. In order to understand landscapes of energy, it is important to understand the connections that communities and individuals hold towards their local landscapes. Community attachment, landscape aesthetics, and lifestyle changes are all important social concerns that need to be understood. Energy infrastructure developments may thus threaten citizens' existing subjective connections to the landscape (Bell, Gray, Haggett, & Swaffield, 2013; Devine-Wright, 2009, 2011; Selman, 2010; van der Horst & Vermeulen, 2012; Wolsink, 2007; Wüstenhagen, Wolsink, & Bürer, 2007). In the context of energy landscapes, some citizens see energy landscapes as aesthetically displeasing, and as intrusions into a landscape's natural beauty (Devine-Wright, 2009; Selman, 2010). Others, however, hold the view that energy landscapes represent innovation, sustainability and positive environmental health, and that such symbolism can drive cultural acceptability (McLachlan, 2010; Selman, 2010). In order for the world to make a large-scale transition to renewable energy it will be crucial to understand how such views about the landscape are held and expressed by citizens, and if and how those values change.

1.2 CONCEPTUAL FRAMEWORK

A Baselines of Acceptability Model will be used as the overarching framework of analysis, developed in the study to synthesize the work of several scholars working in the field of

landscape norms (Figure 1). The framework has four quadrants across two axes representing the changeability of the values, and the level (individual or societal) of the norms.



	Individual level	Societal level
Hardwired   Dynamic	1. Generational Baselines (Kahneman, 2011; Pauly, 1995)	3. Evolutionary Baselines (Kaplan, 1987; Selman, 2010)
	2. Experiential Baselines (Wolsink, 1994, 2007)	4. Cultural Baselines (Selman, 2010)

Figure 1. Baselines of Acceptability Model

The first quadrant titled *generational baselines* is based on Pauly’s (1995) shifting baselines syndrome concept, whereby people use the first environment they are exposed to as their baseline of acceptability. Developed in the context of fisheries, Pauly (1995) describes how new fisheries managers accept the fish quality and composition they first encounter as a baseline, and measure change from there however degraded or diminished that first ecosystem may be compared to earlier points in time. This quadrant is thus associated with rigid individual norms, shifting only with subsequent generations. In the context of landscape research, the acceptable baseline would be the landscape one first sees or experiences being set as normal, against which once can measure alternative forms of the same landscape or landscapes elsewhere. This is

similar to Kahneman's (2011) concept of 'anchoring' which describes how humans often rely on the first piece of information available to them and make decisions and judgments from this point.

The second quadrant, titled *experiential baselines*, is based on the work of Wolsink (1994, 2007) indicating that individuals may support the idea of wind energy, but reject the siting of wind farms in their communities. However, despite this initial opposition to the wind infrastructure when first constructed, over time researchers have observed that individuals adapt and often learn to appreciate and see the public value of the wind turbine or wind farm (Wolsink, 2007). Thus quadrant two recognizes that landscape baselines can be changed or adapted based on new perceptions of value and benefit. This quadrant assumes that when one experiences benefit or new value in a landscape, one may adapt their baseline to see this as acceptable or even ideal (Devine-Wright, 2005; Wolsink, 1994, 2007). For example, people can learn to love wind farms if they perceive the landscape to represent a low carbon future, or a means to local energy security or even financial profit, versus aesthetic damage or landscape intrusion.

The first two quadrants represent values at the individual level. The second two quadrants (three and four) look at baselines on a societal level. Quadrants three and four are based on Selman's (2010) understanding of the two ways in which landscape values can be influenced. Selman (2010) talks about two types of societal level baselines. The first I have termed *evolutionary baselines*, which refers to those baselines perceived to be ingrained in humans, or biologically set. Similarly, Kaplan (1987) noted humans hold aesthetic preferences based on evolutionary meaning. The last quadrant, referred to here as *cultural baselines*, refers to the idea of baselines being malleable and influenced by culture; this implies the same concept as the experiential

quadrant, that tastes, values and preferences can change over time (Selman, 2010). There is interplay between these two quadrants as changes to individual values drive what becomes societally desirable and vice versa.

The model was developed to help explore how landscape values are determined, developed and altered. The model was used to structure the study's test and understand whether baselines of acceptability in the context of renewable energy landscapes are concrete or malleable at an individual level. Understanding how baselines are formed and how they shift could be a key component to understand how citizens react to energy infrastructure in the future and to predict if and how communities can adapt and come to accept renewable energy infrastructure in the landscape.

1.3 CONTEXT: THE MACTAQUAC DAM AND HEADPOND

Mactaquac, New Brunswick (NB), is the site of the Maritimes' largest hydroelectric dam which began generating power in 1968 (NB Power, 2013). The Dam is located 19 km upriver of the provincial capital of Fredericton and maintains a 96-km reservoir or headpond (NB Power, 2013). The Mactaquac Dam has a generating capacity of approximately 670 MW, thus able to supply 12% of New Brunswick's power (NB Power, 2014d). Additionally, the Dam's powerhouse is able to come online when other supplies fail, termed 'bootstrapping', starting up the electrical power system when needed. Hundreds of families had land expropriated prior to dam construction and numerous businesses and historically significant buildings were lost when flooding submerged the land adjacent to the river (Lawson, Farnsworth, & Hartley, 1985; Si, 1993). The stress of relocation and the emotional strain of losing important and memorable landscapes and landmarks were difficult on the communities in the flood zone of the Mactaquac

Dam (Bourgoin, 2013; Si, 1993). The dam opposition movement was focused on preserving history and sentiment, whereas dam support was based on viewing construction as a means of progress and modernization (Bourgoin, 2013). The dam altered the St. John River Valley and ecosystem from Hartland to Mactaquac (Si, 1993). For example, the area lost much of the best farming land, locally known as the *intervale*, when the area was inundated (Lawson et al., 1985). *Intervale* land, a term primarily used in New England and New Brunswick, describes the low-lying rich fertile floodplain land along the river. Today, 47 years later, a provincial park, a marina and other new businesses (such as a houseboat rental company) rely on the headpond. In addition, many new homes have been built along the water, especially since the new TransCanada highway routed heavy traffic away from the river in the mid-2000s. The headpond today is valued for its recreational opportunities and lake-like landscape (NB Power, 2014a).

The power station and spillway are expected to reach the end of their lifespan in 2030 (30 years earlier than anticipated). This is due to a problem with the concrete known as alkali-aggregate reaction (AAR) whereby the concrete paste is reacting with the silica concentrates in the gravel and sand that make up the concrete (NB Power, 2014d). AAR is affecting the concrete of the spillways and the powerhouse, causing these structures to absorb water, making them swell and crack over time (NB Power, 2014d). The earthen dam, the structure that holds back the headpond, is not affected by this problem (NB Power, 2014d). Three possibilities are currently being considered: (1) the concrete spillway and power house will be rebuilt; (2) the dam will be removed completely (restoring the river by removing the spillways, earthen dam and powerhouse) or; (3) the earthen dam will be left in place and a new spillway will be built to maintain the headpond (the dam would no longer generate power) (NB Power, 2014e). The costs

of these solutions are estimated to range from \$3 billion (removal) to \$5 billion (to rebuild the power house and spillway) (NB Power, 2014c).

The Mactaquac Dam dramatically changed the physical, ecological, economic, and social environments of the St. John River Valley. The residents now living in the area and the ecosystem that presently exists will thus be affected if the decision is made to remove the dam. Research into the biophysical and restoration implications of the options is being undertaken by the World Wildlife Fund (Mitchell, 2012) and the Canadian Rivers Institute (Canadian Rivers Institute, 2011). The biophysical ecosystem study through the Canadian Rivers Institute is being supported by a \$2.3 million investment from NB Power and a recent \$2.8 million grant from the National Science and Engineering Research Council of Canada (NSERC) (NB Power, 2015a). Additionally, Dillon Consulting Limited was awarded contracts from NB Power to undertake an engagement process with the affected First Nations groups starting in 2013 (Government of New Brunswick, 2013; cost unknown) and in 2015 a small (~\$50,000 from NB Power) socioeconomic impact study with the other communities and individuals in the area. Implications of the potential dam removal decision as it will affect the social dimensions of Mactaquac have not yet been rigorously explored. The proposed decisions and the pre-existing opinions of the locals make Mactaquac an interesting test site to explore people's perceptions of the landscape and to understand the values they have attached to it. Through groups such as the Friends of Mactaquac Lake it is apparent that the dam decision is being hotly debated in the community (The Daily Gleaner, 2013). The dam decision also became an election issue in the fall of 2014 (CBC News, 2014).

In addition to the Mactaquac Dam, the political climate around energy in general is currently quite charged in the province. As described above, decisions concerning New Brunswick's energy future are imminent. If the decision is made to remove the dam, power demands will have to be shifted, thus placing new dependence on other energy production technologies and sources.

NB Power has recently refurbished the Point Lepreau Nuclear reactor, New Brunswick's 700-MW nuclear generating station (Canadian Nuclear Safety Commission (CNSC), 2013). The Point Lepreau generating station can produce a third of New Brunswick's power (Canadian Nuclear Safety Commission (CNSC), 2013), but it has had operational issues. Nuclear, however, has a negative stigma in the area (further intensified by a chemical leak in November 2013; CBC News, 2013) and a history of high costs that make citizens hesitant to support it (Bisset, 2013).

Wind energy has also been developed in New Brunswick as a result of the 'Power Shift Atlantic' program, which has placed wind at the forefront of renewable energy development on the Atlantic Agenda (PowerShift Atlantic, 2013). Efforts are also under way to reduce and shift energy demands through smart grid technology, specifically looking to develop Canada's first 'energy internet' to allow greater consumer-home communication (NB Power, 2015b). New Brunswick's energy challenges make the Mactaquac Dam decision a relevant issue to citizens outside the area as well as inside.

1.4 SITE RATIONALE

Renewable energy infrastructure and its effects on social landscape values and place attachment are not new topics of research. Much of the existing social energy research, however, focuses on wind power and solar power, due to their potential for aesthetic and health implications and some continuing social opposition. Hydropower dams are still the most common and most efficient

form of renewable energy as hydro turbines can convert upwards of 80% of available energy into power (IPCC, 2011; Onat & Bayar, 2010; REN21, 2014), and hydropower development is continuing around the world (Zarfl, Lumsdon, & Tockner, 2015), disrupting hydrology, land cover, and land use over large areas. Additionally, dammed waterways, for the purposes of irrigation, flood control, and drinking water will continue to increase as adaptation measures to manage global change (Downing et al., 2006). Worldwide impoundments are estimated to cover over 260,000 km² (Downing et al., 2006). Although a few studies have looked at the social implications of dam construction and removal (Johnson & Graber, 2002; Namy, 2007; Sarakinos & Johnson, 2003), gaps still remain. There has been a lack of research on the social implications of dams, specifically social adjustment and connection to large dams such as the Mactaquac Dam, and the apparent lack of end-of-life planning in such projects (Doyle, Stanley, Harbor, & Grant, 2003; Sarakinos & Johnson, 2003; Zarfl et al., 2015).

Since AAR has shortened the life span of the Mactaquac Dam, this case also presents an opportunity to explore citizen perceptions of pre-dam, current, and potential post-dam landscapes with individuals who could have direct experience with all three thus allowing the opportunity to look at a dam's life cycle through a social lens. Much research on energy development is done on greenfield sites with respect to the natural environment (Zarfl et al., 2015). Some research on dam removal has focused on how removal would affect the present community and environment (Lejon, Renofalt, & Nilsson, 2009). The Mactaquac Dam and headpond thus affords an opportunity for a natural experiment to understand how landscape attachment is developed to utilitarian features and how experience with such a change and connection to such a landscape affects preferences for future options.

1.5 PURPOSE OF THE STUDY

The purpose of the study is to understand how people view the Dam and headpond landscape and understand how people come to accept energy infrastructure in the landscape. It is expected and desirable that renewable energy infrastructure developments will increase in the future, as energy demands grow and renewable energy sources are leveraged to meet these demands over non-renewable sources. Foreseeing this increase in infrastructure, it is important to understand the social implications of such changes, to aid in anticipating and defusing opposition where appropriate. The Mactaquac site will be used to first understand how the locals experience dam construction and the resulting headpond landscapes and to find lessons for the renewable energy transition more generally.

1.6 RESEARCH QUESTIONS

Specifically, the study is designed to answer the following questions and sub questions:

- 1) How do nearby residents perceive the dam and headpond landscape and what do they wish for its future?
- 2) How do baselines of acceptability help to explain local acceptance or rejection of landscapes associated with hydroelectric energy?
 - a) Do attitudes differ by generation?
 - b) Can positive experiences adjust individual baselines of acceptability?
- 3) What are the implications of the above for:
 - a) The Mactaquac decision
 - b) Dam construction and removal decisions elsewhere

c) Landscape changes associated with renewable energy transitions.

1.7 CHAPTER SUMMARY

This chapter introduced the purpose, context, and need for this research on the Mactaquac Dam and headpond to understand how people view renewable energy infrastructure in their local landscapes and how acceptance and attachment towards an energy landscape is developed. As described in this chapter, renewable energy infrastructure is becoming more prevalent in landscapes and will continue to increase as the drive for sustainable energy development grows. Mactaquac offers a case where the creation of a renewable energy landscape, and its potential removal, occur within individual human lifespans, and further understand how both these events affect the community and their values towards the landscape. Understanding citizen values towards current energy infrastructure could assist in the creation and implementation of future energy plans and policies for communities faced with renewable energy construction in their beloved landscapes.

1.8 LIMITATIONS

The study was limited to the present community population, and only individuals who still live in the area were interviewed. Former residents that left before, during, or after dam construction were unable to be heard in the study. Those individuals who left the area may have a very different story to tell. Additionally, the study looked to interview only residents above the dam, potentially missing different opinions from those who live downstream from the dam.

1.9 THESIS OUTLINE

The thesis will be presented in the following four chapters. Chapter 2 will introduce and discuss the current bodies of literature related to this research and situate this case within them. Chapter 3 will describe the methods employed to undertake the study and why such methods were used. Chapter 4 will be presented as a stand-alone manuscript describing the narrative that exists in the Mactaquac community, specifically detailing the views and values felt by the community members at the different time periods throughout the Dam's life cycle. This document will answer the research questions proposed above, employing the Baselines of Acceptability Model as the overarching framework. Chapter 5 will serve as an expanded discussion proposing resilience theory as an alternative explanation for the research findings, suggesting future research opportunities and next steps in the context of social energy study research. The final chapter, Chapter 6, will present overall conclusions from the research more broadly. In order to make Chapters 4 a stand-alone document, some information from Chapters 2 and 3 will be repeated.

CHAPTER 2 LITERATURE REVIEW

2.1 INTRODUCTION

Increasing energy demands, climate change, and dwindling fossil fuels are a few of the reasons the global energy sector is turning its attention to renewable energy sources (International Energy Agency, 2014; IPCC, 2011; REN21, 2014; Shafiee & Topal, 2009). A future of renewable energy production has numerous environmental, social, and economic benefits but with these benefits come drawbacks and challenges that need to be evaluated. The aim of this section is to present background information and a review of the literature applicable to energy studies research, useful in understanding the Mactaquac Dam case. This section will look at renewable energy, energy landscapes, and some of the social impacts and considerations that need to be evaluated to aid in a successful renewable energy transition. Landscape and place theories will be presented connecting theory to the social implications of renewable energy landscapes. Next, an in-depth summary of hydropower dams, specifically focusing on dam construction and dam removal, will be presented to give context to the case of the Mactaquac Dam and headpond. Lastly, gaps in the literature will be identified.

2.2 RENEWABLE ENERGY

Due to declining fossil fuel sources (Shafiee & Topal, 2009), rising greenhouse gas emissions (IPCC, 2011), new energy policies (REN21, 2014) and rising energy demands, renewable energy sources are becoming more prominent in the energy industry. In 2012, renewable energy accounted for 19% of global energy consumption and this percentage is continuing to grow (REN21, 2014). By 2040, energy demands are estimated to increase by 37% and the energy mix

is anticipated to be represented equally by oil, gas, coal, and renewable energy (International Energy Agency, 2014). Renewable energy development is linked to the development of a sustainable future (Dincer, 2000; Stigka, Paravantis, & Mihalakakou, 2014). In 2014, 138 countries had renewable energy policies in place, and 144 countries had set renewable energy targets; only 48 countries had targets 10 years earlier (REN21, 2014). In recent decades, costs associated with construction, operation, and production of renewable energy have been decreasing with technological advancements, making renewable energy more practical and feasible (International Energy Agency, 2014; IPCC, 2011; REN21, 2014; Trancik, 2014). Additionally, the growing renewable energy sector is estimated to support 7.7 million jobs (IRENA, 2015). A transition to a renewable energy future presents many social, environmental, and economic benefits, however, the challenges of this transition must also be recognized. Specifically, the shift from conventional energy production to decentralised renewable energy production has resulted in a complex discussion focused on production infrastructure placement in the landscape (Graham & Rudolph, 2014).

2.3 ENERGY LANDSCAPES

The implementation of renewable energy infrastructure is creating a new type of landscape. ‘Energy landscapes’ refer to the construction of energy production infrastructure in the landscapes. Energy landscapes resulting from renewable energy sources such as wind and hydro are seen to cause social disruption (Pasqualetti, 2011), just as nuclear and hydro technologies did when they were first introduced on a large scale. The increasing demand for renewable energy is placing a new importance on the understanding of the landscape-energy relationship (Pasqualetti, 2011) as energy is anticipated to be the number one driver of landscape transformation in the

coming decades (Nadaï & van der Horst, 2010). Renewable energy infrastructure is often smaller in scale (compared with non-renewable energy infrastructure) and has a lower net energy gain, meaning the number of required physical infrastructure units to produce sufficient energy are greater, affecting more people and a larger area (Firestone et al., 2015; Nadaï & van der Horst, 2010; Wolsink, 2012). Some renewable energy production infrastructures, specifically solar, wind and hydro, use non-transportable natural resources for energy production, meaning the associated infrastructure may be more geographically dispersed and more visible in order to benefit from these resources (e.g. line of sight for sun, ridges for wind, or populated valleys for natural running water) (Boon & Dieperink, 2014; Coleby et al., 2012; Fernandez-Jimenez et al., 2015; Nadaï & van der Horst, 2010; West, Bailey, & Winter, 2010; Wüstenhagen et al., 2007). For these reasons the siting of renewable energy infrastructure and the effects this transition will have on communities continues to be a highly contested issue (Graham & Rudolph, 2014; Walker et al., 2014). The social dimensions, namely the impacts and consequences of energy systems, are largely unrecognized and under-investigated, leading to further disconnect between energy technology and user adoption (Sovacool et al., 2015). Furthermore, energy policies are still focused on techno-economic problems and goals, largely disregarding the social context of energy systems (Miller et al., 2015). The following section will investigate the present literature body as it relates to social opposition and support for renewable energy.

2.4 SOCIAL IMPLICATIONS OF RENEWABLE ENERGY

Societal resistance to renewable energy has been seen to be a critical hurdle in the transition to a renewable energy future (Karimi, 2005). There is recognition that renewable energy is socially and politically endorsed at the societal level but often a contentious issue at the local scale when

the project becomes of a personal nature (during siting and implementation stage) (Bell, Gray, & Haggett, 2005; Bell et al., 2013). Humans can grow attached to their home landscapes regardless of the aesthetic, ecological or cultural value to the outside observer (Gustafson, 2001; Lothian, 1999). Energy infrastructure developments can threaten this connection by threatening the integrity of a landscape a person or community has come to value (Bell et al., 2013; Devine-Wright, 2009, 2011; Selman, 2010; van der Horst & Vermeulen, 2012; Wolsink, 2007; Wüstenhagen et al., 2007).

Numerous studies have looked at the impacts of a variety of renewable energy sources.

McLachlan (2010; 2009) found resistance to biomass development and wave energy due to reasons of aesthetics and visual impacts, specifically the issue of technologies ‘not fitting’ with the natural environment, causing a clash of place meanings. Solar development has also seen opposition for reasons of ‘observability’ and negative visual impacts (Fernandez-Jimenez et al., 2015). Dam construction has been seen as a threat to natural environments and landscapes, as dams are seen to transform areas (Brown, Tullos, Tilt, Magee, & Wolf, 2009; Namy, 2007; Zarfl et al., 2015). Dam removal projects have seen social resistance as well, due to perceived losses of aesthetics, cultural landscapes and recreational benefits (River Alliance of Wisconsin & Trout Unlimited, 2000; Wyrick, Rischman, Burke, McGee, & Williams, 2009).

However, despite the prominent view that renewable energy sources have negative impacts and are socially opposed, studies have found places and communities where this is not the case and renewable energy is actively accepted. Warren, Lumsden, O’Dowd and Birnie (2005) found strong support for wind development in Ireland and Scotland. Support was so strong in some areas that they noted an inverse NIMBY syndrome, whereby those living closest to a wind

project supported wind energy more (Warren, Lumsden, O'Dowd, & Birnie, 2005). In Greece, Kaldellis *et al.* (2013) found high levels of acceptance for wind farms, small hydropower projects and solar energy production. This is likely because citizens strongly opposed the thermal plant in the area that had caused major environmental issues, and they sought alternative means of energy production (Kaldellis, Kapsali, Kaldelli, & Katsanou, 2013). Samsø, Denmark, the first island in the world to be entirely powered by renewable energy, shows the strength and value of community ownership and local investment when promoting renewable energy transitions (Turner, 2007). Similarly, research on wind projects in Scotland and Ontario have found that community ownership of a project can also help promote community support (Walker, Baxter, & Ouellette, 2015; Warren & McFadyen, 2010). Further, wind energy developments have been seen to bring economic and employment opportunities and due to this can be viewed positively (Rygg, 2012).

As indicated above, wind energy is the most heavily studied energy landscape in terms of social acceptance research. Even offshore wind farms have been perceived to spoil the seascape and landscape for local residents (Warren & McFadyen, 2010). Wind energy is seen to create strong visual and audible disturbance for local communities, creating negative attitudes (Firestone *et al.*, 2015; Jones & Eiser, 2010; Rygg, 2012; Waldo, 2012). Additionally, the human health issues associated with wind energy has been debated for decades despite little to no evidence supporting health concerns resulting from exposure (Council of Canadian Academies, 2015). It has also been shown that wind energy is supported in theory but when siting decisions begin, support from communities that will be affected is often lost (Jones & Eiser, 2010; Petrova, 2013; Wolsink, 2007). The first step of this phenomenon, termed the 'social gap' (Bell *et al.*, 2005, 2013), recognizes that renewable energy is socially and politically endorsed at a societal level

but often a contentious issue at the local scale and siting and implementation stage. Interestingly, however, is that over time communities can often find value in wind infrastructure and begin to accept it, shown below in standard units (Figure 2) (Wolsink, 1994, 2007).

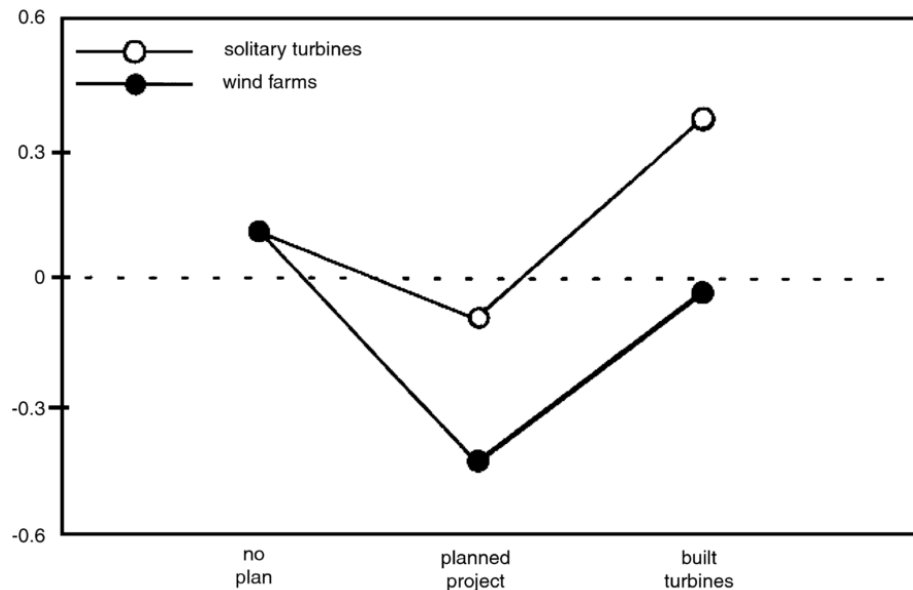


Figure 2. The Development of public attitudes towards wind, often termed the U-curve of acceptability (Wolsink, 1994, 2007).

It is clear that much of the social support or opposition is a result of visual, aesthetic or landscape perceptions. To understand the threat communities perceive when their landscapes come under consideration for an energy project, it is important to understand the significance and meaning individuals hold towards their landscape and its subjective aesthetics.

2.5 LANDSCAPE AND AESTHETICS

Lothian (1999) analyzed two paradigms of landscape aesthetics. First, landscape aesthetics can be viewed as objective, thus having an intrinsic physical value (e.g. mountains and rivers are often considered to have a high aesthetic quality) (Lothian, 1999). This concept further supports

the idea of evolutionary baselines (Kaplan, 1987; Selman, 2010). On the other hand, landscape aesthetics can be viewed subjectively, where value is in the eye of the beholder (Lothian, 1999). These values can align with the concepts of generational, experiential, and cultural baselines as presented in the Baselines of Acceptability Model where individuals perceive aesthetic value based on personal opinion and perceived value. In the study, I am interested in the subjective experience and perceptions of landscape by individuals. Energy development that can threaten landscapes of low objective or intrinsic physical value can still be seen as a threat to local communities and their landscapes.

When referring to landscapes, I am not referring to merely the physical environment and landforms, but rather a combination of the physical elements and the human interactions with these elements. The physical landscape can be viewed simply as an area of land, or it can be viewed subjectively, as an area of land as seen from a specific view from a specific person (Wylie, 2011). Landscape is often defined as the visible features within an area, specifically, the aesthetic appeal of these features (Wylie, 2011). This basic definition implies a human element, as aesthetic appeal is a creation of human perceptions; what one defines as aesthetically pleasing may be different from someone else (Arriaza, Cañas-Ortega, Cañas-Madueño, & Ruiz-Aviles, 2004; Daniel, 2001). For the purpose of the study, I will use the definition of landscape put forth by the European Landscape Convention, whereby landscape is defined as “an area, as perceived by people, whose character is the result of the action and interaction of natural and/or human factors” (Council of Europe (CE), 2000). This simple definition recognizes landscape as being defined and shaped by the people who perceive it (Antrop, 2005, 2006; Glover, Stewart, & Gladdys, 2008; Greider & Garkovich, 1994). Thus “landscape is both the phenomena itself and

our perception of it” (p302) (Wylie, 2011). As such, landscapes are subjective and the values and benefits they possess differ between people.

There are many examples of individuals and societies adjusting perceptions of new infrastructure over time. For example, lighthouses were designed and built for utilitarian purposes; however, over time they have become aesthetically pleasing tourist attractions (Edelheim, 2010).

Similarly, today there are famous and cherished structures, which were fiercely opposed during construction. The Eiffel Tower was originally criticized as useless, monstrous, and a French eyesore (Haacke, 2011). Aesthetic preferences for architecture have changed throughout history (Haacke, 2011), as have aesthetic preferences and perceptions of beauty in the fashion and art industries (Jacobsen, 2006). Aesthetic preferences strongly contribute to how individuals’ value objects and makes decisions, including around renewable energy infrastructure. However, the concern is that landscapes are changing faster than our aesthetic preferences are, as Selman (2010, p169) concludes: “Our heads accept the need for these landscape changes; our hearts need to learn to love them.”

Energy landscapes are often a cause for conflict as cultural services (aesthetics, recreational areas, etc.) can be lost to provisioning (in this case energy) services (van der Horst & Vermeulen, 2012). While energy landscapes are being proposed to aid humans in meeting their energy needs, which are ever growing, the benefits may not be experienced most in the places where the impacts are felt. Electricity transmission has the property that it will flow to the closest unfulfilled need, but that may not be close by, and in cases such as the now-approved Site C dam in northern British Columbia, many citizens may be concerned that the energy is for export, or to fuel industrial development of questionable local value (Shaw, 2014).

Many landscape changes are as a result of changing lifestyle needs and desires from humans (Antrop, 2006). For example, trees are cut down for building purposes, agricultural purposes and urbanization. Landscape change is a result of changes in human practices and regimes (Antrop, 2006). However, despite this understanding, humans constantly resist change due not only to the fear of the unknown but also due to their fear of losing places to which they are attached (Devine-Wright, 2009; Eaton, Gasteyer, & Busch, 2014; River Alliance of Wisconsin & Trout Unlimited, 2000). The concept of status quo bias, the preference to maintain the current setting, helps to explain this phenomenon (Samuelson & Zeckhauser, 1988). The status quo is already being experienced and the other options are unknown scenarios, leading people to want to keep what they know (Samuelson & Zeckhauser, 1988). Landscapes thus need be understood in the context of place, as it is recognized that landscapes are inherently personal and attached to memories with historical, cultural and social significance (Daniel, 2001).

2.6 PLACE

A landscape, as defined in this work, is not only a physical and spatial location in the environment; it is a culturally significant place, with historical, spiritual, sentimental and community meaning (Antrop, 2005, 2006; Glover et al., 2008; Wylie, 2011). Thus, attachment and emotional connection to place mean that potential changes are often seen as a threat to one's valued place (Greider & Garkovich, 1994; Stedman, 2003). It is important that there is recognition of the importance of place and the values and connections people have and develop towards place as energy landscape changes are explored.

At its root, place is defined as either a location or the occupation of a location (Agnew, 2011).

Place is described as having its own special qualities, making it unique to any other spatial

location; place is lived space (Agnew, 2011; Tuan, 1977). Place is understood as having subjective meaning; individuals find different meanings and connection to the same place (Gustafson, 2001), thus developing different degrees of connection to place.

There are several interconnected concepts that explain the subjective experience of place, namely the human-environment interactions. These ideas include sense of place (Jorgensen & Stedman, 2001, 2006), which is defined as the meaning which is attached to a spatial setting by an individual or group. Jorgensen & Stedman (2001, 2006) unpacked the multidimensionality of sense of place, proposing that place concepts can be organized in a framework integrating cognitive (place identity), affective (place attachment) and conative (place dependence) responses to place.

Place identity refers to the ways that place attributes can contribute to a person's sense of self (Proshansky, Fabian, & Kaminoff, 1983). Place attachment relates to the emotional bonds humans develop as they experience and become connected to a place (Low & Altman, 1992). It is recognized as the transition from space to place; as individuals come to know a location, they begin to develop their own personal emotional meanings (Tuan, 1974). Place dependence refers to the opportunities a setting presents for goals and activities (Stokols & Shumaker, 1981), and thus its substitutability. In this regard, people can be attached to areas that they have never visited (Stokols & Shumaker, 1981).

Place identity and place attachment are directly linked to one another, as identity and emotional variables have strong ties (Devine-Wright & Clayton, 2010) and contribute to the concept of place-protective behaviours. When a place that is positively valued faces change (i.e. one's place attachment is disrupted or place identity is threatened), place-protective actions may follow as

people look to avoid the change and protect the place they are attached to or see as a key part to their identity (Jacquet & Stedman, 2013; Stedman, 2002). Many researchers have looked to understand community resistance to energy siting as an issue of NIMBY (not in my backyard); in fact, NIMBY is one of the most widely used concepts in energy landscape studies (Devine-Wright, 2005; McLachlan, 2009). NIMBYism is often cited as the motivation of individuals to protect their homes and places of value for instance, people may recognize the benefits of an energy installation however, do not want it placed where it may physically and visually affect them on a personal level (e.g. visual landscapes, real estate values, etc.) (Devine-Wright, 2005; Wolsink, 1994, 2000). However, NIMBY has been heavily criticized for its lack of explanatory value, and its derogatory nature (e.g. selfishness) (Bell et al., 2005; Devine-Wright, 2005; van der Horst, 2007; Wolsink, 2000). Instead it has been argued that there is more value in understanding connections to place and place-protective actions based on these connections. Thus, researchers can look at energy infrastructure development not only through the concepts of place and place attachment but also through the lens of place-protection (Devine-Wright, 2009). When one has a strong positive connection to a place it has been shown that this can be the basis for place-protection motivations; when people want to avoid change and protect what is important to them (Adams & Bell, 2014; Jacquet & Stedman, 2013; Manzo & Perkins, 2006; Stedman, 2002; Warren, 2014). However, it must be recognized that connections to place can be negative or neutral as well if people are rooted in place due to social structural factors (i.e. ‘anchors’ such as economics, social ties, and family) instead of positive sociocultural or ecological attributes (termed magnets) that draw people to a place (e.g. social networks landscapes, recreation) (Beckley, 2003).

As mentioned, place concepts are increasingly being utilized to understand how individuals and communities accept or reject renewable energy infrastructure development. Studies have looked to use place attachment to understand acceptance and opposition associated with wind power (Cass & Walker, 2009; Devine-Wright & Howes, 2010; Pasqualetti, 2011) , solar power (Carlisle, Kane, Solan, & Joe, 2014; Fernandez-Jimenez et al., 2015), tidal power (Devine-Wright, 2011; McLachlan, 2010), and hydropower (Laborde, Imberger, & Toussaint, 2012; Vorkinn & Riese, 2001). Similarly, place-protective behaviours have been evaluated in the context of opposition to energy infrastructure (Devine-Wright & Howes, 2010; Devine-Wright, 2009).

Different types of renewable energy have different effects on attachment to place, place-protect motivations and sense of place. This project looks at the Mactaquac hydropower dam in New Brunswick and thus focuses on the above literature in the context of hydropower projects.

2.7 HYDROPOWER DAMS

This research focused on the Mactaquac hydropower dam and the changed landscapes that resulted, focused on at its construction, operation and potential removal through a social lens. The following section will explore in depth the complexities of hydropower dams, both their construction and removal in a broader context, to delineate the study of the Mactaquac Dam.

2.7.1 Dam Construction

Hydropower is the oldest, most mature, and most efficient renewable technology (IPCC, 2011; REN21, 2014). The global hydropower capacity far outweighs all other renewable energy methods (REN21, 2014). Hydropower stations are recognized as the best energy production

technology in terms of energy output (net gain) with efficiency rates above 90% (Onat & Bayar, 2010). Hydropower is recognized as a continuous form of renewable energy, ideal for complementing more variable and intermittent forms of renewable energy (such as wind and solar) (IPCC, 2011; REN21, 2014). Canada ranks third in the world, after China and Brazil, and the United States ranks fourth for total hydropower generation (REN21, 2014), making the issue of hydropower development relevant and important to North America. Canada does not rank in the top five for any other renewable energy source (REN21, 2014).

The era of large dam-building began in the 1930s with the construction of the Hoover Dam (Nüsser, 2003). Hydropower dam construction grew in popularity in the 20th century, peaking in the 1970's when it is estimated that 2-3 large dams were commissioned every day worldwide (The World Commission on Dams, 2000). By the year 2000, over 45,000 large dams had been built, globally, inundating approximately 500,000 km² of land surface (The World Commission on Dams, 2000). Despite a decline in hydropower energy in North America (The World Commission on Dams, 2000), hydropower dams are still under construction around the world (Ansar, Flyvbjerg, Budzier, & Lunn, 2014; Zarfl et al., 2015), with significant growth primarily in China, as well as Turkey, Brazil, Vietnam, India and Russia (REN21, 2014).

With new dams being built today, many individuals will be facing the changes that the Mactaquac communities experienced 50 years ago: losses to farmland and homes while also new opportunities for jobs and development. A relevant example in North America is the Site C dam proposal on the Peace River in British Columbia, which echoes the site and scale of Mactaquac 50 years ago. The community is concerned that there will be a loss of homes, fertile farmland, and wildlife (West Coast Environmental Law, 2014) however, the dam development is expected

to bring economic development, new jobs and business opportunities (BC Hydro, 2015). It has been shown elsewhere that rural residents faced with dam infrastructure construction experienced changes in their relationship to their environment, losing cultural connections to the land (Million, 1992; Tilt, Braun, & He, 2009). However, over time it has been found that communities develop connections to and appreciation for the new aesthetics, recreation opportunities, and landscape with the dam in place (Born et al., 1998; Klein, 1999; Lejon et al., 2009).

2.7.2 Dam Removal

Despite the energy and economic benefits of hydropower dams, dams have been shown to have environmental (Doyle et al., 2003; Namy, 2007; Pohl, 2002; The World Commission on Dams, 2000), ecological (Mims & Olden, 2013; Namy, 2007; Zarfl et al., 2015), and societal consequences (Babbit, 2002; Nüsser, 2003; The World Commission on Dams, 2000; Vorkinn & Riese, 2001). Dams are estimated to be responsible for diverting 60% of the world's rivers and displacing 40-80 million people (The World Commission on Dams, 2000). Due to these consequences, as well as due to the loss of utility in some infrastructure, dam removal is beginning to make a presence on North American agendas (Doyle et al., 2003; Graf, 2003).

To date, in the United States, it is estimated that approximately 1000 small dams (<30 MW of power with a reservoir of ~1000-100,000 m³) have been removed. Only a select few medium or large dams (>30 MW of power, >15m in height or with a reservoir totaling more than >100,000m³) have been removed (American Rivers, 2014), such as the Elwha and Glines Canyon Dams on the Elwha river in Washington (Witze, 2015) and the Condit Dam on the White Salmon River in Washington (Pohl, 2002). Canada has similarly seen small dam removal

(such as the barrage removal on the Petitcodiac in Moncton, New Brunswick (The Atlantic Salmon Conservation Foundation, 2013)), but large dam removal has not yet taken place.

Dam removals are being completed primarily for environmental reasons (e.g. increase the number of free flowing rivers, increase of fish quantity and quality, natural ecosystem restoration, etc.) and health and safety reasons (e.g. unsafe infrastructure, water quality concerns, etc.) however, there are dam removal consequences that need to be taken into consideration.

Interestingly, dam removal is often met with the same hostility and anger as is common in dam construction events (Babbit, 2002; Klein, 1999). A dam can change a community's surrounding landscape however, it must be recognized that dams are not necessarily permanent and can be susceptible to alteration or removal. Little communication occurs around the end-of-life options or planning and often communities see dams as permanent structures in the landscape, thus further intensifying emotions when removal is considered (Born et al., 1998). It is clear that end-of-life planning for such infrastructure is inadequate. Klein (1999) found that, despite the utilitarian nature of dam construction, people often come to appreciate and value the dams and the environments they create. Communities often oppose dam removal because removal can decrease water recreation opportunities, degrade aesthetics, and alter communities and lifestyles (Born et al., 1998; Johnson & Graber, 2002; Klein, 1999; Lejon et al., 2009; Wyrick et al., 2009). Dam removal also presents environmental and economic concerns as community and ecosystem structures have adjusted to the infrastructure in the landscape (Babbit, 2002). Thus dam removal can be opposed for the same reasons for which they are proposed: economic, environmental, and social.

2.8 GAPS IN THE LITERATURE

More research is needed to understand if and how residents can accept renewable energy sources in the landscape (Stigka et al., 2014). There is a disconnect between the fast pace at which renewable energy production is being implemented and the slow pace at which public attitudes and aesthetic preferences are evolving (Warren, 2014). There is a need for research that expands on the socially constructed views of renewable energy (Devine-Wright, 2007). There is some evidence that people can get used to energy infrastructure in the landscape (Brown et al., 2005; Devine-Wright, 2005; Selman, 2010) however, this literature is limited and fundamentally, it would still be extremely tenuous for proponents of renewable energy installations to tell locals that “they will get used to it”. Very few studies have been able to look at energy landscapes through their entire history to further this literature. The Mactaquac Dam landscape offers this uncommon opportunity as its lifespan has been short (compared to most dams) and its construction occurred within the last 50 years, meaning there are still individuals in the area that experienced both the pre-dam and dam-in-place landscape. The literature recognizes that there needs to be an increase in “acceptance-improving strategies” to decrease the negative impacts of energy developments and increase the perceived benefits (Cohen et al., 2014) and the best means to accomplish this is to understand the full history of more energy landscapes and how acceptance changes over time.

Despite the recognition that renewable energy poses social implications and concerns, limited research has focused on the social consequences of hydropower dams. Most research looking at the social issues of energy landscapes and energy transitions focus on wind power, solar energy and biofuel. Little has been presented that looks at the social concerns of hydropower, despite its

prominence in North America's energy mix (Babbit, 2002; REN21, 2014; Sarakinos & Johnson, 2003; The World Commission on Dams, 2000). Most hydropower projects are comprehensively evaluated for their economic and environmental impacts yet, neglect the complexities of the social sector. The Comparative Environmental Review process currently underway for the Mactaquac Dam decision is a good example of this bias (NB Power, 2014b). Hydropower continues to be the most used renewable energy source around the world and the social impacts of hydro energy need to be more extensively investigated.

2.9 CONCEPTUAL FRAMEWORK

The Baseline of Acceptability Model (Figure 1 in Chapter 1) was developed to guide my exploration of how individuals perceive the Mactaquac Dam and headpond in the landscape. This conceptual model incorporates the two views of how Selman (2010) believes landscape norms are established. He proposes that society has either biological baselines, those that are hardwired into our views of the world, or cultural baselines, baselines that are fluid and malleable, the norms adapting with cultural shifts around aesthetics, meaning or needs (Selman, 2010).

In addition to Selman's perspectives on cultural landscape norms, the framework includes individual baselines. Specifically, the framework distinguishes between norms that are generationally set or experientially set. The latter is supported by evidence that perceptions of impact from an energy development can change over time (Brown, Dorius, & Krannich, 2005; Devine-Wright, 2005). Individuals who once disliked an energy landscape can perceive benefit from it and begin to accept or even value the new landscape (Wolsink, 1994, 2007). Opposite to this dynamic conception of landscape acceptability is the idea, adapted from Pauly's (1995)

concept of shifting baselines syndrome, which posits that baselines are generationally set; the first experience with the environment becomes the baselines of acceptability from which change is assessed. This concept was developed in the context of fisheries, whereby the fish quantity and composition that existed at the start of a new manager's career is used as that individual's baseline from which they measured change. In Pauly's (1995) usage the concept refers to the unintentional degradation of ecosystem conditions. In the context of landscapes, this would mean the first landscape one is exposed to is the acceptable baseline from which they evaluate change (See Figure 1 in Chapter 1). This concept is similar to Kahneman's (2011) psychological term of 'anchoring,' whereby the first information available to someone is often relied most heavily on to base future opinions and decisions from. This would translate to resistance to new infrastructure or removal of old infrastructure grounded in the same conditioning. This difference between individual hardwired baselines versus adaptive baselines was the primary axis for inquiry in this work, but I also recognize that these are affected by larger evolutionary and cultural norms.

2.10 CHAPTER SUMMARY

From this literature review it is clear that a diverse list of complexities have and will continue to affect the success of the renewable energy transition. It is imperative to recognize the social impacts of renewable energy infrastructure and look to find solutions to support those affected by landscape transformations as a result of these energy installations. This review illustrates the importance of understanding and accepting subjective landscape values and aesthetic preferences, as well as the significance of place theory, which recognizes the connections people develop to their surrounding landscapes, communities and homes.

The main focus of this research is to understand how the communities in the Mactaquac area perceived the landscape prior to dam construction, how they perceive the present dam landscape, and how they perceive future options, including a potential post-dam landscape. The aim is to understand how values are developed and adapted in order to understand the transition that has occurred in the Mactaquac Dam landscape and gain insight into how communities and individuals may react to energy landscape transitions more broadly.

CHAPTER 3 RESEARCH METHODS

3.1 RESEARCH DESIGN AND METHODS

The purpose of the study was to understand how people view renewable energy infrastructure in their local landscapes and how acceptance and even attachment towards energy landscapes is developed. Specifically, the study looked at how people have viewed the novel landscape created by the Mactaquac Dam and its attendant headpond area throughout its potential life cycle: the landscape prior to dam construction, the present dam landscape and they perceive future options, including a potential post-dam landscape. I was interested in understanding the meanings citizens have associated with the different time periods of the Mactaquac Dam and headpond landscape through the use of a semi-structured interview enriched by a map of the landscape change. This chapter will present an overview of the research methods, followed by the study area and study participants, and finally a detailed account of the data collection and data analysis methods.

3.2 CONSTRUCTIVIST FRAMEWORK

A constructivist framework guided the study. The constructivist paradigm states that an individual or a group of individuals can uniquely form perceptions of reality (Creswell, 2013). As such it is recognized that there are multiple realities of place constructed in the minds of different individuals. No constructed reality is less true but each is informed by different experiences (Guba & Lincoln, 1994). In order to elicit an individual's construction, a researcher must interact with the individual (Guba & Lincoln, 1994). This is commonly done through interviews. The interviews are traditionally semi-structured with broad questions to allow

participants to express their personal meanings and not limit or narrow the discussion (Creswell, 2013).

The social construct framework has been drawn on by other researchers to understand how individuals value place and landscape (Berger & Luckmann, 1967; Greider & Garkovich, 1994; Kyle & Chick, 2007). When looking to understand how one values landscape, it is crucial to recognize that landscape cannot be spoken to as if all individuals see it or value it in the same way. Further, space has no value to humans without these socially constructed views as humans give meaning to place through their own experiences and time in a place (Tuan, 1977). Thus landscapes are human-constructed, resulting from cultural identities and values (Greider & Garkovich, 1994); “Cultural groups transform the natural environment into landscapes through the use of different symbols that bestow different meanings on the same physical objects or conditions” (Greider & Garkovich, 1994, p.2). The application of a social constructivist perspective allows the researcher to look at and understand the common symbolic meanings of a landscape from the perspective of multiple individuals. It is important to recognize that although social construction results in one’s reality of a landscape, social construction is bounded and influenced by the local physical environment (Stedman, 2003).

3.3 VISUAL RESEARCH METHODS

Visual methods in research have increased in popularity over the past two decades (Rose, 2014). These methods allow the researcher to take advantage of the ‘visual culture’ and the hyper-visual nature of 21st century life, which is continuing to grow in prevalence. (Rose, 2014; Spencer, 2011).

Visual research methods are increasingly used in place-based research and landscape research. Researchers have made use of visual methods in a variety of ways. *In situ* methods (taking participants into the landscape in question) are ideal for eliciting values towards that landscape as participants are able to use all of their senses (Owen, Duinker, & Beckley, 2009; Propst, Mcdonough, Vogt, & Pynnonen, 2008). *Photo elicitation*, where photography, captured by either the interviewee or interviewer, is examined by both parties to understand a given theme or subject, is another common form of visual methods (Beckley, Stedman, Wallace, & Ambard, 2007; Sherren, Fischer, & Fazey, 2012; Sherren, Fischer, & Price, 2010; Tonge, Moore, Ryan, & Beckley, 2013). Another form of photo elicitation is *photovoice*, the use of participant photography as personal documentary with marginalized groups, which encourages involvement and feelings of ownership and power in the research process (Castleden, Garvin, & Huu-ay-aht First Nation, 2008).

Although much focus on visual research methods is around photographs, other methods include the use of maps and mapping tools. *Public participation GIS (PPGIS)*, the use of GIS and digital mapping tools in community research, is also a common method for understanding public values (Anderson, Beazley, & Boxall, 2009; Greg Brown & Reed, 2012; Gregory Brown & Weber, 2012). Similarly, physical maps are used to give participants the opportunity to see a new view of a common place or the history of a place with which they may not be familiar (Powell, 2010; Spencer, 2011). Countering commonly accepted representations of landscape using maps is sometimes discussed as a ‘critical cartography’ approach that counters prevailing power structures, as evident in the *Before the Mactaquac Headpond* storymap (Holman, 2014; <http://energytransitions.ca/storymap>).

Visual methods are often seen as a means to enhance the traditional method of interviewing. Pairing interviews with visual research methods allows participants to share novel information that may not have been drawn out by a spoken interview alone (Rose, 2014). Further, visual methods give the researcher and interviewee something to look at and discuss together (Rose, 2014). The visual media can often help to prompt ideas that would not have otherwise been discussed in a traditional interview, as an element or section of the visual stimuli can elicit memories (Rose, 2014). Similarly, the visual prompts can empower the interviewee, which may result in a richer interview, because they have the opportunity to teach the interviewer about the topic through ‘show and tell’ (Rose, 2014). Visual methods, using respondent-generated or researcher-chosen visual media, are becoming increasingly popular in social research studies. I chose to use researcher-generated visual media in the study to enhance the interview process and aid in the elicitation of historical memories and place values.

Previous work in the areas of energy studies research have been primarily quantitative with a focus on the physical and engineering sciences and economics (Sovacool, 2014). Sovacool (2014) completed a content analysis on 4444 articles from 1999 to 2014 published in three energy journals and found that only 12.6 percent of articles reported using “human-centered” research methods, and of these less than 5 percent used field research, interviews or focus groups. This underdeveloped sector is crucial for energy studies as I look to understand how human attitudes, values and experiences have and will shape energy use, production, consumption and support (Sovacool, 2014). The study looked to help fill the gap in human-centered research, specifically research in the field, as opposed to surveys for instance, by using interviews to understand how local values have changed and adapted to a new renewable energy landscape. In undertaking a research project around the perceptions of a landscape (an inherently

visual feature), it was essential for me recognize and make use of visual research methods (expanded upon further in section 3.7.2).

3.4 THE STUDY AREA: THE MACTAQUAC DAM AND HEADPOND

The study area consisted of the local communities that surround the Mactaquac Dam and headpond. The Mactaquac Dam is located in rural New Brunswick, 19 km outside of New Brunswick's capital city, Fredericton (NB Power, 2013). The Dam created a 96 km headpond which extends from the dam infrastructure NW to the town of Hartland (NB Power, 2013). Hundreds of families were relocated prior to dam construction as flooding submerged valuable farmland and family property (Si, 1993). Many citizens, during construction in the mid 1960s, did not welcome the Mactaquac Dam proposal and as a result the "Association for the Preservation and Development of the St. John River in its Natural State" (APDSJR) was created (Bourgoin, 2013). The dam was opposed by citizens due to the resident relocation it would entail, as well as the negative effects the dam was perceived to have on the salmon, the loss of farmland, and the loss of the St. John River Valley floodplain and the deep cultural heritage associated with it, including important sites for First Nations and Loyalist descendants (Ferrar, 2005). Despite citizen dissent towards the dam's construction, some residents feel the project was a success (Ferrar, 2005) while others see it as a failure (Dickison, 2006).

For the study, the population of interest was specifically those who live upriver, but nearest to the dam infrastructure today. Those individuals who have moved out of the area since the dam's construction were not included in the study. The study area was defined by the research team for previous work using ArcGIS software to create a 'viewshed' map (Figure 3), which shows the areas (highlighted in a light grey) that can see the headpond between the dam infrastructure and

the town of Nackawic. This map was used as a starting point for recruitment. The communities surrounding the Mactaquac headpond, from Nackawic to Keswick Ridge, make up a rural population of approximately 5,600 residents (Statistics Canada, 2012). Residents who lived in the viewshed area but whose homes did not face the water or those who could not see the water from their homes were also welcome in the study. Nackawic was chosen as the furthest limit to the study area for numerous reasons. First, Nackawic was a planned town, created by the government during the dam's construction, as a home for those forced to move due to flooding and to house employees of the new pulp mill, which was to use much of the new dam's power (The Town of Nackawic, 2012). For this reason, Nackawic is home to many citizens actively interested in the debate over the dam decision. The second reason Nackawic was chosen as the western extent was because previous work (Keilty, Sherren, Beckley, & Marmura, 2014) defined this area as the limit for houseboat tours undertaken in summer 2013. To make the work comparative, the study worked with the same constraints. The viewshed includes a rural population of approximately 3000 people, covering the areas of Nackawic, Keswick Ridge, Queensbury, Prince William, Dumfries, Kingsclear and Bright.

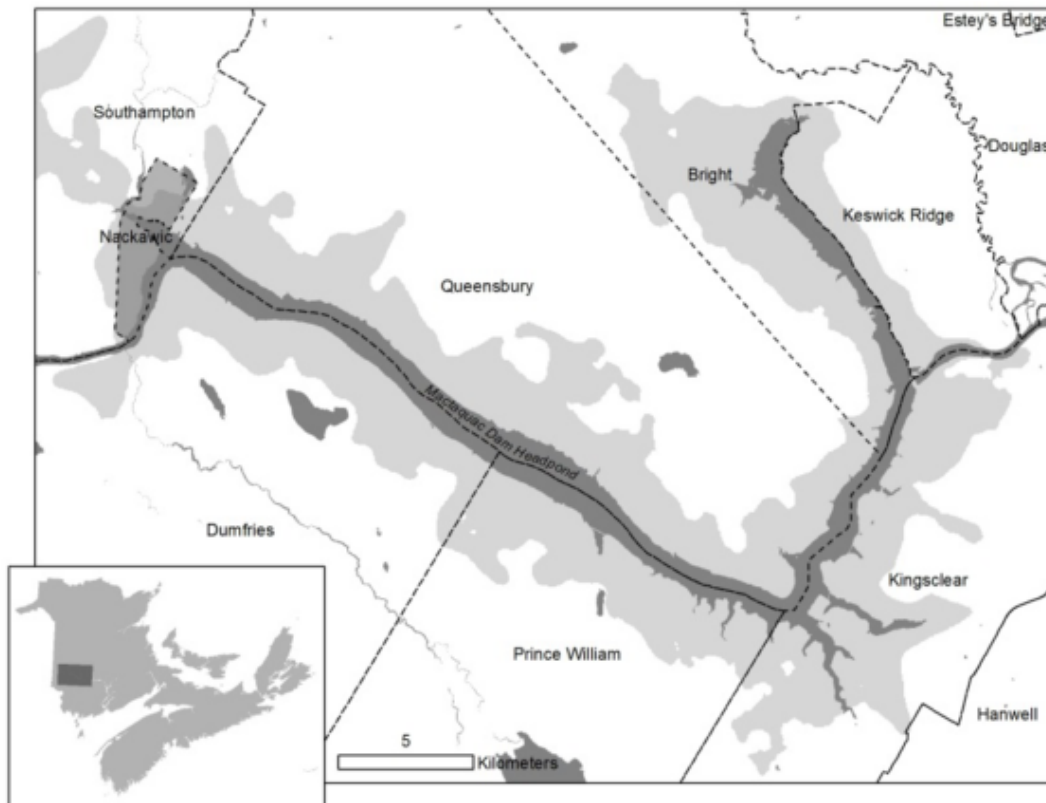


Figure 3. Viewshed map of the study area (created by Kate Sherren, 2013). The light grey shading shows the areas, between the dam and Nackawic, that are visible from the headpond.

3.5 RECRUITMENT

Local residents across four specific adult cohorts were sought for interviews:

1. *Pre-Dam Elders.* Members of this target group would have been residents and ideally landowners in the Mactaquac area prior to the dam being built (1967). This group would range in age from approximately 70 to 100 years. Cohort 1 individuals were important because they provided a rich historical recount of the landscape, the community, and the political context prior to dam construction. This group was also crucial to testing the generational baselines quadrant because these individuals would have spent many years in the

landscape prior to dam construction, time to have potentially developed an attachment to the pre-dam landscape.

2. *Pre-Dam Children.* These participants would have been children (approximately <15 years of age) when the dam was being built. These individuals would range in age from approximately 50 to 70 years. This group was anticipated to provide an interesting perspective on dam construction and focus much of their discussion on the present landscape, with only a weak memory of the landscape prior to dam construction.
3. *Headpond Children.* This group was intended to include those who grew up in the Mactaquac area having never experienced the landscape prior to construction. This group would range in age from approximately 25 to 50 years. This group was targeted because they held a different view than the previous two cohorts, as they would have no experience with the pre-dam landscape.
4. *Headpond Migrants/Amenity Migrants.* This group was intended to include those who moved into the area in the last 40 years, to live in the community or on the Mactaquac headpond. This again would present a new view of the area, as their length of connection to the location could be shorter than those born in the area. The age range of Cohort 4 was 45 to 65 years.

I was interested in speaking to 16-24 individuals, with even representation across all cohorts.

Although the number of participants for a study varies greatly depending on goals and objectives, the number of participants was determined as the acceptable size for qualitative interview research (Baker & Edwards, 2012).

I began recruitment by contacting participants from two previous studies that were done in the Mactaquac area (Keilty et al., 2014; Parkins, Hempel, Beckley, Stedman, & Sherren, 2015) who had expressed that they knew interested peers who wanted to be a part of the conversation around the decision whether to refurbish or remove the Mactaquac Dam. In addition, those who expressed interest in previous studies but were unable to participate were contacted. Following this first set of emails, a recruitment flyer (Appendix A) was posted on the research team's website and Facebook page. Following these methods, the broader research team sent the study information out to their networks in the area to further facilitate recruitment. Through email, telephone and social media postings a list was established of individuals who were interested in setting up an interview. During the first set of interviews these participants were asked if they knew of any other interested individuals in their communities.

The next method of recruitment was connecting with citizens through local stakeholders. The rural communities around the headpond are tightly knit, as word of the study was quickly spread through social and community networks. Groups such as the Nackawic Historical Society and Friends of Mactaquac Lake were approached and they were willing to send study information out to their email contacts and Facebook members. Additionally, local businesses such as the Mactaquac Marina and Kings Landing Historical Settlement posted recruitment posters on staff notice boards.

The final method of recruitment was through a local radio station (UP 93.1) interview with me. The radio interview provided a brief overview of the study and who to contact if interested. I believe this method helped to reach some of the younger participants who were missed through the previous social networks.

Interested participants were asked a short series of screening questions (Appendix B). This was done to ensure that they fit into one of the cohort groups of interest and to find out if they had any associations with any formal group with an interest in the headpond (e.g. World Wildlife Fund (WWF), NB Power, Friends of Mactaquac Lake). It was acceptable to have an association to a formal group; the study was only interested in having a diverse group of participants (i.e. not too many from any one group). Once a potential participant answered the screening questions and was placed into one of the specific cohorts he or she was provided with a background document about the study (Appendix C). This outlined what the study was about and what the participant's role and commitments would be as an interviewee. Once the participant agreed to take part in the interview process, a time and date was selected for the interview. Participants were required to sign the informed consent form prior to the start of the interview (Appendix D).

The study was completed with a total of 20 participants (n=20), having 4-6 individuals per cohort (Table 1). This diversity allowed for a variety of opinions per cohort.

Table 1. Summary of participants and their gender per cohort.

Cohort	Female	Male	Total number of participants
Cohort 1 (Pre Dam Elders)	3	1	4
Cohort 2 (Pre Dam Children)	2	4	6
Cohort 3 (Headpond Children)	4	1	5
Cohort 4 (Headpond Migrants)	2	3	5
Total	11	9	20

Interviews were held in a local and accessible location, usually the participant's home or place of work, allowing them to feel comfortable, relaxed, and in control (Holloway & Wheeler, 2013). Cohort 1 individuals were elderly and particularly appreciated the accessibility of the interview. Inaccessibility was recognized during the 2013 houseboat tours as a limiting factor for recruiting elderly participants, as the houseboat was difficult to board and required the use of a steep staircase for access to the upper deck. The home setting for the interviews also allowed people to not only describe their attachment to the landscape but also show it to me directly. Participants were eager to share their personal stories and connections to the landscape and being in their home or at their place of work allowed this.

The study was expected to have a minimal level risk or discomfort for the participants. The interview was largely driven by the respondent and their own memories, and as such was not confrontational and did not create undue distress. There were instances where interviews became emotional, when traumatic or stressful memories were elicited but participants were told they did not need to speak to these memories if they were uncomfortable doing so.

3.5.1 Recruitment Challenges

The employed set of recruitment methods was successful in bringing interest to the study; however, there were challenges in reaching all of the cohorts. Cohorts 2 and 4 showed the most interest, but it was difficult to reach the elder generation and the youngest generation (Cohorts 1 and 3,). It has been found in aging research and health studies that recruiting older adults can be challenging for reasons of accessibility, ill-health and their belief that they will not be useful to the researcher or the research study (Forster et al., 2010; Mody et al., 2008). Additionally, interviewed elder individuals did not feel that the dam decision would impact them and thus did

not necessarily find the same connection to the study as those who currently have an ongoing stake in the community and the landscape. Recruiting for Cohort 1 was achieved through connections with the local historical society and snowball sampling through other interviewees.

Cohort 3 individuals were difficult to reach due to their busy work schedules, and young families (O'Neill, 2007). Further, New Brunswick has a large population of young adults working outside of the province (Shaker & Doherty-Delorme, 2004; Willbond, 2012) which other young participants noted and felt may be affecting the low interest in the study. Recruiting for Cohort 3 was achieved through two different means. First, snowball sampling was done during interviews with participants in the three other cohorts. Numerous participants were happy to get in touch with their own children or young families in their neighbourhoods to spread the word as they felt the dam decision greatly impacted these growing families and young individuals. Second, online recruitment, specifically through Facebook, complemented the snowball recruitment methods. Online methods of recruitment for young adults is common (Balfe, Doyle, & Conroy, 2012; Ramo, Hall, & Prochaska, 2010) because these methods allow a large population to be contacted in an efficient and cost-effective manner (Balfe et al., 2012; Chu & Snider, 2013). However, social media methods do present challenges such as small response rates and slow replies (Balfe et al., 2012; Kapp, Peters, & Oliver, 2013) as well as 'slacktivism' whereby people are happy to 'like' or 'share' the issue or study but make no real commitment or action (McCafferty, 2011).

3.5.2 Recruitment Summary

A total number of 25 individuals were contacted from the previous study databases. These individuals were those who showed interest in previous work in the Mactaquac area but were not able to participate in these projects. Of these individuals, 13 were interested in completing an

interview. Ten individuals completed the screening questions and of these six individuals took part in an interview. Two were unable to complete interviews due to scheduling conflicts.

I was also given a list from two locals in the Mactaquac area who had large social networks and knew interested individuals. From both lists, a total list of 18 individuals was compiled. From this list, eight individuals completed the screening questions and took part in an interview. Three other individuals expressed interest, but their summer schedules were busy and they were unable to find time for an interview

Two other individuals were interested in the study after seeing the recruitment flyer in their community. An additional two individuals contacted me through Facebook after seeing the online recruitment advertisement. Of these individuals three completed the screening questions and an interview during the research week in July.

During each interview I also looked to make connections with the interviewee and find more participants through their social networks. Three individuals were recruited in this manner for an interview.

Additionally the other members of the research team had social connections in the area and this resulted in two individuals who were contacted directly by the lead researcher. Both individuals completed the screening questions and an interview. To ensure anonymity for these participants, given the local association of several members of the research team, no participant names were disclosed to anyone except myself on the research team, unless the interviewee did it him or herself.

Eight interviews were completed in June 2014, and 13 in July 2014. However, one participant chose to leave the study after reviewing their transcript, taking the final study number of participants down to 20. No participants were screened out of the study; all met the requirements for one of the four cohorts of interest, and in aggregate there was no evident bias as a result of memberships or employment. Some interested individuals were not able to complete an interview due to busy summer schedules.

3.6 DATA COLLECTION METHODS

The study employed semi-structured interviews and semi-quantitative data analysis. Semi-structured interviews were used to understand the values citizens hold towards the landscape, how these values were formed and changed, and if generational change was necessary for energy landscapes to become acceptable – even valued. Due to the nature of the study, qualitative field methods were chosen because they generate rich datasets (Bryman, 2012).

3.6.1 The interview guide

The data were generated by individual semi-structured interviews. Semi-structured interview questions (Appendix D) were used to understand the individual's experiences in and feelings for the area. The interview guide included seven sections of questions:

1. **Personal History-** The interview began with questions about the participant's time in the area and what their experience in the area had been like. This was followed with questions around the landscape changes they had experienced and how they perceived these changes. This section of questions elicited strong internal values that participants held towards the landscape at different times (i.e. pre-dam and present day).

2. **Perception of naturalness-** Participants were asked how they saw the present landscape, whether they liked it and/or viewed it as natural or normal. This was asked to help understand if there were direct and/or obvious shifts in a participant's baseline.
3. **Experience elsewhere-** Participants were asked about their time away from the area (if any). This was done to understand what other landscapes they may have experienced in order to understand landscapes on which they might be basing comparable opinions.
4. **Views of others-** Participants were asked their perceptions of what others felt about the area. This section allowed me to understand if certain cohorts perceived other cohorts, or other individuals in their cohort, as having different views of the area. This helped me to understand if others perceived baselines of acceptance as shifting or as concrete. Additionally this section was used to test for potentially inherited opinions, for example younger generations feeling a certain way due to the experiences shared by their parents or grandparents.
5. **What should be done to the dam-** Participants were asked which decision (dam removal, dam rebuilding with power, or dam rebuilding without power) they thought was best for themselves and what they felt was best for society. They were also asked which decision they felt other groups thought was best.
6. **Energy and development options-** Participants were asked what other energy sources they could see as appropriate in the area and what other development they would accept in the area.
7. **The local perspective-** Lastly, participants were asked who should be involved in the dam decision. This section allowed me to understand if the participant felt the decision

should be local or provincial or how those interests should be balanced and also if they felt the decision would have personal effects or more general public effects.

3.6.2 Map elicitation

Due to the goals of the study, seeking to understand perceptions of the past, present and future landscape, I chose to use a historical map overlaid with key present landscape features (town boundaries, new highway) and the area inundated by the headpond as an interview prompt to give the best discussion prompt for all participants (Figure 4). In addition, participants were welcome to show their own photos of the headpond and the surrounding area if they thought the photos would help them explain their stories in the interview (but photos were not required). I felt that the use of a map (versus photographs) would give a more universally accessible overview of the landscape before and after dam construction. Photos taken by the participants or others may have been difficult to orient to the landscape (due to the changes as a result of the dam), and potentially upsetting. Researcher-photographs would have allowed for a more uniform set of photographs, but I may have missed essential landscapes/photographs (Clark-Ibanez, 2004) and these may still have been difficult to align to modern realities. Additionally, photographs that may have appeared aesthetically pleasing to me may have little to no meaning to the interviewees (Clark-Ibanez, 2004). Maps, on the other hand, are not only useful for orienting and understanding different landscapes but can also be used to draw out memories and connections people hold towards a certain landscape (Spencer, 2011) that may not have been represented in a photograph. Maps can show what once existed in a landscape relatively neutrally, allowing people to remember and reminisce about areas that have changed (Spencer, 2011). Powell (2010) found similarly that when maps were used during a series of interviews,

participants actively drew on the map as they told stories or rotated the map as they were talking to specific areas.

During the interview process participants were invited to write or draw on the laminated map as the interview was taking place or simply point out locations to me as they spoke. Participant engagement with the map differed widely across the twenty interviews. All participants pointed out their current homes on the map. Some pointed out where family members currently lived or where they had lived in the past. Many participants then used the map throughout the interview to share stories and memories. For example, many pointed out the islands that were flooded by the headpond, sharing stories about farming the islands, picnicking with family or wading to them in the dry summer months. For those who did not know the pre-dam landscape, the map allowed them to learn more about the area. Some participants were unaware of the islands that once existed and others noted how narrow the river channel once was. The map acted as a crucial prompt during the interview, helping to elicit historical memories that may not have been otherwise shared.

Additionally the map prompted numerous participants to want to share more personal items (e.g. family photos, paintings, mementos, etc.) related to the landscape. Numerous participants brought out additional photo albums with pictures of the landscape, and gave tours of their homes to show me special pictures or paintings of the landscape. Others gave me tours of their property showing where things used to be and how different things would be without the dam. Another participant showed me their view of the headpond from the dining room and proceeded to point out where the houses and businesses in her village had been before the flooding of the headpond. One interview even ended with the participant inviting me on a short boat tour of the headpond in order to better show why they felt the landscape was so important to them.

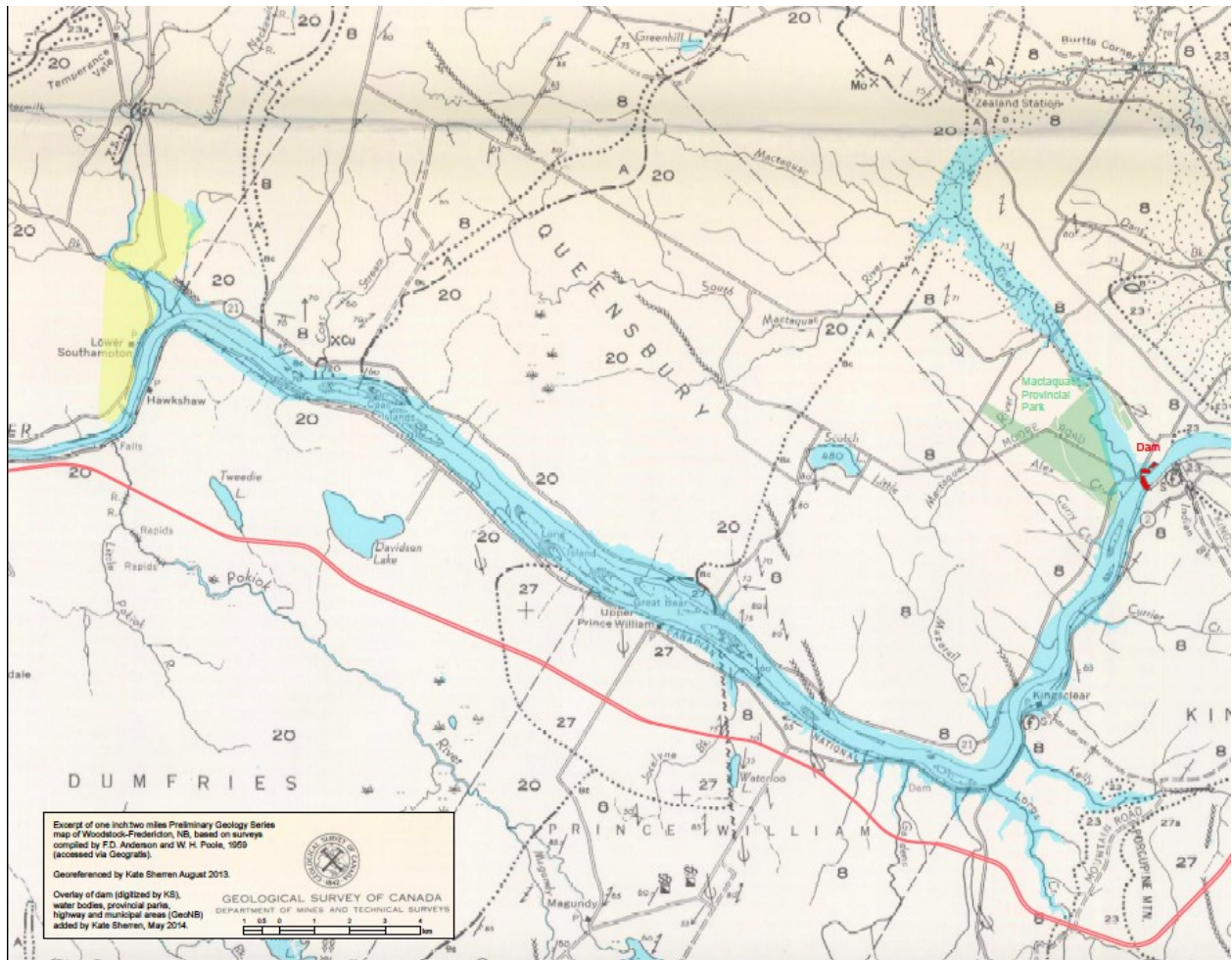


Figure 4. GSC Preliminary Geology Series map of Woodstock-Fredericton, NB based on surveys compiled by F.D Anderson and W.H Poole (1959), accessed via Geogratis and georeferenced by Kate Sherren (2013). The original map has been overlaid with the dam, water bodies, provincial parks, highways and municipal areas (2014) (GeoNB).

3.7 DATA ANALYSIS METHODS

Each interview was audio recorded with the participants' approval. The interviews were then transcribed verbatim and approved by each interviewee. A thematic analysis was completed to identify, understand, and analyze the patterns that arose in the interview transcripts (Braun & Clarke, 2006). First transcripts were read and reviewed concurrently with field research notes I

kept during and after each interview to ensure the correct meaning was being portrayed in the transcript. Key words noted in the journal acted as preliminary codes during the first phase of analysis. Next, I compiled a list of emergent codes that reflected the large patterns and themes present in the transcripts. My supervisor and I next compiled a master list of both inductive codes, determined in the previous stages, and a deductive code list from the research questions. I then went through the transcripts using *NVIVO 10* software (QSR International Pty Ltd., 1999-2015) to code all of the transcripts. More details in regards to the deductive and inductive coding stages are included below

3.7.1 Deductive coding stage

The interview data were analyzed to reveal themes that relate to the research questions established at the start of the study. Each interview was first classified by gender and cohort group. This allowed comparisons to be done across the specific cohort group as well as against the other three cohort groups. From the prompting questions participants expressed their opinions and values towards the landscape at five different periods of time:

1. Pre dam
2. Dam construction
3. Dam today (infrastructure intact)
4. Dam removal
5. Dam rebuild (with power) and dam rebuild (without power)

Data were coded to a specific period of time. The time period most often discussed was present day or recent history, which fell under the code “Dam today.” This code included anything a participant mentioned about the landscape as it is today or as it has been in the past 47 years

since the dam has been in place. Despite NB Power proposing three distinctive possibilities for the future of the dam (dam removal, dam rebuilding with power, and dam rebuilding without power) most participants associated the same outcomes and the same values to dam rebuilding with and without power. Participants often referred to dam rebuilding with or without power as the same option, thus both options were grouped into time period number five.

3.7.2 Inductive coding stage

In addition to coding the period of time, the data were also coded to the observation or sentiment the participant mentioned. These observations and sentiments became the themes to which each passage was coded. Most interviews took a similar form, whereby a participant would talk about the positive or negative theme they felt or saw during each different time period as it related to their time in the landscape. Codes were determined by their prevalence in all transcripts (Braun & Clarke, 2006). A final set of 17 major themes was determined and used in the analysis phase. All themes had a positive and negative component for a total of 34 inductive codes.

The coded data were then analyzed using matrix queries to cross-tabulate themes and time periods, to semi-quantitatively identify differences in landscape perceptions, norms and preferences between cohorts. Matrix queries allowed the researchers to see where strong themes existed and illustrate the changes from positive themes to negatives themes across the various time periods.

For example:

- Coded to “Pre Dam” & “Aesthetics (+)”

“Well down by the river bank we called that the flats, there was a flat piece of ground, beautiful and fertile ground and it was just lush hay crop in it because the river would overflow in spring and come up into the flats and that seemed to fertilize the fields.” (Female, Cohort 1)

- *Coded to “Dam Today” & “Recreation (+)”*

“Yes, yes, and I am glad, the more I see the happier I am, the parasailers, they have skis and in the winter they glide on the ice and they come up, they can come right up half way up the shore. Lots that happens, winter and summer, and skidoos in the winter, that is fun but it is cold for old people.” (Female, Cohort 1)

- *Coded to “Dam Removal” & “Ecosystem (-)”*

“It will never be the ecosystem that it was because the soil and shifted sediment that is different so as far as that goes its like you are never going to go back to the way it was.” (Male, Cohort 2)

3.7.3 Semi-quantitative matrix analysis

Coded data were analyzed semi-quantitatively through a set of matrix queries. A semi-quantitative analysis of qualitative data means that data are coded to allow for numerical counts of significance, reported in addition to specific exemplar quotes supporting the quantitative analysis (Johnson, Dunlap, & Benoit, 2010). It is recognized that counting is integral to qualitative research in order to recognize patterns and areas of importance (Sandelowski, 2001). Patterns are, by definition, the recognition of repetitive mention/observation, thus although counting may be done unconsciously, a strictly qualitative analysis will likely still be employing numbers to some degree on the raw data (Sandelowski, 2001). In the study I decided to use

numbers and patterns to visualize the prevalence of apparent themes. A preliminary set of matrices illustrated (1) the number of passages that were coded to a specific theme; (2) the number of participants per cohort that discussed a given theme; and (3) the number of words that were associated to a given theme. Using a scatterplot, the number of passages and number of words were compared to understand if significance could be drawn from number of passages coded and number of words. I felt that the passages coded was a more realistic representation of importance and a smaller number to use for analysis but to further justify this choice of metric, a scatterplot was completed to understand the relationship between passages coded and words coded (Appendix G). This graph resulted in an R^2 value of 0.93 indicating a close relationship between the number of passages coded and the number of words allowing me to use the number of passages coded as the metric for analysis. A final matrix was developed to illustrate the themes elicited and the passages coded to each theme by cohort and time period. Significance was given to themes where ≥ 5 passages were coded by $\geq 75\%$ of the participants in the respective cohort. Other research has used a similar semi-quantitative approach to determine themes of significance (Greenland-Smith, 2014; Sherren et al., 2010).

3.8 CHAPTER SUMMARY

The study looked at landscape perceptions of four specific cohorts living in the areas surrounding the Mactaquac Dam. Participants took part in a semi-structured interview, which consisted of a seven-section interview guide, additionally prompted by a map showing the landscape as it was pre-dam overlaid with present day features. Data were analyzed to show the themes and observations different cohorts felt towards different time periods of the Mactaquac landscape. Following this chapter is a stand-alone paper (Chapter 4) intended for independent publication in

a peer-reviewed journal. For this reason, there may be some repetition found in the introduction and methods sections. Chapter 5 will present an expanded discussion exploring a potential alternative explanatory model, and Chapter 6 will wrap up the overall thesis with more general concluding thoughts.

CHAPTER 4 ADAPTIVE BASELINES OF ACCEPTABILITY ON THE MACTAQUAC HYDROELECTRIC DAM AND HEADPOND, NEW BRUNSWICK, CANADA

This chapter has been written with the intention of being submitted for publication in the journal *Landscape Research* with my supervisor Kate Sherren and committee member Tom Beckley as co-authors. As such there is some repetition in the following introduction and methods section from previous chapters. I am the primary author on this paper; however, ‘we’ is used throughout to acknowledge the co-authors.

4.1 ABSTRACT

There is a growing interest in sustainable energy futures, and jurisdictions at all scales are exploring options to reduce dependencies on dwindling fossil fuel reserves and move forward with renewable energy generation. In the pursuit of a sustainable energy future, it will be key to understand not only the economic and environmental implications of renewable energy infrastructure, but also the social implications of such a change. The purpose of the study is to understand if and how people can accept and even appreciate utilitarian energy infrastructure in the landscape. The study used the Mactaquac Dam and headpond in New Brunswick, Canada, to understand public perception and landscape values. We developed a Baselines of Acceptability Mode and tested it using 20 interviews with locals from four demographic groups, to see whether baselines of acceptability towards energy landscapes are hardwired or malleable. The study found that individuals were able to adapt their landscape preferences after dam construction as they experienced the new landscape and found value and benefit in its changed form. It is

important to recognize that this transition is possible however communities need to be supported with information and transparency to avoid unnecessary uncertainty that can lead to fear and opposition.

4.2 INTRODUCTION

A person can grow attached to their home landscape regardless of its aesthetic, ecological, or cultural value to an outside observer, based on positive subjective connections. Renewable energy production infrastructure, often large and geographically dispersed, in order to make use of non-transportable resources (e.g. sun, wind, water), can threaten this connection (Bell et al., 2013; Devine-Wright, 2009, 2011; Selman, 2010; van der Horst & Vermeulen, 2012; Wolsink, 2007; Wüstenhagen et al., 2007). A landscape is more than a physical location in the environment; it is a culturally significant place, with historical, spiritual and community meaning (Antrop, 2005, 2006; Glover et al., 2008). Thus, attachment and emotional connection to place means that potential changes are often seen as a threat to one's meaning of place (Greider & Garkovich, 1994; Stedman, 2003). Sense of place (Jorgensen & Stedman, 2006; Stedman, 2003; Tuan, 1974) is often used to describe the person-place relationship, incorporating the ideas of place attachment and place meaning (Brehm, Eisenhauer, & Stedman, 2012). Thus, connection to place can hinder the progress of renewable energy adoption when communities fiercely oppose energy development via place-protective behaviours (Bell et al., 2013; Devine-Wright, 2009; Warren, 2014).

Social acceptance of renewable energy and its associated infrastructure is not a new issue in resource decision-making. However, the need for rapid energy transitions for reasons of energy security and climate change mitigation, and commensurate policies and targets, are forcing us to

take a deeper look at the issues surrounding acceptance (Batel, Devine-Wright, & Tangeland, 2013; Cohen et al., 2014; Stigka et al., 2014). Citizens often support the idea of renewable energy in theory, but when it comes to local infrastructure siting and implementation, support rapidly dissipates for reasons of aesthetics and landscape concern (Fernandez-Jimenez et al., 2015; Wolsink, 2007; Wüstenhagen et al., 2007). For instance, Wolsink (2007) found that there is strong support for wind power but far less support for sited wind farms, however, people can learn to accept and appreciate these wind farms in place over time.

Renewable energy infrastructure is often smaller scale (compared with non-renewable energy infrastructure) using technology with a lower net energy gain, meaning the number of required physical infrastructure units to produce sufficient energy are greater, affecting more people and more landscapes (Firestone et al., 2015; Nadaï & van der Horst, 2010; Wolsink, 2012).

Renewable energy production infrastructure, specifically solar, wind, and hydro, use natural resources for energy production, meaning the associated infrastructure may be more distributed and visually apparent to benefit from these non-transportable resources (e.g. line of sight for sun, prominent ridges for wind, or populated valleys for natural running water) (Fernandez-jimenez et al., 2015; Wüstenhagen et al., 2007).

The oldest renewable technology is hydropower energy technology, which has and will continue to have major effects on ecosystems, landscapes, and nearby communities. Despite a decline in hydroelectric energy and increasing numbers of dam removal in North America in the past two decades (The World Commission on Dams, 2000), hydropower dams are still under planning and construction around the world (Ansar et al., 2014; Zarfl et al., 2015). Furthermore, water impoundments, for the purposes of irrigation, flood control, and drinking water will continue to

increase as adaptation measures under global change (Downing et al., 2006). Presently, worldwide impoundments are estimated to cover 260,000 km² (Downing et al., 2006). Because of this we need to gain a better understanding of how both dam construction and removal may affect local communities. Looking at dams can allow us a unique perspective to understand social acceptance during both the implementation phase and removal phase as dam construction and dam removal are both taking place around the world today.

Hydropower dam construction grew in popularity in the 20th century, peaking in the 1970's when it is estimated that 2-3 large dams were commissioned every day worldwide (The World Commission on Dams, 2000). Dam construction projects have been seen to have environmental consequences (Namy, 2007; The World Commission on Dams, 2000), ecological consequences (Mims & Olden, 2013; Namy, 2007; Zarfl et al., 2015), and societal consequences (Nüsser, 2003; The World Commission on Dams, 2000; Vorkinn & Riese, 2001). Dams are believed to be responsible for diverting 60% of the world's rivers and displacing 40-80 million people (The World Commission on Dams, 2000). Due to these consequences, as well as aging infrastructure and industrial changes, the social movement around dam decommissioning and removal is gaining legitimacy.

There is a substantial movement in North America in support of dam removal for reasons of ecological, economic, and safety concerns (Babbit, 2002; Born et al., 1998; Pohl, 2002; Prowse, Wrona, & Power, 2013). To date, in the United States, it is estimated that approximately 1000 small dams (<30 MW of power, <6m in height) have been removed and only a few medium or large dams (>30 MW of power, >15m in height) have been removed (American Rivers, 2014), such as the Elwha and Glines Canyon Dams on the Elwha river in Washington (Witze, 2015)

and the Condit Dam on the White Salmon River in Washington (Pohl, 2002). Canada has similarly seen small dam removal (such as the barrage removal at Petitcodiac in New Brunswick (The Atlantic Salmon Conservation Foundation, 2013)) but large dam removal has not yet taken place. Despite the positive intentions associated with dam removal (e.g. free flowing rivers, increase of fish quantity and quality, natural ecosystem restoration, etc.) there are negative consequences that need to be acknowledged. Evidence suggests that local societies and to some degree ecosystems adapt to the changes brought by dam construction (Babbit, 2002). Thus, communities often oppose dam removal because removal can decrease water recreation opportunities, change or degrade aesthetics, and alter communities and lifestyles (Born et al., 1998; Johnson & Graber, 2002; Klein, 1999; Lejon et al., 2009; Wyrick et al., 2009). There is often limited end-of-life planning when dams are proposed and constructed (Born et al., 1998). Communities thus begin to see dams as permanent structures in the landscape, further intensifying emotions when removal is considered (Born et al., 1998) indicating a need for better end-of-life planning.

4.2.1 Conceptual Framework

We were interested in testing the adaptive capacity of the Mactaquac community through our developed Baselines of Acceptability Model (Figure 5). We developed a conceptual model to help organize various theories of how landscape acceptability is established and how it might change. Our Baselines of Acceptability Model is based on two axes, scale (individual versus social) and rigidity (concrete versus malleable). We use this framework to structure our exploration of acceptability around the Mactaquac Dam and headpond.



	Individual level	Societal level
Hardwired   Dynamic	1. Generational Baselines (Kahneman, 2011; Pauly, 1995)	3. Evolutionary Baselines (Kaplan, 1987; Selman, 2010)
	2. Experiential Baselines (Wolsink, 1994, 2007)	4. Cultural Baselines (Selman, 2010)

Figure 5. Baselines of Acceptability Model

The first quadrant, titled *generational baselines*, is based on Pauly’s (1995) shifting baselines syndrome concept, whereby people use the first environment they are exposed to as their baseline of acceptability. Developed in the context of fisheries, Pauly (1995) describes how new fisheries managers accept as a baseline the fish size, quality, and species composition they first encounter in a given ecosystem, and react positively or negatively to change from these baselines. This quadrant is thus associated with rigid individual norms, shifting only with subsequent generations. This is similar to Kahneman's (2011) concept of ‘anchoring’ which describes how humans often to heavily rely on only the first piece of information available to them and make decisions, opinions, and judgments from this information.

The second quadrant, titled *experiential baselines*, is based on work from Wolsink (1994, 2007) indicating that individuals may support the idea of wind energy and the production of wind

energy on a global scale or at a conceptual level, but reject the siting of wind farms in their communities and at the local level. However, over time Wolsink (1994) observed that individuals adapted and often learned to appreciate and see the public value of the wind turbine or wind farm in the community (Wolsink, 2007). Quadrant two recognizes that landscape baselines can be changed or adapted based on new perceptions of value and benefit. This quadrant assumes that when one experiences benefit or new value in a landscape, they may adapt their baseline to see this as acceptable or even ideal (Devine-Wright, 2005; Wolsink, 1994, 2007).

The first two quadrants represent values at the individual level. The second two quadrants (three and four) refer to baselines at a societal level. Quadrants three and four are based on Selman's (2010) understanding of the two ways in which landscape values can be influenced. Selman proposes two ways in which societal level baselines are held and developed (Selman, 2010). Quadrant 3 has been termed *evolutionary baselines*, and refers to baselines for which humans have a genetic disposition. Similarly, Kaplan (1987) found that aesthetic and environmental preferences could be explained from an evolutionary perspective. For example people prefer water, trees, and foliage scenes, as these elements indicate an area of habitat which would increase human survival (Kaplan, 1987). Quadrant four, referred to in the framework as *cultural baselines*, refers to the idea of baselines being malleable and influenced by culture (Selman, 2010). This implies the same concept as the experiential quadrant, that tastes, values and preferences can change over time (Selman, 2010).

The goal of the study was to examine whether different generational groups perceive a dam landscape and its future possibilities differently, and if those differences are related to their first

experience in the landscape, or adapted perceptions of the changing landscape over time. To test this idea we were interested in testing quadrants one and two since interviews were completed at the individual level.

4.2.2 Research Questions

The study uses the case of the Mactaquac Dam and headpond in New Brunswick, Canada, as a means to understand the views and attitudes held by local citizens towards pre-dam, post-dam and possible future landscapes. We are interested in whether attitudes toward landscapes shift, and if so, how. The area presents a unique setting where the lifespan of the dam will be well within the lifespan of some local residents. As a result, some citizens could share their thoughts and values of the landscape throughout the life cycle of the dam; pre-dam landscape values, current dam landscape values and perceived post-dam landscape values as citizens are faced with the possibility of dam removal. Specifically this paper aims to answer three research questions:

- (1) How do nearby residents perceive the Mactaquac Dam and headpond landscape and what do they wish for its future?
- (2) How do baselines of acceptability help to explain local acceptance or rejection of landscapes associated with hydroelectric energy?
- (3) What are the implications of the above for the Mactaquac decision, dam construction and removal decisions generally, and managing the landscape changes associated with renewable energy transitions.

4.3 METHODS

The study used map elicitation interviews with four different cohorts of local residents to test whether baselines of acceptability were generationally set (*generational*) or malleable (*experiential*) based on experience. Twenty interviewees completed interviews and approved their transcripts for data analysis. Analysis was done semi-quantitatively through a set of matrices to identify common themes across the different cohorts and different time periods.

4.3.1 The Case

Mactaquac, New Brunswick (NB) is the site of the Maritimes' largest hydroelectric dam which has been generating power since 1968 (NB Power, 2013). The dam is located 19 km upriver of the provincial capital of Fredericton and maintains a 96-km headpond (NB Power, 2013). Inundation displaced thousands of residents, submerged historical landmarks (i.e. cemeteries and waterfalls) and impounded the St. John River from Hartland to Mactaquac (Si, 1993). Today, a provincial park, a marina and new businesses rely on the headpond (such as a houseboat rental company) and over the years many new homes were built along the water, especially since the new TransCanada highway routed heavy traffic away from the river in the mid-2000s. The hydroelectric generating station is expected to reach the end of its lifespan in 2030 (30 years earlier than anticipated). This is due to a problem known as Alkali-Aggregate Reaction (AAR) whereby the concrete paste is reacting with silica concentrates in the gravel and sand that constitute the concrete (NB Power, 2014d). AAR is affecting the concrete of the spillways and the powerhouse and causing these structures to absorb water, swelling and cracking over time (NB Power, 2014d). The earthen dam, the structure that supports the headpond, is not affected by AAR (NB Power, 2014d). Three possibilities are currently being considered with the final

decision being made in 2016 to be implemented by 2030: (1) the dam will be rebuilt (a new spillway and power house will be built); (2) the dam will be removed completely (restoring the river by removing the spillways, earthen dam and powerhouse) or; (3) the earthen dam will be left in place and a new spillway will be built to maintain the headpond (the dam would no longer generate power) (NB Power, 2014e). Estimated costs are about \$5 billion for rebuilding and approximately \$3 billion for removal (NB Power, 2014c).

The Mactaquac Dam changed the physical, ecological, economic and social environments of the St. John River Valley. The residents now living in the area could be affected once again if the dam is removed. There was little information sharing between NB Power and the general public about the process until the launch of the project website in late 2014 (<http://www.mactaquac.ca>). While substantial research is underway about the biophysical implications of the various options, and a specific engagement process is underway with affected First Nations groups, the social and cultural implication of this decision has not been rigorously explored leaving many feeling uninformed about the future of the dam.

The study was a part of a larger study dedicated to understanding the social drivers of interest in exploring the complexities of energy choices and energy issues in Canada. The first phase of field research for this project began in 2013 when a team of researchers (including the three authors of this paper) took local residents on a houseboat on the Mactaquac headpond to elicit landscape values and dam preferences. During the first half of the tour, participants were given a personal tape recorder and asked to reflect on their thoughts and experiences with the Mactaquac headpond landscape. Participants talked alone or small groups. During the second half of the cruise we conducted a focus group, talking more specifically about the future of the dam, as well

as energy and economic development in New Brunswick more generally. That study established that many locals wish the dam to be rebuilt, but the data was limited in terms of more nuanced insights, with a lack of representation among the young and elderly, both in their attendance and participation (e.g. of the 2 participants representing the youngest cohort, they spoke very little in the focus group and personal elicitation). Additionally there were varying levels of adherence to instructions leading to poor-quality transcripts (Keilty et al., 2014) and limited structured data. Insights and weaknesses in that study informed the design of this one, but they are otherwise independent.

The study area for the houseboat tours was limited to the distance the houseboat could travel from the marina adjacent to Mactaquac Park and across from the dam in a 3-hour period. This limited recruitment to the communities between Hawkshaw and French Village (Figure 6), excluding the communities on the headpond west of Hawkshaw (Meductic to Hartland). A viewshed map analysis, identifying those areas able to see the headpond, was used to begin recruitment. The same study area was used in the study for triangulation purposes.

Participant recruitment for this map-elicitation interview study was done through snowball sampling from an existing contact database from the houseboat tours and as a later Q-method study (Parkins et al., 2015). The previous works indicated that there were many community members eager to get involved in the discussion about the dam decision but were unable to take part in those previous opportunities. We started with these community members, and worked to expand the participant pool through snowballing, social media and a radio ad.

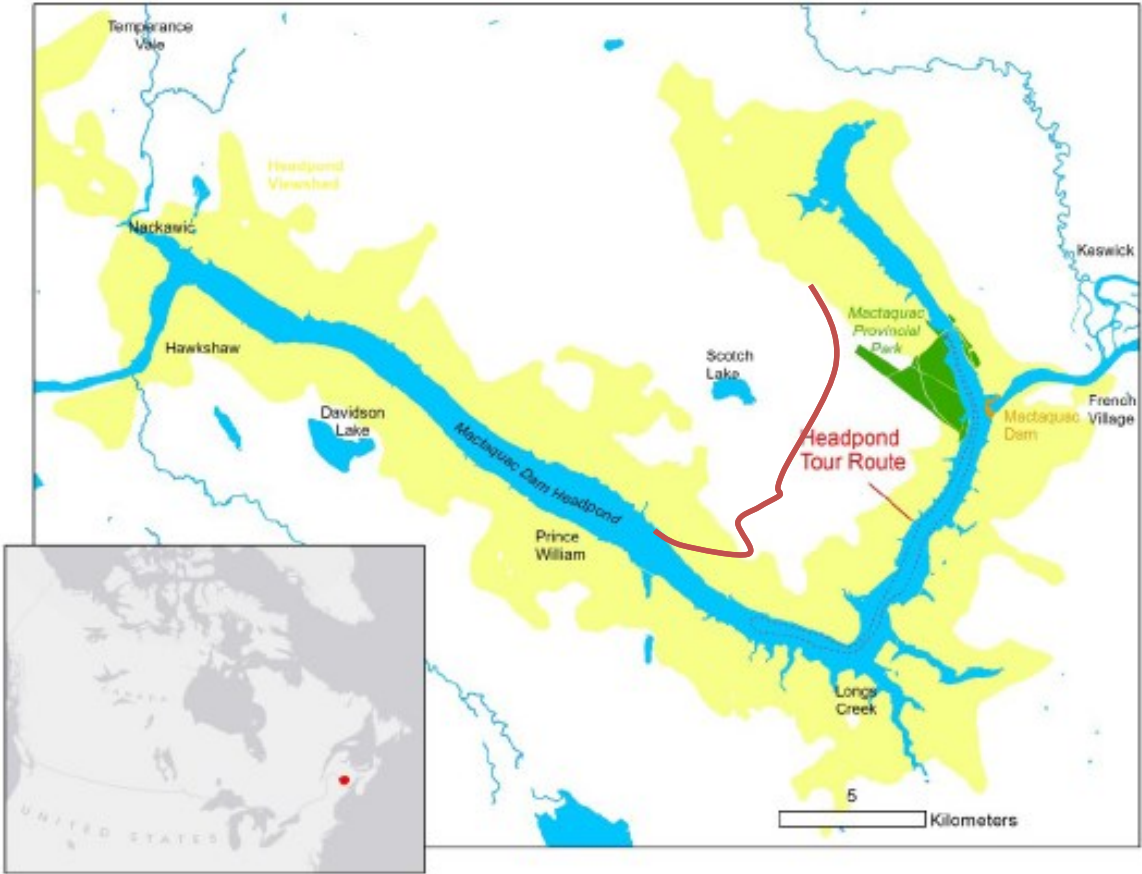


Figure 6. The study area (shown in yellow) was between Hawkshaw and French Village and included those who are able to see the headpond, based on viewshed analysis in GIS (created by Kate Sherren, 2013).

4.3.2 Data Collection

We interviewed 20 individuals spanning four cohorts (Figure 7):

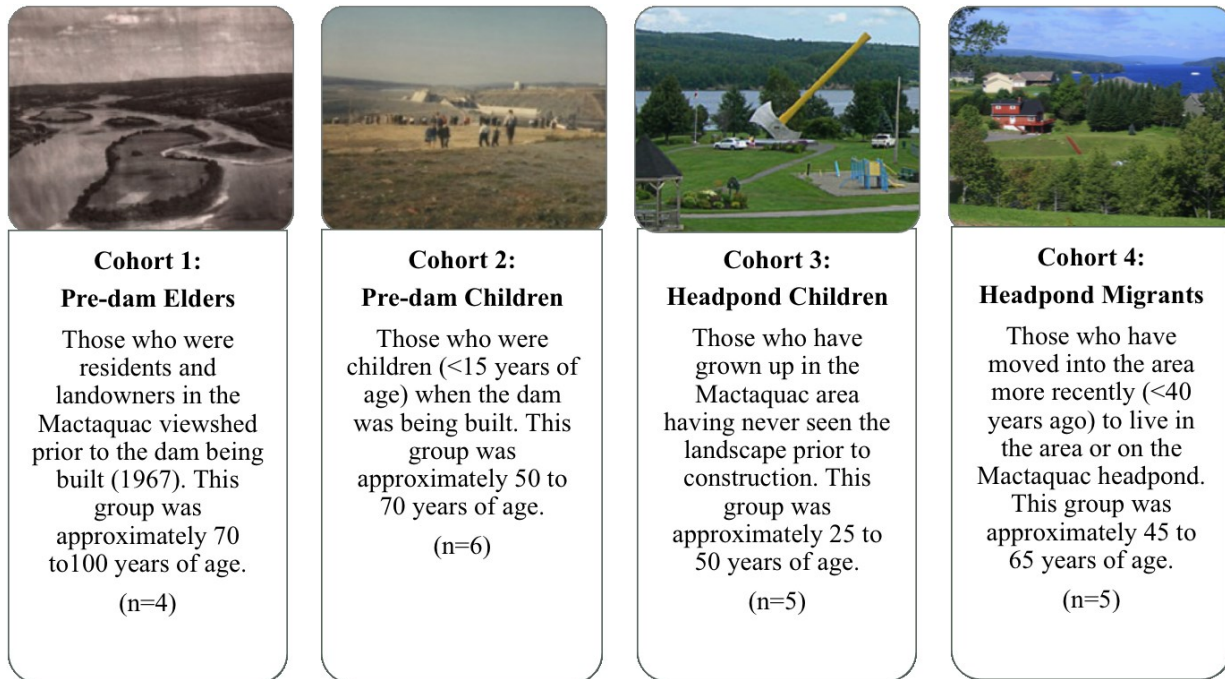


Figure 7. Cohort descriptions

These four cohorts represented four important and distinct interests and experiences related to the dam. The first cohort was designed to give a strong historical perspective to the study, having experienced the pre-dam landscape. The second cohort also consisted of people who experienced the landscape change, but they were young (<15 years of age) during the dam construction time period. The third cohort was important in order to understand how those who had only known the dam in place landscape viewed and valued it. The final cohort was unique in that they only knew the present landscape but have a broader experience as they ‘came from away’ and moved in as adults. By studying four different cohorts the study was able to understand how those with different interests and experiences view the landscape and perceive future scenarios for the

region. The four cohorts included multiple generations that further allowed analysis of attitude over generational change.

Interviews took place in a mutually agreed upon location, often participants' homes or places of work, and ranged in length from 25 minutes to 80 minutes. The interview guide was broken down into seven sections of semi-structured interview questions:

1. **Personal History-** The interview began with questions about the participant's time in the area and what their experience in the area had been like. This was followed with questions around the landscape changes they had experienced and how they perceived these changes. This section of questions elicited strong internal values that participants held towards the landscape at different times (i.e. pre-dam and present day).
2. **Perception of naturalness-** Participants were asked how they saw the present landscape, whether they liked it and/or viewed it as natural or normal. This was asked to help understand if there were direct and/or obvious shifts in a participant's baseline.
3. **Experience elsewhere-** Participants were asked about their time away from the area (if any). This was done to understand what other landscapes they may have experienced in order to understand landscapes on which they might be basing comparable opinions.
4. **Views of others-** Participants were asked their perceptions of what others felt about the area. This section allowed me to understand if certain cohorts perceived other cohorts, or other individuals in their cohort, as having different views of the area. This helped me to understand if others perceived baselines of acceptance as shifting or as concrete. Additionally this section was used to test for potentially inherited opinions, for example younger generations feeling a certain way due to the experiences shared by their parents or grandparents.

5. **What should be done to the dam-** Participants were asked which decision (dam removal, dam rebuilding with power, or dam rebuilding without power) they thought was best for themselves and what they felt was best for society. They were also asked which decision they felt other groups thought was best.
6. **Energy and development options-** Participants were asked what other energy sources they could see as appropriate in the area and what other development they would accept in the area.
7. **The local perspective-** Lastly, participants were asked who should be involved in the dam decision. This section allowed me to understand if the participant felt the decision should be local or provincial or how those interests should be balanced and also if they felt the decision would have personal effects or more general public effects.

The interview guide was supplemented with a map (Figure 8), used to help evoke memories of the landscape and give a new perspective to the landscape. Visual research methods have increased in popularity over the past two decades (Rose, 2014). Maps have been found to not only be useful for orienting and understanding different landscapes, but also to draw out memories and connections people hold towards a certain landscape (Spencer, 2011). Maps can show what once existed in a landscape, allowing people to remember and reminisce about areas that have changed (Spencer, 2011). The map shows the previous landscape and river channel as it was in 1959, which is overlaid with a modern map layer showing the new headpond, highway, dam, and the settlement constructed to house displaced citizens. This allowed people to compare the landscape they were presently in to the pre-dam landscape they either knew from the personal experience or from stories they had heard in the community. In the time since these

interviews took place, a colleague has developed an online story map that allows the user to dynamically swipe between the past and present landscape (energytransitions.ca/storymap)

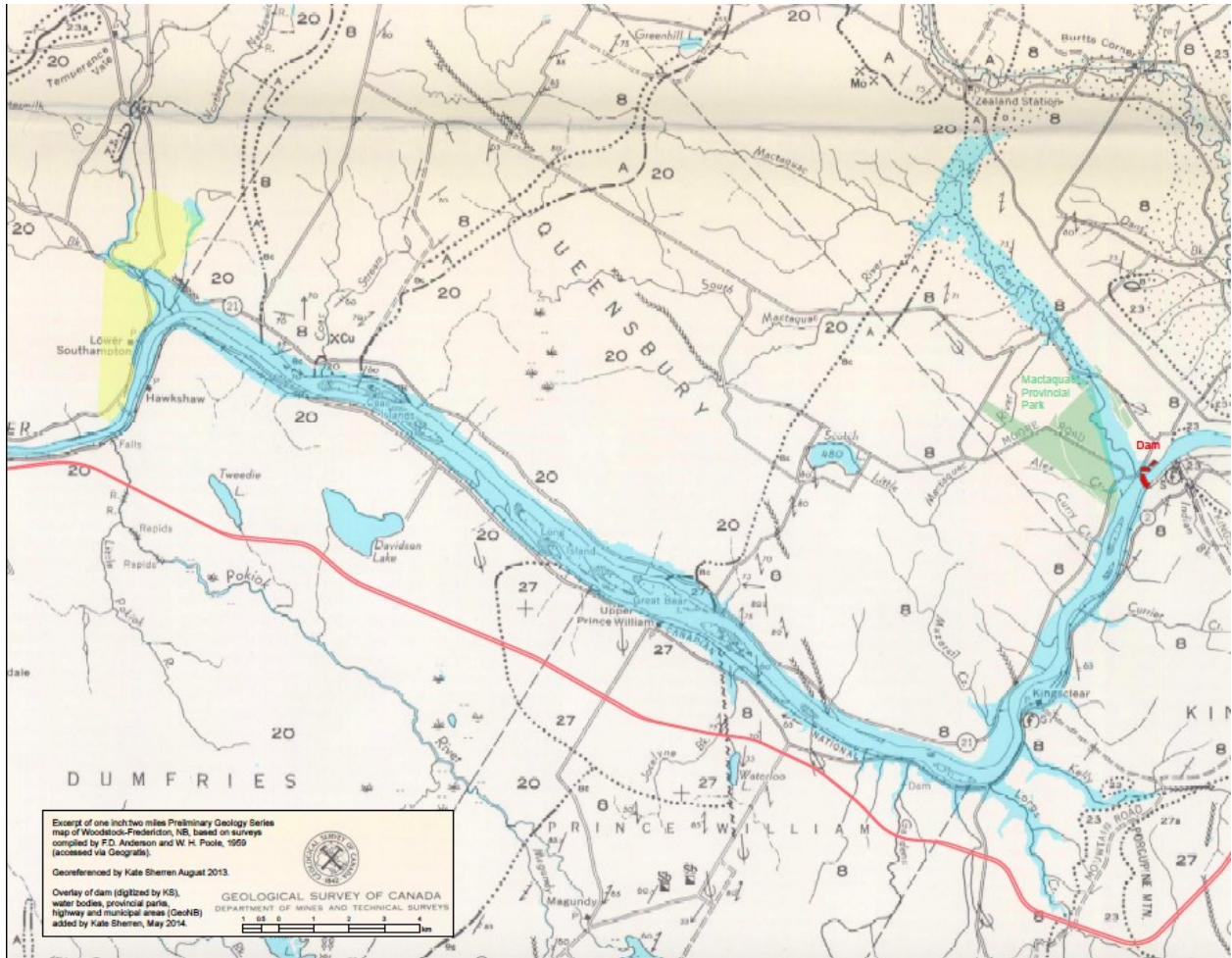


Figure 8. Map used during interviews, printed at a size of 60cm x 90cm GSC Preliminary Geology Series map of Woodstock-Fredericton, NB based on surveys compiled by F.D Anderson and W.H Poole (1959), accessed via Geogratis and georeferenced by Kate Sherren (2013). The original map has been overlaid with the dam, water bodies, provincial parks, highways and municipal areas (GeoNB 2014).

The participants were invited to write or draw on the laminated map as the interview was taking place or to simply point out locations as they spoke. Participant engagement with the map differed widely across the twenty interviews. All twenty participants pointed out their current homes on the map. Some pointed out where family lived or where they had lived in the past.

Many participants then used the map through the interview to share stories and memories. For example, many pointed out the islands that were flooded by the headpond, sharing stories about farming the islands, picnicking with family, or wading to them in the dry summer months. For those who did not know the pre-dam landscape the map allowed them to learn more about the area. The map acted as an additional prompt during the interview and helped to elicit memories that may not have been otherwise stimulated.

4.3.3 Data Analysis

NVivo 10 software (QSR International Pty Ltd., 1999-2015) was used to code the interview data elicited by the different participants, alternatively deductively and inductively. The interviews were deductively classified by the participant's gender and cohort to allow comparisons to be done within the specific cohort group as well as against the other three cohorts. From the prompting questions participants expressed their opinions and values towards five different time periods: (1) Pre-dam; (2) Dam construction; (3) Dam today (infrastructure intact); (4) Dam removal; (5) Dam rebuild (with power and without power). Data were coded to the appropriate time period being discussed. The most discussed time period was that of present day or recent history, which fell under the code "Dam today." This code included anything a participant mentioned about the landscape as it is today or as it has been in the 47 years since the dam has been in production.

A thematic analysis was used to identify themes and values discussed by the participants (Braun & Clarke, 2006). The process of thematic analysis consists of searching for themes in the data, "it is a form of pattern recognition within the data where the emerging themes become the categories for analysis" (Fereday & Muir-Cochrane, 2006, p. 82). The inductive approach was

used to code values, observations and sentiments expressed (termed themes) by the participants. Inductive coding was done through an iterative process where preliminary codes were developed, expanded and modified as the coding process unfolded. This resulted in a set of positive and negative themes (Figure 10). Seventeen themes were developed (Table 3), which were sorted into 6 overarching topics (Figure 11). Each theme included positive and negative sub codes.

Themes were then analyzed semi-quantitatively through a set of matrices to determine the most common themes, by cohort and landscape. A semi-quantitative analysis of qualitative data means that data is coded to allow for numerical counts of significance and is presented in collaboration with representative quotes from the interviews (Johnson, Dunlap, & Benoit, 2010). It is understood that counting is integral (whether consciously recognized or not) to qualitative research in order to recognize patterns and areas of importance (Sandelowski, 2001). In the study we have decided to visually represent these patterns of significance through matrices. A preliminary set of matrices illustrated (1) the number of passages that were coded to a specific theme; (2) the number of participants per cohort that discussed a given theme; and (3) the number of words that were associated to a given theme. There is no standard definition of ‘passage’ in the qualitative literature. Coded areas could extend over several sentences, so we first tested if our ‘passage’ counts over these themes were significantly related to word counts. Using a scatterplot the number of passages and number of words were compared to understand if significance could be drawn from number of passages coded and number of words. This graph resulted in an R^2 value of 0.93 indicating a close relationship between the number of passages coded and the number of words. The number of passages was thus chosen as the most manageable unit of analysis. A final matrix was developed to illustrate the themes elicited and

the passages coded to each theme by cohort and landscape period (Figure 9). Significance was defined as themes where ≥ 5 passages were coded by $\geq 75\%$ of the participants in the respective cohort (Figure 9). Similar semi-quantitative approaches have been used to determine themes of significance (Greenland-Smith, 2014; Sherren et al., 2010). This matrix was then graphically represented by tone (Figure 10) and by overarching theme (Figure 11) to aid in interpretation.

Cohorts	Aesthetics		Recreation		Emotion		Community		Ecosystem		Economics		Lifestyle		Fishing		RealEstate		Landscape		Energy		Tourism		Progress		Employment		Innovation		Unspecified		WaterQuality				
	-	+	-	+	-	+	-	+	-	+	-	+	-	+	-	+	-	+	-	+	-	+	-	+	-	+	-	+	-	+	-	+					
PreDam	1	0	9	0	5	1	1	0	7	0	2	0	3	0	0	0	5	1	1	0	4	0	0	0	1	0	0	0	2	1	0	0	0	0	1		
	2	4	7	7	10	0	4	0	5	2	3	0	1	1	6	1	6	0	0	0	8	1	0	0	1	0	0	0	0	0	1	0	0	1	1		
	3	0	3	2	0	1	0	0	1	0	1	1	0	0	0	1	1	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0		
	4	0	0	0	1	1	0	0	0	1	0	1	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0		
DamConstruction	1	2	0	0	1	29	4	13	2	2	0	11	4	2	1	0	0	5	0	4	0	0	0	0	0	1	8	6	2	8	0	0	0	0	0		
	2	3	0	0	0	37	1	9	1	5	0	9	1	6	0	3	1	7	0	3	0	0	0	0	0	7	4	5	12	0	0	0	0	0			
	3	0	0	0	0	4	0	2	1	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	2	0	0	1	0	0	0	0	0			
	4	0	0	0	0	0	0	0	0	0	1	0	1	0	0	0	0	0	0	0	0	0	0	0	1	1	0	1	0	0	1	0	0	0			
DamToday	1	1	6	0	8	0	1	3	4	3	3	6	8	0	4	4	1	1	2	4	2	0	2	1	3	0	0	2	3	0	1	0	0	4	0		
	2	0	23	2	36	1	10	2	11	8	15	5	8	3	18	19	9	0	22	2	9	1	20	0	7	0	5	0	4	0	0	0	1	2	0		
	3	3	16	3	37	0	5	7	19	6	7	2	8	2	15	7	10	4	4	2	2	1	6	2	8	0	1	1	11	0	0	0	1	1	0		
	4	0	33	2	55	1	7	0	23	1	5	2	6	1	24	4	7	1	13	0	8	2	6	0	16	0	1	0	2	0	0	0	0	0	0		
DamRemoval	1	12	0	0	0	3	0	1	0	12	0	5	0	0	0	4	0	2	0	6	1	0	0	0	0	1	1	1	0	2	0	1	1	0	0		
	2	39	4	6	1	11	1	5	0	18	7	4	0	6	1	1	1	10	0	16	4	10	1	5	0	8	1	1	0	2	1	3	1	1	0		
	3	23	7	14	4	28	1	25	2	24	5	8	5	14	2	12	6	15	4	8	0	0	1	8	2	4	0	3	4	2	3	2	1	1	0		
	4	25	0	14	2	24	0	9	0	19	0	19	1	15	0	2	5	15	1	12	1	9	1	8	0	13	1	3	1	0	0	4	0	0	0		
DamRebuild	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0		
	2	0	1	0	1	0	2	0	1	0	2	6	4	1	3	1	1	0	5	1	1	1	12	0	0	1	1	0	0	1	0	0	1	0	0		
	3	0	2	0	1	1	2	0	1	0	0	1	6	0	1	0	1	0	1	0	1	0	1	0	6	0	1	0	0	0	1	0	0	1	1	0	0
	4	0	0	0	1	0	0	0	0	0	3	4	4	0	1	0	4	0	0	0	3	0	5	0	5	0	2	0	0	0	0	0	0	0	0		

Figure 9. Matrix of themes elicited and number of passages coded in the intersection of cohort and time period (rows) and themes (+/-) (columns). Bolded numbers indicate a theme expresses by 75% or more participants in the cohort. These bolded items are represented diagrammatically in Figures 10 and 11.

4.4 RESULTS

Of the twenty participating individuals, 4-6 individuals represented each cohort. 55% of participants were female and 45% were male (Table 2).

Table 2. Summary of participants per cohort.

Cohort	Female	Male	Total number of
Pre-dam Elders	3	1	4
Pre-dam Children	2	4	6
Headpond Children	4	1	5
Headpond Migrants	2	3	5
Total	11	9	20

Table 3. Themes of sentiment or observation derived through inductive coding paired with the themes description of how each was recognized in the data.

Theme	Description	# of passages	Overarching theme
Coded to when participants discussed:			
Aesthetics +/-	the beauty or attractiveness of the landscape.	223	Visual
Recreation +/-	recreational activities that took place in the landscape (e.g. boating, swimming, winter sports, etc.)	213	Social
Emotion +/-	personal wellbeing or feelings towards the landscape.	181	Social
Community +/-	the sense of community and neighbourhoods within the landscape	154	Community
Ecosystem +/-	the ecology or physical environment of the landscape	154	Environment
Economics +/-	economic opportunities and the general economics of the landscape.	145	Economic
Lifestyle +/-	the lifestyle the landscape supported	128	Social
Fishing +/-	recreational fishing as well as fish health, populations and diversity.	118	Environment
Real Estate +/-	land values and housing prices	114	Economic
Landscape +/-	the benefits and drawbacks of the landscape in its entirety	102	Visual
Energy +/-	energy production and/or energy security.	85	Energy
Tourism +/-	tourist opportunities and tourist activities in relation to the landscape.	68	Economic
Progress +/-	the progression or advancement of the area.	60	Community
Employment +/-	job opportunities and work associated with the landscape.	57	Not significant
Inundation +/-	the flooding of the land.	36	Not significant
Unspecified +/-	the landscape in a descriptive or neutral manner.	19	Not significant
Water Quality	issues around water health	12	Not significant

4.4.1 Results by Cohort

The four cohorts varied on what they perceived as the greatest benefits and drawbacks to the dam and headpond landscape. In general all four cohorts viewed the time period of dam construction and the potential time period of dam removal negatively and viewed the current landscape and pre-dam landscape positively (Figure 10). Six overarching themes were noted and illustrated to show how each cohort viewed each time period (Figure 11).

In the following summaries, the term ‘most’ will denote themes supported by at least 75% of the cohort (e.g. themes that were spoken to by at least 3 of 4 participants in Cohort 1, 4 of 6 participants in Cohort 2 and 4 of 5 participants in Cohorts 3 and 4). ‘Less significant’ will denote themes expressed by 50-70% of the cohort. ‘Uncommon’ will denote themes expressed by less than 50% of the cohort.

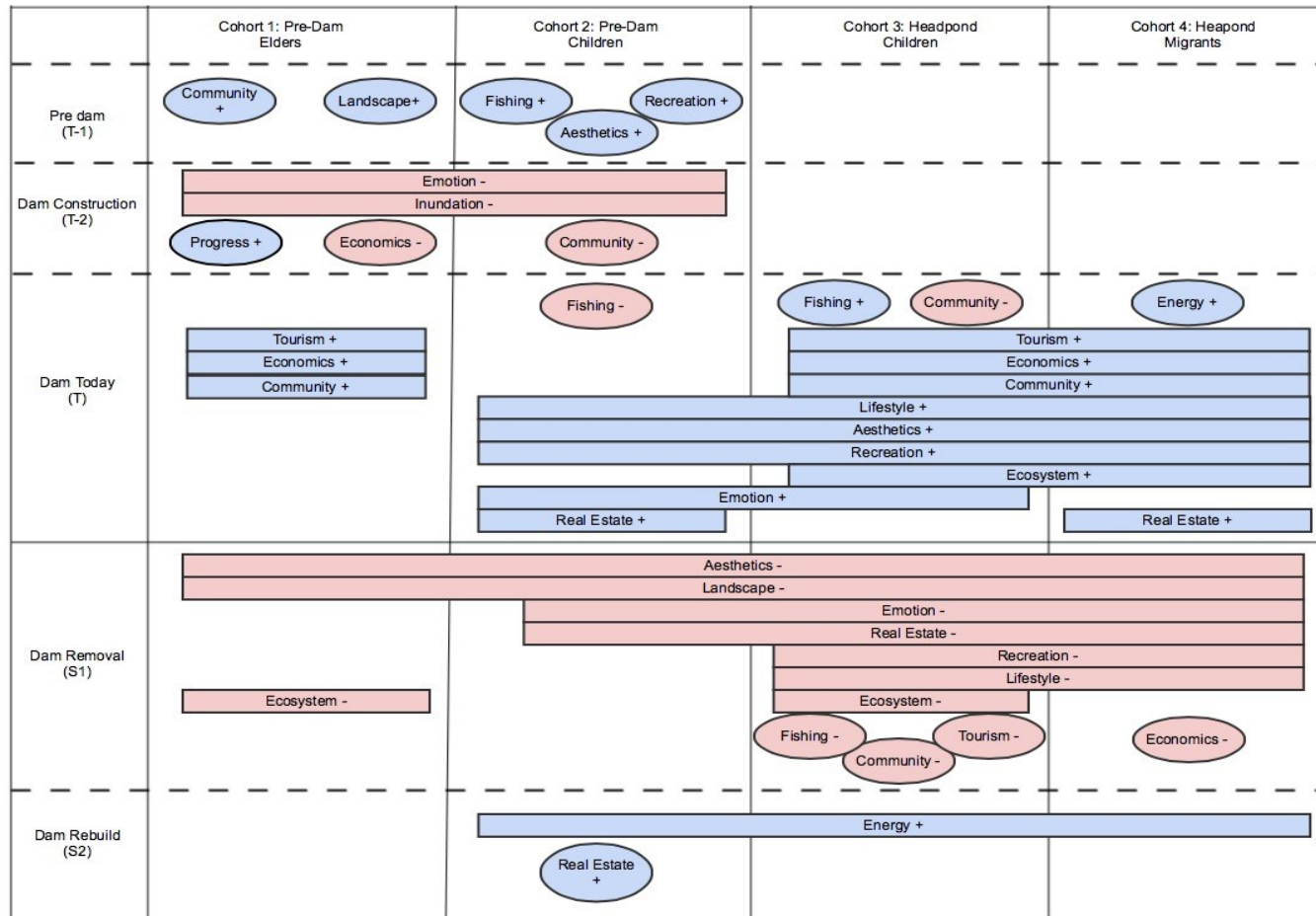


Figure 10. Themes elicited by each cohort per time period. Red shapes indicate negative themes and blue shapes indicate positive themes. Rectangles represent themes shared by multiple cohorts in a given time period and ovals represent themes unique to the cohort in a given time period. Note only themes expressed by 75% or more of the cohorts are illustrated.

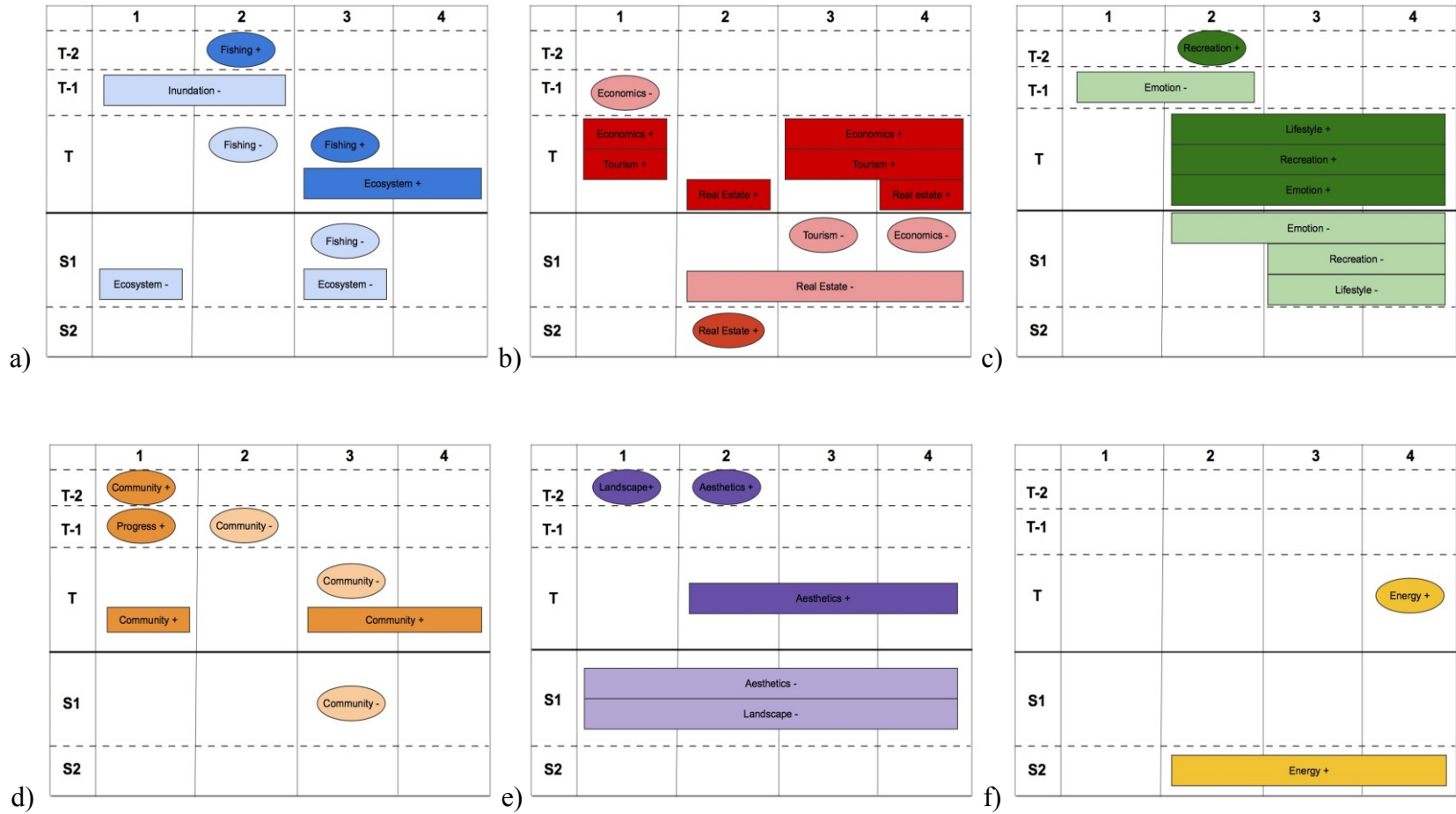


Figure 11. Positive (bold) and negative (pale) themes associated with each time period of the Mactaquac landscape by theme: a) environment b) economic c) social d) community e) visual f) energy. Column headings refer to cohorts and row headings to time periods.

Cohort 1 (Pre-dam Elders)

When talking about the pre-dam landscape Cohort 1 spoke to the positive aesthetics that they experienced, and the strong sense of community that existed. They also discussed the fishing, specifically salmon fishing, and recreation that took place in the river landscape. Participants noted recreational activities such as salmon fishing, picking fiddleheads, and swimming along the shores.

The most discussed time period for Cohort 1 was dam construction. This cohort was the most affected group because for many the dam's construction changed their livelihoods and the community significantly. Cohort 1's overarching feeling towards dam construction was negative. Negative emotions included sadness, anger, fear, and depression. Participants discussed how numerous people, including themselves, were dealing with physical illnesses as a result of the trauma and stress many were under during the construction period (this was tracked within the theme of emotion). For most participants in this cohort this was paired with negative aesthetic views and a negative economic outlook, as some of the sampled individuals lost their means of income (agriculture) and/or were faced with the burden of relocating their homes, families, and careers (Si, 1993). Interesting, however, was the emergence of the theme of progress, whereby despite the turmoil of construction, people regarded this as a period of positive progress and development, specifically in regards to energy development and technological advancement.

Progress, that was all we heard and that was why a lot of us were quite willing to give it up what we were asked to give up, for prosperity and work for the young people, we were for that, we all supported that. (Female, Cohort 1)

When talking about the future of the area most Cohort 1 individuals talked only about the potential of dam removal and did not mention or comment on the option of dam rebuilding.

Cohort 1 individuals were not as interested in the future options as many did not see the future as a major concern for them due to their age. However, of greatest concern to most, in regards to dam removal, were the negative aesthetics and the negative landscape that would develop. Most Cohort 1 participants felt that dam removal would leave an ugly landscape with little aesthetic appeal and an unhealthy ecosystem. Specifically, they felt that over the past 47 years they had seen the area develop into a stable ecosystem that would be faced with yet another period of fluctuation if dam removal were to occur.

Cohort 2 (Pre-dam Children)

Cohort 2 individuals spoke fondly of the pre-dam time period, discussing the beautiful landscape that was present along the river course and the lifestyle that their families maintained. Most Cohort 2 individuals had a strong emotional connection to that landscape and the benefits it afforded, likely because this cohort was of an age (<15) where they were exploring the area and connecting with nature.

Most of Cohort 2 viewed dam construction negatively. In particular they discussed the negative emotions that were felt at the time, seeing their families and communities facing the challenges associated with major landscape change regardless of what benefits may also have occurred to individual families or the region. Most of Cohort 2 also viewed inundation negatively, as it took away the landscape they knew during their childhood. Less significant were the themes of economics and real estate.

Despite viewing construction as a negative period, the dam and contemporary landscape was viewed positively by Cohort 2 participants. This group spoke to the aesthetic values of the

landscape, the lifestyle the new lake allowed, and the recreational opportunities the headpond supports. Cohort 2 also expressed how they had grown attached to the altered landscape both emotionally and for the real estate values their homes now possess. Cohort 2 holds the greatest interest in the areas current and future real estate because they have invested strongly in the present landscape since they developed family homes after dam construction. Cohort 2 holds the dam responsible for the loss of native fish, specifically the salmon, likely because fishing for recreation and sustenance was common practice prior to dam construction in their youth.

Cohort 2 felt that the removal of the dam would be a poor decision. They viewed dam removal as damaging to the aesthetics of the area and the landscape as a whole. They have lived most of their lives with the headpond in place and the resultant landscape, and the idea of change was worrying to them. They also felt that their properties would face large real estate value losses if the headpond were to be drained. They noted how much time and money they had put into developing their homes in the area and felt dam removal would threaten this, and subsequently the value of their real estate.

Lastly, Cohort 2 was the most vocal group when speaking about the rebuilding of the dam. They felt dam rebuilding was the best scenario for energy production needs, despite not mentioning the topic of energy in regards to any other time period. Again they also focused on real estate values and the potential to maintain or enhance their real estate values if the dam were to be rebuilt.

Cohort 3 (Headpond Children)

Cohort 3 consisted of individuals who grew up in the headpond landscape after the construction of the dam; this group has only experienced the landscape as it is today. This cohort rarely spoke about the pre-dam landscape or the dam construction time period, as they never personally experienced it.

Most of Cohort 3 viewed the current landscape positively. They expressed a connection towards the landscape based on its aesthetic benefits, the community coherence it supports, the lifestyle it allows them to maintain, and the recreational opportunities. External to personal benefits, Cohort 3 participants perceived benefits and opportunities for tourism and the economy within the headpond landscape. Lastly, they noted the positive ecosystem that has been established and the fishing opportunities that exist as a result of the dam. Cohort 3 held an opposite view to Cohort 2, believing that fishing opportunities were plentiful in the headpond landscape.

Cohort 3 viewed the potential of dam removal as a major threat to their homes, landscape and lifestyle. They felt removal would damage the areas aesthetics, sense of community, the present established ecosystem including fishing populations, and their real estate values. This potential option for the future elicited strong negative emotions, of sadness, anger, and anxiety.

Cohort 3, like the others, did not speak at great length about the potential decision to rebuild the dam. They viewed dam rebuilding as the best option but only spoke to dam rebuilding within the context of positive energy generation and security for the area.

Cohort 4 (Headpond Migrants):

Cohort 4 did not discuss pre-dam or dam construction as they were not involved or connected to the landscape or the community during the pre-dam. Many Headpond Migrants moved into the area after 1980 and by this time the communities and the present landscape were established.

Similar to other cohorts, the Headpond Migrants spoke strongly in support of the current landscape and spoke at length to the positive aesthetics of the area, the lifestyle it allows, the strong sense of community in the region and the recreational benefits of the headpond landscape. Interestingly, this group also spoke to the tourist benefits and felt that the landscape could be exploited further to increase tourism and subsequently the economics of the area. Cohort 4 participants welcomed the idea of new people and new activities to the area more so than Cohorts 1 through 3. Cohort 4 participants were focused on the 'dam today' time period as it is the only version of the landscape they know.

After so many years, now you've got several generations again that have gone through the change that now you have to leave it. Why would you take it out, we have all accepted it. (Female, Cohort 4)

The thought of dam removal evoked strong negative emotions from Cohort 4 participants. This cohort felt that there was a responsibility to maintain the headpond landscape because of the benefits it offers. They felt that dam removal would have negative impacts on the aesthetics of the area, the economic success of the area, and the lifestyle it currently supports.

Lastly this group spoke to the benefits of dam rebuilding, similarly to cohorts 2 and 3, focusing on the energy the dam creates and could maintain into the future.

4.4.2 Results by Theme

Environmental themes

All four cohorts presented environmental themes during the course of the interviews. Specifically, the term environment or ecosystem was used to discuss the changes that had been seen, or were perceived to have occurred as it related to species health, ecosystem structure, and environmental health. Of greatest concern were the fish populations in the area. However, different groups focused on different species of interest (

Table 4). Cohort 2 expressed concern for fish population decline (specifically salmon) caused by the dam and limited fishing opportunities in the current landscape. Cohort 3 felt that the headpond supported a multitude of fish (specifically bass) and fishing opportunities (Figure 11a). Lastly the theme of inundation or loss of land was present by those cohorts who saw ecosystems forever changed by the flooding of the headpond. Cohorts 1 and 2 focused on the loss of species that thrived on the islands, for example many discussed the abundant fiddleheads they had once picked on the islands and shoreline.

Economic themes

Economic themes were threefold: real estate, tourism and economics (Figure 11b). The themes of economics encompassed discussions around job creation and job loss, and more generally around economic stressors (e.g. loss of home or land), and economic opportunities (e.g. newly created business ventures). The creation of the headpond flooded out many homes and farms or parts of farms, forcing many families and businesses to relocate. This was a major focus for Cohort 1, who faced relocating or rebuilding their homes, and for, some finding new work as a result of the dam. The theme of real estate emerged when participants were talking about the present landscape. Many felt real estate values were relatively high as a result of the headpond. Similarly, because of this, participants felt that real estate values would be negatively impacted if the dam were to be removed and the river channel was to narrow, leaving homes with no water frontage or a larger distance to it (

Table 4).

The last theme related to economics focused on tourism. Participants spoke positively to the present tourist opportunities in the area, namely the successful houseboat company on the headpond, the golf course, and the beach at Mactaquac Park. Many felt that tourism was good for the area, creating jobs and opportunities for many of the locals. Tourism was viewed positively overall and many felt there were unexplored opportunities to be exploited.

Social themes

Social themes were a strong focus when cohorts discussed the benefits they found in the current dam landscape (Figure 11c). Overall the view of the landscape as it is today was positive and much of this positivity was linked to the personal benefits derived from the landscape. Participants discussed recreation, specifically swimming, boating, snowmobiling and parasailing (

Table 4). Aside from physical uses of the headpond landscape participants associated a positive lifestyle to the present landscape. They spoke to the enjoyment they felt from living on the water in a quiet rural environment. Contrary to how the present landscape is viewed, the potential for dam removal elicited strong negative emotions such as anxiety, stress, sadness and concern about losing recreational activities and waterfront lifestyle. Many participants seemed to perceive the loss of the headpond as a loss of the lifestyle they deeply loved.

The same idea of loss evoked strong negative emotions when the dam was being constructed. Negative emotion was felt towards the loss of land, the loss of homes and businesses, and the loss of community. Cohorts 1 and 2 spoke to the emotional stress of the change and how difficult the time period was. It became clear that negative emotions were felt toward periods of transition or change and positive emotions were felt towards periods of stability.

Community themes

Throughout the study it was evident a strong sense of community has existed along the St. John River for a long time (Figure 11d). A strong sense of community existed among the agricultural communities prior to the dam and a strong sense of community exists today among the waterfront waterfront communities (

Table 4). Cohort 3 expressed an interesting take on community, viewing it as both negative and positive. Specifically they discussed negative community impacts and a poor sense of community cohesion as a result of the dam construction. For example, old families left because their homes were gone, and new families came for new job opportunities. Cohort 2 individuals were native to the area but felt lost in their new communities and new schools, as people ‘from away’ were moving in. Those who grew up on the headpond would have missed much of this transition. This same concern for changing community dynamics was expressed when discussing the potential for dam removal. A strong sense of community is apparent in the present landscape and upheaval could create negative change and disconnect.

Visual themes

The present landscape was described as beautiful, pretty, breathtaking and peaceful (Table 4). Cohorts 1 and 2 described the pre-dam landscape in a similar way. Of greatest significance, however, are the concerns over the landscape and the aesthetics of the area if the dam were to be removed (Figure 11e); participants across all four cohorts strongly believe the area would be unappealing for many years. Visual themes were associated with social and community themes. People that found the area provided physical and social benefits also perceived the landscape and its overall aesthetics in a positive way.

Energy

Energy was anticipated to be an important theme of discussion but it was only minimally discussed (Figure 11f). The drive for new and secure energy fortified the dam construction decision in the 1960s, however, few participants connected the landscape and the benefits it provides to the energy production of the dam. Despite the limited mention of energy in discussing past and present time periods, the theme of energy did appear quite strongly as participants discussed reasons they support dam rebuilding (

Table 4).

Table 4. Example quotes showing positive and negatives views across the different cohorts and time periods related to the six broad themed areas (Figure 11)

Theme	Positive Example	Negative Example
Environment	“Right now every year we watch geese, ducks, loons, everything comes back, you know I don't know the ecology side of it, but it's all natural now, what is here is natural and beautiful” (<i>Dam Today, Male, Cohort 2</i>)	“I mean you've created a brand new ecosystem for the last 50 years. How can you now just disregard that?” (<i>Dam Removal, Female, Cohort 4</i>)
Economic	“Economically there are possibilities. I know for us, for the sports we do, in the winter with the paraskiing we created a school out of that” (<i>Dam Today, Female, Cohort 4</i>)	“Right now, living on the headpond, property values are up there, but all of a sudden the river goes back up, the property values drop, people are going to lose big time” (<i>Dam Removal, Male, Cohort 2</i>)

Social	“Our waterfront is very active, there are lots of kids down there, we have a little beach...they will play in the water or jump of the docks. And of course there are all kinds of boaters that come here” (<i>Dam Today, Male, Cohort 4</i>)	“Well everyone would get a new neighbour for sure, and these houses would be in the middle of the woods, and suddenly every boat would have to turn into a four wheeler” (<i>Dam Removal, Male, Cohort 3</i>)
Community	“We were down there every summer, we would have friends over, everyone would just be at the water together” (<i>Dam Today, Female, Cohort 3</i>)	“We moved back to what we called Lower South Hampton and it was hard to adjust to calling it Nackawic because we had been there so long. We moved back and just found it a different community all together (<i>Dam Construction, Female, Cohort 1</i>)
Visual	“Where could you be that is anywhere prettier than here? Pretty hard to beat.” (<i>Dam Today, Male, Cohort 2</i>)	“The water came up and my rose bush was a way out in the water and of course the where our buildings were covered in water... it looked like a great big lake, not a river anymore. I remember him [my husband] saying well, now it is gone, nothing left, nothing but memories.” (<i>Dam Construction, Female, Cohort 1</i>)
Energy	“It is a power that does not take coal or oil...it’s really a wonderful way to make money and create power.” (<i>Dam Today, Female, Cohort 1</i>)	N/A

4.5 DISCUSSION

We undertook a set of 20 semi-structured interviews to elicit landscape values from four specific cohorts that had different experiences with and different baselines in relation to the construction, operational or maintenance period and potential removal or rebuild of the Mactaquac Dam and headpond. This included exploring landscape values around the pre-dam landscape and the post-dam landscape. We sought to understand: (1) how nearby residents perceived the landscape and what they wish for its future; (2) if the Baselines of Acceptability Model helped to explain these values across the different cohorts; and (3) the implications of both for the Mactaquac decision, dam construction and removal decisions elsewhere, and other renewable energy decisions.

This work aimed to understand the complexities that exist around citizen perceptions of dams and renewable energy in the landscapes to inform new energy landscape decisions. This section interprets the results in the context of the current literature by looking at our three research questions.

4.5.1 Perceptions of the dam and headpond landscape today and in the future

All four cohorts presently value the Mactaquac Dam and headpond landscape. Most notably the landscape is valued for its positive aesthetics and lifestyle as well as the recreation, tourism and real estate/economic opportunities it presents. Referring to Figure 10 most of Cohort 1, the Pre-Dam Elders, value the landscape for its tourism, economics and positive sense of community, while the other 3 cohorts value the landscape primarily for its aesthetics, recreation and lifestyle. Overall the present landscape is perceived by the study participants to hold positive values and benefits for the current community, however, the transition to the present landscape (the process of dam construction) was viewed differently across different cohorts.

For those affected at the time (Cohorts 1 and 2) the period of dam construction represented a time of negative emotion and stress related to the inundation of land and loss of homes and property. However, it is important to note the theme of progress, identified by Cohort 1, who spoke about the dam as a means of progress and modernization (Figure 10). Bourgoin (2013) noted dam opponents resisting the modernization of the landscape, which would destroy the history and natural landscape however, dam supporters promoted the modernization of the area as a means to innovative development and progress. The theme of progress in the Mactaquac Dam case is a major focus of Dickison's (2006) work. The provincial government conducted a long and well-funded propaganda campaign on the idea of modernization and progress as

justifications for construction of the dam. The ideology of progress through hydroelectric development was borrowed quite directly from the Tennessee Valley Authority, which was created to modernize an underdeveloped region in Appalachia beginning in the 1930s (Kenny & Secord, 2010).

This idea of progress associated with dam building in general was once quite common. Dams were once viewed as “symbols of modernity” (Dickison, 2006; Kenny & Secord, 2010; Namy, 2007); evidence of “humanity’s ability to harness nature” (The World Commission on Dams, 2000) and “symbols of national strength and pride” (Klein, 1999). Political leaders, media sources and pro-dam individuals at the time of the Mactaquac Dam construction promoted the project as an opportunity for progress, an opportunity for industry and economic development, and an investment that would bring new life into the area (Manzer, 1996; Si, 1993) further supporting this idea of progress. The concept of progress was expressed to citizens at the time of construction and many accepted the idea as a way to justify their own struggles. Today, with the potential of dam removal many feel a sense of unfulfilled promises; they do not feel the dam has brought the modernization and progress they promised (Dickison, 2006; Kenny & Secord, 2010).

Having experienced the landscape change associated with the dam’s construction, the studied population of the Mactaquac community feels strongly about the future of the dam and its landscape. All four cohorts believe the removal of the dam would result in negative aesthetics and a poor landscape overall. This fear of dam removal has been noted in other communities and landscapes. It is understood that people fear the repercussions of dam removal and want to defend the landscape and communities that depend on the energy infrastructure (Johnson & Graber, 2002; Poma & Gravante, 2015). Citizens living in energy landscapes often perceive

future changes to their landscape as having negative effects, even if the change is predicted to bring benefit to the area (Parkhill, Butler, & Pidgeon, 2014). Furthermore, river landscapes are often valued by residents and any threat (development or infrastructure) is perceived negatively (Davenport & Anderson, 2005).

Many communities view dams as a natural part of the landscape, despite dams being man-made additions (Klein, 1999; Lejon et al., 2009), and value them for the recreation values of the associated headponds (Born et al., 1998). Johnson and Graber (2002) found that people fear what the future may hold after dam removal, specifically for their valued landscape and the associated aesthetics, their developed community, the current ecosystem and the areas economic future. Lejon, Renofalt & Nilsson (2009) also found opposition to dam removal from citizens who enjoyed boating and swimming in its reservoir. Recreation was a significant benefit mentioned in the Mactaquac case for 3 of the 4 cohorts, and participants noted that the dam allowed them to maintain an ideal lifestyle and supported positive aesthetics. Numerous studies found similar results (Johnson & Graber, 2002; Klein, 1999; Wyrick et al., 2009). Wyick, Rishman, Burke, McGee & Williams (2009): residents anticipated significant aesthetic losses, worrying that their scenic lake would turn to mud; Klein (1999) found that dams that were in a landscape for a long time became a part of the community and were seen similarly as a part of the environment. All of these are major concerns facing the communities currently around the Mactaquac Dam and headpond as they await the Mactaquac decision (Figure 10).

4.5.2 How do baselines of acceptability help to explain one's acceptance or rejection of landscapes associated with hydroelectric energy?

The Mactaquac case study can be placed in the lower left corner of the Baselines of Acceptability Model, where baselines are malleable based on individual experience. Cohort 1 and Cohort 2 for example, were exposed to the pre-dam landscape and yet they still came to value the present dam landscape, albeit for different reasons than for their pre-dam positive affect toward the landscape. This shows that generational change was not required for the dam to become accepted and rather as they experienced and found benefit in the changed landscape they began to view the landscape in a positive way. One participant said:

To me this is the natural way that it should stay. And if you ask the geese and the ducks that live along the headpond they would say the same thing. (Male, cohort 2)

Today both pre-dam cohorts feel a similar love and attachment to the dam and the headpond landscape. More specifically, even those individuals who saw the loss of their properties, jobs and communities (Cohort 1) have found acceptance and even benefit in the new landscape through experience in place. For instance:

My family personally likes it the way it is, they were brought up before the dam but now one son has a trailer and a grandson has one down here and now his granddaughter is coming up...so now 5 generations that have witnessed this wonderful place. (Female, cohort 1)

When participants were asked how they viewed the landscape as it presently exists, numerous participants discussed the landscape as 'natural' or 'normal' (participants used these two terms interchangeably), despite the man-made infrastructure that is responsible for it. This indicates there is not only acceptance to the landscape but a perception of a new natural:

No this is normal now, we have made it normal. (Male, cohort 2)

Yeah this is just life now for everyone, and I do not think too many people really think about how it used to be unless you are asked to think about it (Female, cohort 4)

It is clear that the dam landscape at present is valued by all four cohorts, indicating that in fact landscape baselines are not necessarily concrete and do not require generational change. Our framework identified two ways that landscape norms are established: hard wired (Pauly, 1995; Selman, 2010) or malleable, driven by culture and experience (Selman, 2010; Wolsink, 1994, 2007). In the case of the studied population of the Mactaquac community and landscape, landscape perceptions appear to be malleable and influenced by experience in the landscape. This is evident from the two cohorts (Cohorts 1 and 2) who knew the pre-dam landscape and were able to learn to accept and appreciate the new dam landscape. McLachlan (2010) found these positive values were as a result of people feeling a sense of fit between technology and landscape. Firestone et al. (2015) further emphasized the importance of energy infrastructure projects fitting with a community's sense of place and surrounding landscape. Communities have also been able to accept the aesthetic impacts on their home community as a result of energy development implementation when positive economic opportunities and employment result from the change (Boyd & Paveglio, 2015). The meanings people attach to place can change as the physical landscape changes (Stedman, 2003). Both the pre-dam time period and the present dam time period are viewed positively but for different reasons (Figure 10) as people have developed new meaning and attachment to the landscape. The Mactaquac Dam is seen as a natural part of the environment, an element that many perceive as supporting a positive lifestyle and lending to greater means of recreation.

However, it is important to note that the shifting baselines syndrome (Pauly, 1995) does hold true for some elements. Given that the concept of shifting baselines syndrome originated in

fisheries it is interesting that fishing is the only theme that demonstrated adherence to the concept in the Mactaquac case (Figure 11a). Prior to dam construction it is estimated that the number of adult salmon sat between 18,000 and 30,000 (Canadian Rivers Institute, 2011). However, during dam construction numbers hovered in the 100s and post-dam construction it has been estimated that approximately 2000 salmon per year come up the river (Canadian Rivers Institute, 2011; Jones, Anderson, Gibson, & Goff, 2010). Today the Mactaquac headpond is home to the non-native smallmouth bass, which occupy the same niche as the native brook trout and Atlantic salmon (Canadian Rivers Institute, 2011). Due to their persistent nature, smallmouth bass are pushing the limited number of native fish out of the area. This relates to the trends we see in Figure 11a, showing Cohort 2 concerned with poor fishing and negative fish populations compared with Cohort 3 who felt that fishing was still present and successful today. Cohort 2 is focusing on the decline of native salmon and the rise in smallmouth bass, whereas Cohort 3 is viewing smallmouth bass as a new tourist market and a recreational fishing opportunity. Cohort 3, having only experienced the post-dam landscape, does not know what the fish populations were in the past and can only speak to the benefits they perceive from the smallmouth bass population in the headpond today. This pattern indicates that despite being able to shift ones baseline of acceptability in the case of aesthetics and landscape perceptions, there are still some baselines that are set based on earlier experience.

4.5.3 Implications for management

The results of the study show that baselines of acceptability are malleable in regards to perceptions of landscape and the associated benefits. Understanding change as a means of improvement or enhancement rather than as an act of erasing the community identity can

enhance support for a change (Devine-Wright, 2009; Stewart, Liebert, & Larkin, 2004). For example, the theme of progress that was expressed to the community prior to dam construction encouraged support from citizens as they saw the construction as a means to move forward or enhance their community and its future. The removal of the Mactaquac Dam is being viewed, in the case of this studied population, as a step back, representing regression for many citizens and giving negative connotation to the potential of dam removal. Many citizens in the study feel a great amount of uncertainty and fear towards dam removal and oppose removal to avoid potential negative outcomes and further trauma. Understanding that the general perceptions of dam removal are negative, and there is a lack of knowledge and understanding surrounding the landscapes future without the dam, the provincial government and power commission need to change the discussion and provide more information to allow citizens to make informed opinions of the future. Providing good information to the community may help to alleviate people's fears about change. For example, numerous participants felt that a drained headpond would be a 'mud hole' or 'mud flat' for many years, while in fact with modern environmental remediation techniques this would not likely be the case as re-vegetation has been seen in some cases to begin within a couple of months (Doyle et al., 2005; Kim, Toda, & Tsujimoto, 2015; Lejon et al., 2009; Wyrick et al., 2009).

However, information alone is not enough (Johnson & Graber, 2002) and the public should maintain a healthy skepticism about such claims. Researchers, citizens and decision makers need to discuss the future of dam infrastructure by looking at the economic, environmental and social values and concerns that exist (Brown, Tullos, Tilt, Magee, & Wolf, 2009). The discussion needs to be around how the landscape is valued and what values citizens want to maintain in the future.

Understanding that people can adjust to landscape changes is encouraging for the future of renewable energy landscapes. However, decision makers and renewable energy proponents need to understand that the transitional phase of change and upheaval is difficult for the communities involved. Renewable energy is not necessarily rejected for reasons of NIMBYism, or on the basis of visual discontentment but rejection to renewable energy development may be understood as a desire to maintain the status quo (Samuelson & Zeckhauser, 1988) and maintain the landscape that is in place. Additionally this rejection can be viewed as place-protection, as the community wants to protect a place with strong value and meaning to them (Adams & Bell, 2014; Jacquet & Stedman, 2013; Manzo & Perkins, 2006; Stedman, 2002; Warren, 2014). This can be seen clearly in the Mactaquac Dam case. Dam construction was viewed negatively (the creation of infrastructure), and the potential of dam removal (the destruction of infrastructure) is also being viewed negatively. This shows that the physical infrastructure is not being rejected, but rather the potential loss of a landscape of value. The common thread in both the period of construction and potential period of dam removal is a perceived loss of place value and an inevitable period of instability and transition. Future research needs to look into a means of catalyzing these situations to allow a more seamless transition, from natural landscapes to landscapes of energy, and further to deconstructed landscapes of energy. End-of-life planning is a complex issue needing further research in order to understand how and when to plan and recognize the inevitable end of the infrastructure and changed landscape. It became apparent that many participants in the study saw the dam infrastructure as a permanent addition and research is needed to identify how to tackle end-of-life planning with the affected communities. Understanding the resiliency and adaptability of communities and landscapes will be crucial to managing and improving transitional periods.

4.5.4 Limitations

The case of the residents' perceptions of the Mactaquac Dam and headpond showed a gradual shift in baselines of acceptability, indicating baselines are not set generationally nor are they concrete. It must be noted, however, that the study was only able to include individuals who remained in the Mactaquac area post-dam construction or those who came to the area after the dam was built. The individuals who left the area, whether due to the turmoil or stress of the dam or for other reasons may have felt differently compared with the people that stayed in the area and learned to appreciate the new landscape. We must recognize as well, that in addition to those who left the area, the concept of generational baselines may not have been abundantly evident because the sample size was small (n=20). Generational baselines may actually exist or have existed to the point that people who could not handle the change migrated away, instead of adapting their baselines to the new landscape.

In addition, the study only focused on the headpond communities within the lower half of the headpond (Mactaquac, NB to Hawkshaw, NB). This area faced great upheaval and drastic landscape change during the dam construction and river flooding. However, the headpond flooded a total of 96-km, as far as Hartland, NB, northwest of Nackawic, and the voices of residents' in that area were not heard in the study.

Lastly, the study aimed to incorporate a diverse group of citizens in its discussion, however, despite exhaustive recruitment, there were no First Nations people involved in the study. The Kingsclear reserve is located less than one kilometre from the dam and faced negative repercussions in the community during and after construction (Bourgoin, 2013; Si, 1993). Due to the potential for dam removal the New Brunswick Power Commission has begun a consultation

process with the Kingsclear First Nations and other First Nations in the area, ensuring their voices are heard within the Mactaquac Dam discussion (Government of New Brunswick, 2013).

4.6 CONCLUSION

Overall, baselines of acceptability are not necessarily concrete when looking at landscape perceptions in energy landscapes. In fact, the study shows how people can reframe their views based on experiences of personal and community-level benefit. Baselines of acceptability can shift at varying times and for a variety of reasons. It was clear that baselines shifted, as generations who once loved the natural river course came to love the quiet and serene headpond landscape in a similar way. Baselines did not require a generational shift, but were rather affected by experience, as all four cohorts recognized the area as normal or natural illustrating that the point of baseline change may be more related to a sense of benefit. Increasing public involvement and public knowledge about the landscape and demystifying the future options for the landscape would aid in supporting the community in its next landscape transition. Understanding that landscape perceptions can change over time will be crucial to the success of renewable energy landscapes, as we are faced not only with development but also the potential removal of infrastructure in the landscape.

CHAPTER 5 THE MACTAQUAC DAM AND HEADPOND: UNDERSTANDING RESILIENCY AND ADAPTATION TO LANDSCAPES OF ENERGY

5.1 PREAMBLE

This chapter will explore an alternative framework for understanding social perceptions of renewable energy in the Mactaquac Dam and headpond case. Chapter 4 looked at the Mactaquac Dam and headpond through the Baselines of Acceptability Model to understand how baselines of landscape values are established and how those baselines affect renewable energy acceptance. The analysis found that baselines are not generationally set – that is, are not established based on first experience and kept rigid – rather that baselines are malleable and change as citizens and communities find new benefits and amenities from the new energy landscape. The case of the Mactaquac Dam and headpond indicated that all cohorts positively valued both the pre-dam landscape and present dam-in-place landscape, while dam construction and the potential of dam removal were viewed negatively (Refer to Figure 10, Chapter 4). This paper looks to propose a new explanation for understanding this shift of landscape perceptions and acceptance of the new landscape.

This chapter will be presented as a conceptual discussion proposing an alternative explanatory theory for the social values that were evident towards the Mactaquac landscape, as it was in the past, as it is today and as it may be in the future. This expanded discussion chapter will look to explore the applicability of place theory, resilience theory, and the adaptive cycle on the renewable energy production transition specific to the Mactaquac Dam and headpond. This

section will begin with a brief overview of three bodies of literature, specifically, place, resilience, and the adaptive cycle. Following this overview will be a discussion on the applicability of these concepts for explaining and understanding the case of the Mactaquac Dam and headpond. Next, the implications of this model for the management of the Mactaquac Dam and headpond will be explored. The final section will propose why the concepts of resiliency and adaptability may help us to move forward successfully with the renewable energy transition by helping us understand patterns of social perspectives to such developments over time. This chapter is exploratory in nature and is not currently intended for refereed publication.

5.2 PLACE

Many humans seek rootedness and dwelling, and a lifestyle of repetition and stability (Seamon, 1989), as was evident of the rural individuals in the study. People usually take their homes--their places of stable dwelling--for granted, until they are challenged or significantly changed (Million, 1992). When one's home or place of attachment is changed or lost, and thus one's sense of regularity, strong emotions of sadness, depression, and loss can result for those who value stability (Devine-Wright & Howes, 2010; Fried, 2000; Million, 1992). Place attachment can be defined as the emotional bonds held between a person and a place (Low & Altman, 1992; Manzo, 2005). It is the transition from 'space to place', as people give meaning and value to space through experience, forming attachments and bonds to make it into a place of value (Tuan, 1974). When one's place of value is altered, a transitional period commences as the individuals and communities find new meaning after the change or move to a place to avoid the change completely. Understanding how people initiate and secure new place bonds will be crucial to understanding how to ease transitions such as those common to the construction of energy

landscapes (Pasqualetti, 2011). We understand that people develop attachment to places, but it is unclear how and why; the transition to attachment is still very much unexplored (Scannell & Gifford, 2014b). Understanding this creation of the person-place bond and the ‘why’ behind the development of attachment could assist in many situations (Scannell & Gifford, 2014a). Place theory has been used in numerous studies to understand how individuals and communities perceive energy landscapes (Carlisle et al., 2014; Devine-Wright & Howes, 2010; Devine-Wright, 2009, 2011; McLachlan, 2009). What is notable about place attachment is its resilience, given time. That is, for those who persist in a place after such changes, experiences start anew to build connection, independent of evident amenity. We need better understanding of the development of place attachment in man-made landscapes, specifically the resiliency and adaptability of place, landscape and community.

5.3 RESILIENCE

Holling (1973) proposed the idea of resilience theory in 1973 in order to explain how ecological systems react and persist in the event of a change or disturbance. Holling further expanded this definition to include the explanation of all complex systems, ecological and social-ecological, and their respective abilities to handle disturbances. Resilience is defined as the ability of a system to absorb disturbance, and sustain its essential structure (Walker, Holling, Carpenter, & Kinzig, 2004; Walker & Salt, 2006). A system that has the capacity to resist shock without collapse is considered a highly resilient system. Conversely, systems that cannot maintain their basic components as the result of a disturbance are said to have low resilience. For example, landscapes supporting wind farms are able to maintain high resilience when the turbines are dismantled because wind turbines disturb only a small area of land (Le Dû-Blayo, 2011). In

comparison, renewable energy sources such as biofuels and hydropower dams implemented in areas of previously limited or no development, leave landscapes with low resilience because they have resulted in a high rate of modification to the landscape (Le Dû-Blayo, 2011). Hydropower dams for example, which affect a large area of land (due to infrastructure and the resulting headpond) leave a landscape drastically changed. When a dam is removed it causes substantial landscape changes and can result in an entirely new landscape (Born et al., 1998).

This shift from one functioning system to an entirely new functioning system can be understood through the concept of basins of attraction. A basin of attraction is the full spectrum of states in which a system can exist without the system being substantially altered (Walker et al., 2004). Systems can go through changes but maintain their function within the same basin of attraction (Walker et al., 2004). However, if large changes or periods of disruption take place, a system may be moved into a completely new basin of attraction (Walker et al., 2004). Moving into a new basin of attraction is not necessarily negative, it is only perceived negatively if one basin of attraction is considered to be more desirable than another (Matthews & Selman, 2006). The concept of resilience is then viewed as the amount of effort or energy needed to move a system from one basin into another (Matthews & Selman, 2006).

Resilience theory has continued to develop, focusing on resilience, adaptability, and transformability (Walker et al., 2004) in the context of complex social-ecological systems (SES) (Folke et al., 2010). SES assumes the view that social, economic, and biophysical components must be understood together (rather than separately) in order to grasp the whole understanding of a system. Viewing landscapes as SES recognizes the physical elements that bound the social construction of the landscape system (Stedman, 2003), as well as interaction between social and

economic elements that recognizes humans as integral to the meaning of a landscape (Matthews & Selman, 2006). To understand the resilience, adaptability, and transformability of SES there is value in looking to the adaptive cycle (Gunderson & Holling, 2002).

5.4 THE ADAPTIVE CYCLE

Social-ecological systems are always changing. By studying systems all around the world, researchers have learned that most systems usually proceed through recurring cycles consisting of four phases (Figure 12) (Gunderson & Holling, 2002; Walker et al., 2004; Walker & Salt, 2006):

1. **Exploitation (rapid growth, r phase)** – The exploitation phase is often characterized by people exploiting new opportunities and resources. For example, new communities and businesses are developed. This stage is characterized by rapid accumulation, the seizing of opportunities, and initially high but decreasing resilience.
2. **Conservation (K phase)**- This transitional phase, from growth to conservation, is long and slow. The conservation phase is indicated by stability, rigidity, and certainty. This phase is characterized by reduced flexibility and low resilience and as a result increased vulnerability to disturbances.
3. **Release (creative destruction, omega (Ω) phase)**- This is initiated by a point of shock, which can be instantaneous or slow (i.e. natural disaster versus political tension). The disturbance is greater than the system's resilience and disrupts the developed and stable system. This phase is characterized by high uncertainty, chaos and trauma.
4. **Reorganization (renewal, alpha (α) phase)** – In the final phase, uncertainty is high and all options are open. This is characterized as a period of innovation, opportunity, and

restructuring. Depending on the system this can lead to the repetition of the previous cycle or the initiation of a new system structure.

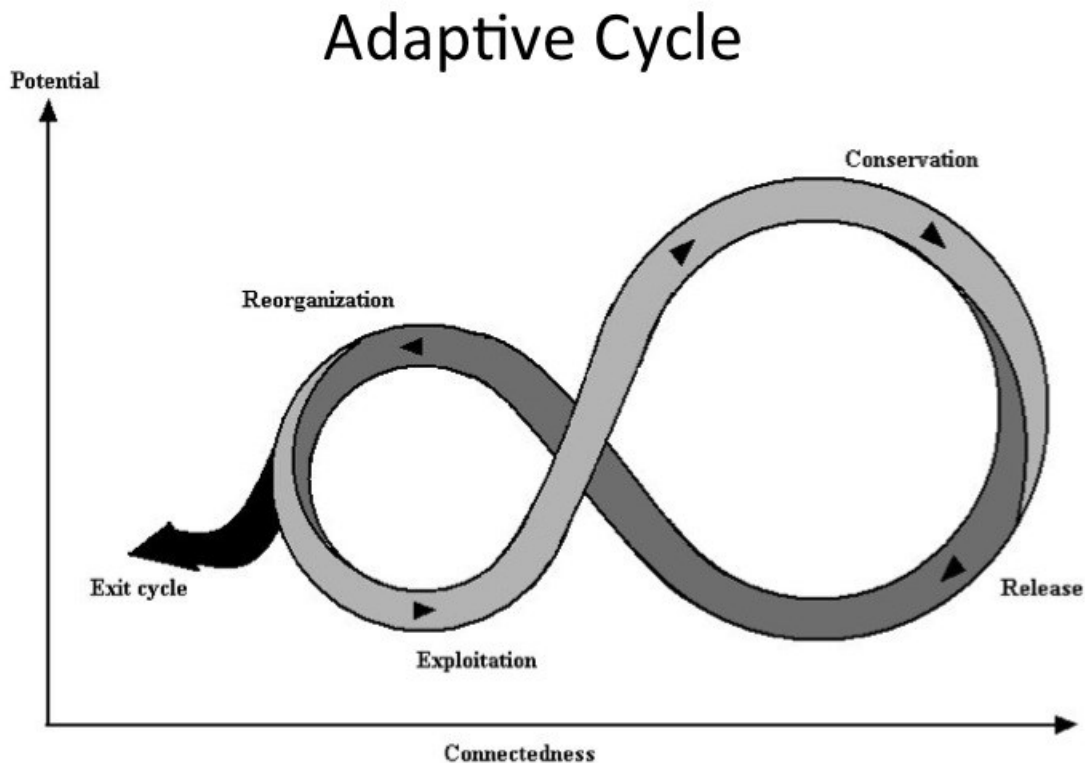


Figure 12. The adaptive cycle. The fore loop is indicated by the light grey and the back loop is indicated by the dark grey. (Gunderson & Holling, 2002)

The first two phases (r and K phase) make up the fore loop and the last two phases (Ω and α phases) make up the back loop. The fore loop is characterized by the accumulation of capital (Walker & Salt, 2006), and stability, predictability and conservation (Walker et al., 2004). This loop is crucial to establish system and human wellbeing (Walker & Salt, 2006). The back loop is characterized by uncertainty, unpredictability, experimentation and most importantly new potential (Walker et al., 2004; Walker & Salt, 2006).

The cycle's pace and sequence is not set, meaning systems may skip or speed up/slow down through certain phases (i.e. a system can skip from K back to r, by-passing the back loop) (Walker et al., 2004). For instance, unlike in purely natural systems, the human capacity for foresight means the cycle can be altered, skipping or expediting phases as a result of human intervention. Adaptive management can be used to build up the resilience in a system or used to allow reorganization and recovery for a disturbance in a system (Adger et al., 2009).

Lastly, adaptive cycles exist at different scales, defined as panarchy (Figure 13) (Walker et al., 2004). Panarchy refers to the hierarchies of adaptive cycles, for instance, an individual level cycle is embedded in a community level which is imbedded into a state level and so on (Gunderson & Holling, 2002; Walker & Salt, 2006).

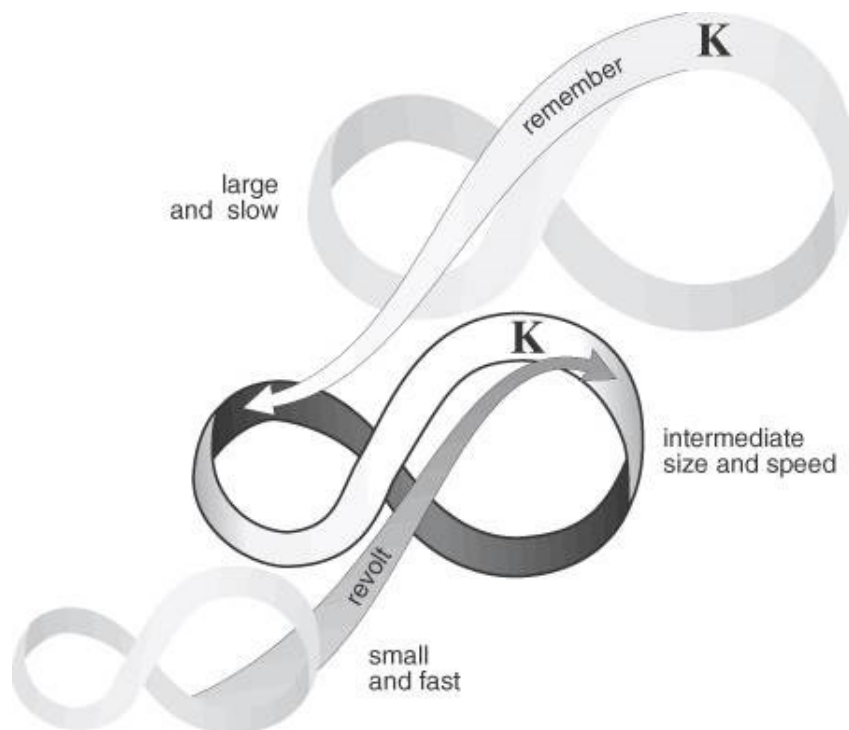


Figure 13 The Panarchy model, illustrated through nested adaptive cycles (Gunderson & Holling, 2002).

5.5 THE CASE OF THE MACTAQUAC DAM AND HEADPOND

The study looked at the case of the Mactaquac Dam and the values that local individuals hold towards the landscape. Chapter 4 presented the results of the study, testing baselines of acceptability as an explanatory theory. Landscape values were revealed to be malleable, not set based on one's first experience in a landscape, or based on evolutionary or cultural norms. Rather baselines of acceptability are constantly changing with experience, as new personal benefits are perceived. Results indicated that individuals, despite different experiences and time in the landscape have come to accept and appreciate the Mactaquac Dam and headpond landscape. Clear patterns exist (Chapter 4, Figure 10) showing how the pre-dam landscape and present dam landscape are viewed positively whereas the dam construction landscape and dam removal landscape are viewed negatively across all key demographics. The evidence of cycles of acceptance suggested the utility of resilience theory and the adaptive cycle to the case of the Mactaquac Dam and headpond.

The first adaptive cycle after European settlement saw the region developing as an agricultural centre through to the back loop adjustment period associated with the Mactaquac Dam construction. In the late 1700's 14,000 Loyalists to England came to settle the Saint John River Valley, receiving land grants (Lawson et al., 1985; Si, 1993), marking a period of growth for farming and agriculture in the valley. This marked the beginning of the *exploitation* phase (as it relates to the communities in the Mactaquac area) as illustrated in Figure 14. This phase was characterized by not only an increase and expansion of agriculture but also an expansion in population (Si, 1993). Immigrants and newcomers also came to settle in the valley, interested in fertile land for farming and woodlots for supplementary income (Si, 1993).

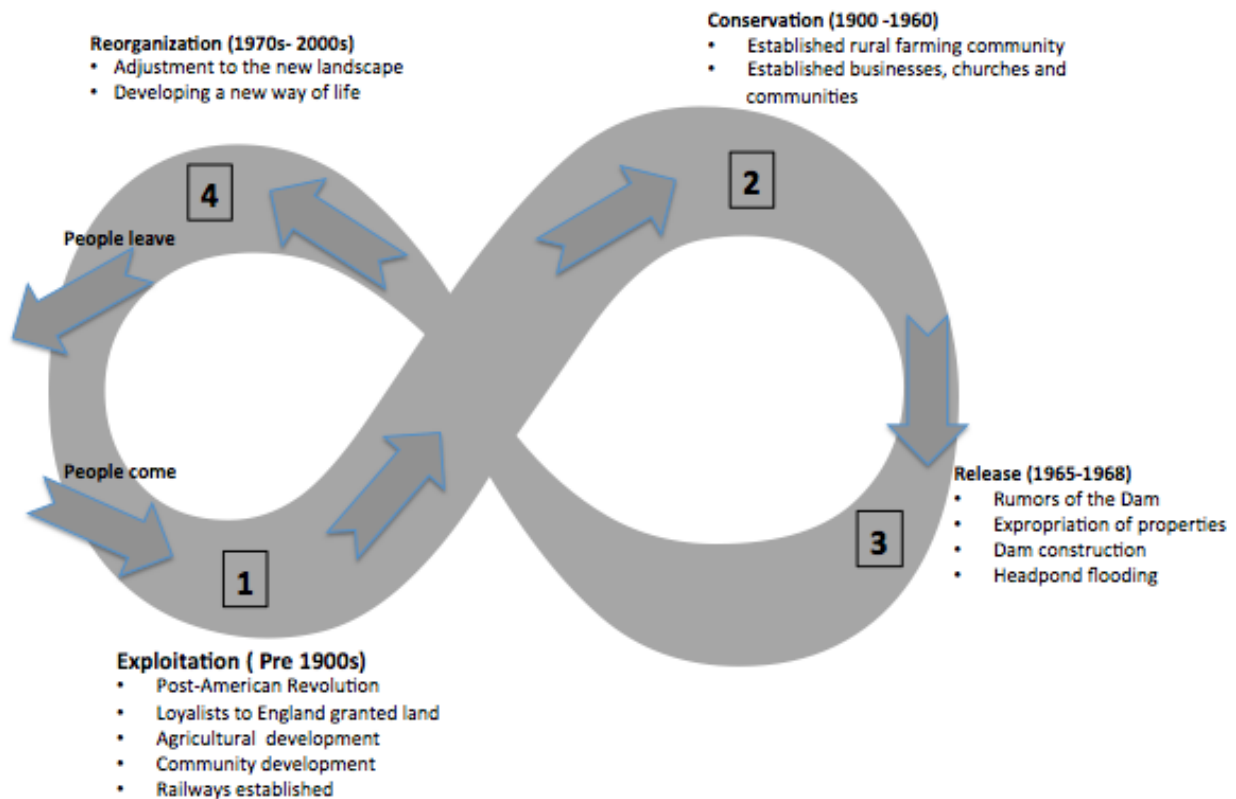


Figure 14. The adaptive cycle illustrating the Mactaquac area as the community and landscape faced dam construction. Phases 1 and 2 indicate pre-dam periods. Phase 3 is defined by the upheaval of dam construction. Phase 4 is characterized by the community’s successful re-establishment post dam construction.

Prior to dam construction, the area chosen for the Mactaquac Dam construction and inundation was the site of established farms, communities, and other businesses and infrastructure. This period marked the *conservation* phase. In the early 1960’s the whole areas population was just over 10,000, with approximately half of those residents working in full time farming operations (Si, 1993). The average length of residency in the area was 23 years (Si, 1993), indicating high stability and low flexibility. Collectiveness and cooperation was common in the area. Co-operative arrangements took place, as farmers worked together to create small local economies

(Si, 1993). Communities were close knit, developing community clubs and local fire brigades (Si, 1993).

Rumours of the dam construction in the mid 1960's began the area's transition into the *release phase*. At first many thought the dam would not happen, or if it did that they would not be affected (Si, 1993). Those living closest to the water were concerned over the loss of their homes, their businesses, as well as their neighbors and communities. Opposition was focused specifically on the historical homes, cemeteries and important landmarks that if lost could not be replaced (Bourgoin, 2013). An organization, the "Association for the Preservation of the Saint John River in its Natural State" (APDSJR) was formed to bring public awareness to the construction plans while also petitioning and protesting against it (Figure 15) (Bourgoin, 2013; Si, 1993). There was a strong sense of stress, tension and emotion in the valley as dam construction went from a rumour to a reality that challenged the social and economic systems of the Mactaquac valley.

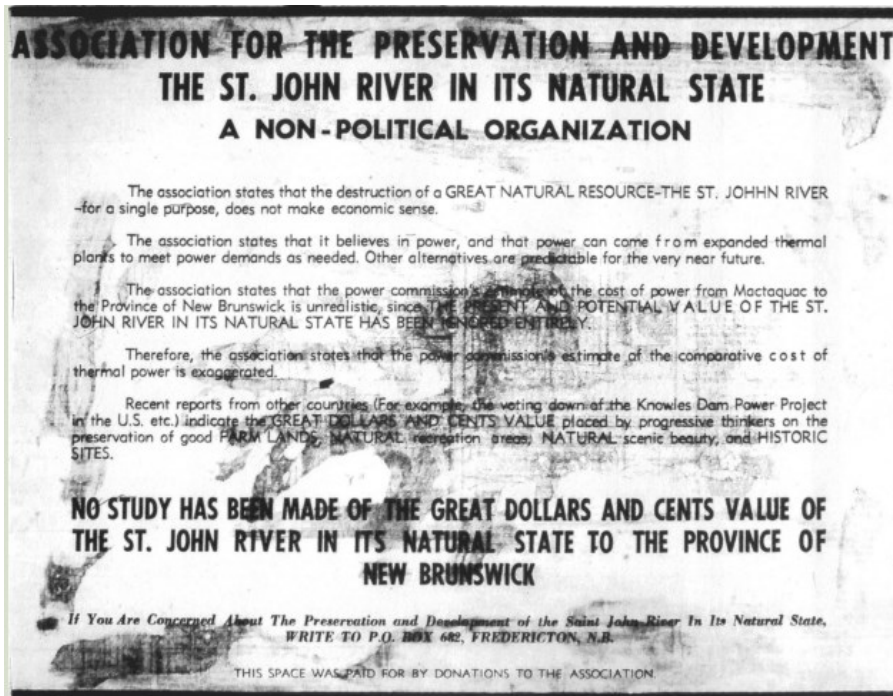


Figure 15. Newspaper advertisement from APDSJR in opposition of the construction of the dam (1966) from the Provincial Archives of New Brunswick (Public Archives of New Brunswick, scrapbook entry including glue damage).

The time of dam construction and relocation was characterized by stress, grief, inconvenience, and loss as individuals were expropriated from their homes and properties (Si, 1993).

I really remember as a child, it really really hurt the old people. I remember when they burned the homes, that was so sad. There are some old people that hated the government and NB Power for doing what they did and not giving them a choice... You would have to be in it to understand how they felt but I watched it and know exactly how they feel. And the government just said suck it up, we paid you for your land. \$80 though, come on that's not fair. (Male, Cohort 2)

Negative health impacts, including premature death (several self-inflicted), were common in the elderly community affected by the dam and relocation (Si, 1993). Further, community dynamics changed, as friends and neighbours moved away and new people moved in (Si, 1993). Si (1993) found that farmers were more adversely affected than those of other occupations because farmers were faced with greater economic and socio-cultural losses.

The uncertain future aesthetics of the landscape, specifically the conversion of the river valley to a large lake-like headpond, was controversial. Some saw the headpond as a way to increase the landscape's beauty and others saw the headpond as detracting from the area's aesthetics (Si, 1993). The headpond submerged many useful and symbolic islands to the farmers and First Nations, including the Snowshoe Islands and the Bear Islands (Canadian Rivers Institute, 2011; Si, 1993). Many general stores, churches, schools, roads and the railway were destroyed prior to flooding (Lawson et al., 1985). Numerous graveyards had to be relocated as well (Lawson et al., 1985). The Atlantic salmon were also negatively affected by the erection of the dam and have continued to decrease (Canadian Rivers Institute, 2011; Si, 1993); although a fish hatchery was established to try and mitigate this loss by trucking fish around the dam it has not averted this local massive reduction in the species.

The Mactaquac communities were left with a large body of water, locally known as the headpond (officially called the Mactaquac Lake) after dam construction and a different landscape than the historic valley and river course. Despite the hardships of dam construction communities continued to evolve, indicating the community and the landscape were moving into the phase of *reorganization*. The planned town of Nackawic and adjacent new pulp and paper mill brought new people to the area and provided building sites and jobs for some of those who lost their livelihoods in the dam flooding (Lawson et al., 1985). As the newly developed town grew, it housed a new library, recreational facilities and a golf course, presenting many new amenities and opportunities to the residents as a result of the dam (Lawson et al., 1985), but there was clearly a transitional phase in the early years. One participant noted the impact the dam had on the community:

It [the dam] changed the communities around here. I grew up going to school in Nackawic and at the time it was still kind of settling out because there were the people that had been in that area before and then there was this kind of refugee camp feel and then there were all the folks that came to work in the mill and there were very strong lines between them. Those are fading some what now as it kind of naturalizes out, but it was a very odd town because it was essential kind of a refugee or displaced persons place combined with folks that were coming for work in a way. It had an interesting feel, it was not a natural New Brunswick kind of community development, it was something caused by upheaval. (Female, Cohort 3)

The recreational value of the river began to be recognized and was further enhanced by the building of the recreational facilities, such as the Mactaquac Provincial Park (Si, 1993). Real estate values began to increase as interest arose in ‘lake-front’ properties and the lakefront lifestyle (Si, 1993). Si (1993) found that 68% of interviewed community members (all of whom stayed in the area post dam construction) felt the landscape had either been improved or unaffected by the dam’s construction. Despite the drastic loss of Atlantic Salmon in the river (which continues to be an ongoing concern) sport fishing and recreational fishing opportunities began to increase as the bass population grew in the headpond (Si, 1993). Bass were introduced to the river system in the 1800s, and populations have increased in the warmer water of the Mactaquac headpond (Canadian Rivers Institute, 2011).

The second post-settlement adaptive cycle, still underway, can be described as largely coincident with the latter part of the above-mentioned period of adjustment and re-organization after Dam construction (Figure 16). Its *exploitation phase* was a phase characterized by new communities and new development. Community dynamics continued to shift as residents tried to connect to their place.

Well that is a beautiful body of water out there, because it is used for boating, it is used for skiing, it is used for a lot of different things. (Female, Cohort 1)

Following the construction of the dam, the community began to readjust to the changed landscape. The area lost agricultural land and many moved away, relocating their homes and/or jobs. However, despite the relocation of some residents, development expanded as homes were reestablished and individuals found recreational value and aesthetic value within the landscape. The period included the arrival of amenity migrants, looking to take advantage of the lakefront living and recreational opportunities.

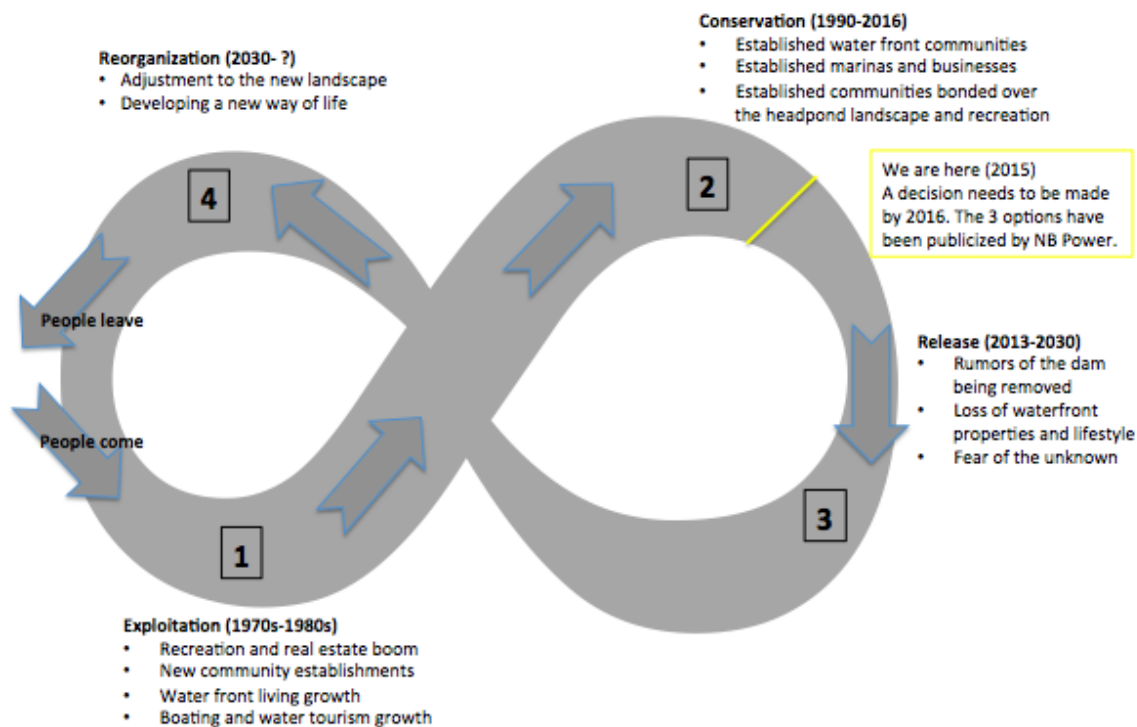


Figure 16. The adaptive cycle illustrating the community and landscape post dam construction. A new equilibrium, state of stability has been found (Phases 1 and 2) and the dam’s potential removal is being view as having the potential to push the system in the back loop again (as the dam construction did in the 1960s).

The community and landscape moved forward within the adaptive cycle from the exploitation phase to the conservation phase as the communities expanded to develop and become more established. Tourism evolved, the golf course and Mactaquac Park were developed, real estate

developments expanded, waterfront subdivisions were planned and constructed and a boating culture became established. This sense of stability and establishment, both within the social and physical realms of the landscape, indicates the community is currently in the *conservation* phase of the adaptive cycle.

Oh in terms of growing up here it has been a great place to grow up, swimming, boating, sailing, it was totally ideal, in that aspect we should keep it, it is here and it is enjoyable, it is a source of revenue in other ways too, like the Mactaquac park and beach; boating is huge. (Female, Cohort 3)

So many people have built beautiful homes along that river, assuming that river is always going to be like it is today and not like it used to be and I do not know how you could ever go back. (Female, Cohort 2)

Presently the communities and ecosystems surrounding the Mactaquac Dam are located within the conservation phase of the adaptive cycle, but the proposed decision for dam removal is moving the system towards a period of *release*. Although participants viewed dam removal as the only option that would cause landscape changes, all three of the future options will cause disruption and move the cycle into a period of release. The period of release and the time frame of the cycle would be different depending on the decision made but the release phase is inevitable. The communities and the landscape are presently stable and settled and overall want to remain in, and extend indefinitely, the conservation phase. The possibility of moving into the release phase causes great stress and fear, unmitigated given the lack of information provided by NB Power about the removal option, such as land ownership issues and landscape remediation measures.

For the most part, around here, I think people are content with the way it is. I do not think I have heard anyone say strongly that it should be taken out. Whether that is that we just do not like change, once people are settled into something they just do not like change and are practical enough to realize that it is good and folks have a lot invested into waterfront property that would [no longer] be waterfront property. (Female, Cohort 3)

It [the headpond] brings too much to too many people on and off the water... You know lots of people have camps and cottages and stuff like that. So then what, you know?
(Female, Cohort 4)

This sense of stress and opposition to dam removal is clear in the community outside of the interviews that were completed in this and prior research (Keilty et al., 2014). There have been numerous meetings sponsored by Friends of Mactaquac Lake where the overwhelming majority of attendees opposed dam removal. The Friends of Mactaquac Lake are a citizen action group advocating for the preservation of the Mactaquac headpond, founded in part by the owner of the houseboat company at the Mactaquac marina. These community meetings have had between 100 and 250 largely pro-dam people attend. The sense of threat, uncertainty, and community upheaval is very clear at these meetings as it was through our interviews. Few individuals are able (or willing) to see beyond the dam's removal and consider that there may be a desirable future landscape and community after a period of adaptation.

Despite the recognition that the system of Mactaquac did reestablish and become desirable to many after dam construction, few participants believe the system will become desirable once again after dam removal. They do not see themselves moving into a new adaptive cycle but rather as moving backwards into the system that existed prior to dam construction. Although the pre-dam landscape was desirable in its time, today the study population views this transition as a regression in terms of progress, lifestyle and community.

Yeah to imagine it in the old river, it was kind of unusable for what we think of as use, for what you would use it for as a young person. But as it is now, well, if it was ever gone it would be a disaster. What a mess! (Male, Cohort 3)

To me, you are going back, back instead of going forward. You are going back 40 or 50 years. (Male, cohort 2)

We used to have ferries running, we had McNally's ferry we had McKinley ferry crossing. Yeah, so are you going to go back again? I thought we were supposed to be moving forward, not going back. (Male, Cohort 2)

I mean we are not going to go back to the 1800s, right, we are not going to rip up all the pavement, we are not going to do all that stuff so why should the river be any different. (Female, Cohort 4)

The phases of the landscape and community development illustrated through the adaptive cycle reveal the local capacity to endure through landscape transition. In the Mactaquac case, and in energy landscape transitions overall, it is important to not only recognize when a system has reached a new phase but further recognize when a system is approaching or in a transitional period. Transitional periods between the four phases (the fore loop and the back loop) present opportunities for intervention into the system. As Walker et al. (2004) stated, mitigation and management can help to ease, catalyze, or even avoid certain transitions. The following section explores management options for the Mactaquac community to support a just decision process, and a more seamless transition from the present landscape to what comes next, whether it is the temporary disruption of dam reconstruction or dam removal.

The idea of panarchy is also useful in the case of the Mactaquac Dam when looking at the different levels of acceptance. The smallest and fastest loop is taking place at the individual and place level. The individual community members adapt as they redefine their perception of place and adapt to the new physical landscape. The intermediate loop takes place at the community level, where the Mactaquac communities face changes to lifestyle and community dynamics. Finally these two cycles are embedded into the largest and slowest loop, which is the adaptability at a global level, looking more broadly at renewable energy transitions. The concept of panarchy allows us to deconstruct the case of Mactaquac and understand that the adaptive cycle is taking

place at different levels, and that these cycles are embedded within one another. Further, this concept allows us to see the connections between place, resilience and the adaptive cycle.

5.6 LIMITATIONS

Looking at the case of the Mactaquac Dam through the adaptive cycle allows a new understanding of the case. However, it must be noted that this framework does have explanatory limitations. Through the adaptive cycle the dam construction and the dam decision (potential removal, release phases) are viewed as single isolated events, not recognizing the other trends and events that are simultaneously taking place. The dam construction for example, was a distinct event with numerous impacts, however, other events and trends were occurring at the same time as dam construction (e.g. a trend away from agricultural livelihoods for work in the city). These were also key events that shaped the community and lifestyle changes, both positive and negative, that occurred during that time. This is where the recognizing of panarchy, multiple adaptive cycles existing at different scales (Walker et al., 2004), becomes of value. The dam, both its construction and potential removal, can be viewed as a fast cycle at a fairly localized scale, while, for example, global warming is also taking place but at a slower rate and at a larger scale, a much slower cycle, but it still ultimately also has important local impacts. This analysis recognizes the limited scope of the single adaptive cycles focused on the dam construction and potential however, finds value in looking at the dams' timeline through this cycle as it aids in conceptualizing the event and allows researchers to propose management implications at different points along the cycle. Although the adaptive cycle is not exhaustive in its understanding of social systems, due to the diversity of trends occurring, it acts a starting point to understanding and a means to understanding social transitions.

5.7 IMPLICATIONS FOR MANAGEMENT

By analyzing the system of the Mactaquac Dam and headpond through its history we can begin to understand what triggers both positive and negative views in relation to the Mactaquac dam landscape. Viewing the Mactaquac system through the adaptive cycle can allow us a better understanding of the transitions that have occurred and how and why these have occurred. This allows us to make some suggestions for the next phase of the system in order to manage and support the system. This research is neutral in terms of the dam decision at hand but will propose suggestions to support all parties in the case of dam removal.

5.7.1 Adaptability and resilience of the community and lifestyle

The community surrounding the Mactaquac Dam and headpond is tightly knit and they feel bound together by the water and the waterfront lifestyle they all share. The communities were successful in adapting and finding benefit in the dam landscape, despite the challenges associated with the period of dam construction. However, dams that have been a part of an area for a long time are often viewed as a valued part of the community and environment (Klein, 1999). Some members of the community fear removal would negatively affect the community identity and their waterfront lifestyle. Dam removal proponents must work to shift this perception. Instead of a loss of identity the potential removal needs to be framed as an event that will bring new opportunities and benefits as well as a stronger identity to the community (Devine-Wright, 2009; Stewart et al., 2004).

Communities around the world are facing energy transitions (Wilson, 2012) and research needs to explore these transitions by understanding community resilience, adaptation and attachment to

place. Research primarily looks at attachment to one's home but expanding upon this researchers are now looking at place attachment in a period of vast human mobility, exploring the idea of attachment to many places (Giuliani, Ferrara, & Barabotti, 2003). Although the case of Mactaquac does not include multiple places, it could be viewed as the same place in different forms, requiring a new bond at each different stage. People can and do adjust and form new bonds to new or secondary places. However, people often hold on to their strongest place bonds (i.e. those bonds we hold with our first home or hometowns/countries), and as individuals we often search for future places with similar qualities (Ryan & Ogilvie, 2001). Research is needed to understand how people can maintain bonds with the previous landscape, but successfully develop bonds with the new landscape as well, not seeing the change as the end of place but rather a new version of place with new possibilities and potential benefits (Stewart et al., 2004). It is clear that some residents of the Mactaquac area hold attachment to both the old landscape and the new landscape, exhibiting that this is possible.

5.7.2 Landscape Implications

In addition to the economic and ecological benefits for dam removal, the potential social and community level outcomes and benefits also need to be recognized and presented. There are often public misconceptions around dam removal; what will come of the communities, real estate, scenery, transportation access and new land? This can lead to removal opposition (Lejon et al., 2009; Sarakinos & Johnson, 2003).

Many local community members for instance, believe real estate values will plummet post dam removal, similar to other communities facing dam removal (Wyrick et al., 2009) however, this is not necessarily the case and real estate values in some cases have increased (Bohlen & Lewis,

2009). Additionally all cohorts expressed interest in future ownership; who would own the ‘new’ land that would be uncovered, land that was expropriated from local families during construction? Would it belong to the province or utility, divested to local municipalities, or be restored to individual ownership? Questions like these cause stress in the community and amplify the risk of a negative release phase. These questions are not unique to the Mactaquac case (Johnson & Graber, 2002; River Alliance of Wisconsin & Trout Unlimited, 2000) however, if left unanswered, become the basis for opposition. All parties involved in the dam decision, including dam removal proponents, dam maintenance proponents, and NB Power, need to be devoting time and money to community knowledge enrichment to support the affected communities. Acknowledging that there will be new land and what is going to be done with the land would allow community members to be better informed about the future. Presenting the benefits and drawbacks of the dam removal and dam maintenance, as they relate to the economic, environmental and societal impacts of both decisions would give those concerned an opportunity to develop a multidimensional, well-rounded opinions, and create a better level of communication between the multiple groups and the community members (Wyrick et al., 2009).

Another major concern, tied to personal wellbeing, is for the aesthetics and landscape of the Mactaquac area. Although some may prefer a lake view and others a river view, a majority in our sample believe the lake view they enjoy and prefer in this setting will be lost through dam removal. There is fear of the landscape becoming ugly, and useless (e.g. “If they pull the plug on this thing I am going to be living on the biggest mudflat east of Montreal” Male, Cohort 3). This fear has been present in other dam removal cases where those in opposition to dam removal believed the landscape would dry up completely or become a mudflat (Sarakinis & Johnson, 2003; Wyrick et al., 2009). In actual fact, studies have found that restoration and revitalization

efforts have been successful in establishing vegetation growth in post-dam landscapes within short time frames (Doyle et al., 2005; Kim et al., 2015; Lejon et al., 2009; Wyrick et al., 2009). Active remediation would be required in Mactaquac to hasten re-vegetation and soil stability, and perhaps even to manage pollutants in sediments. Details on these activities, if the dam is being considered for removal, should be presented to, and well communicated for, the affected community.

Action also needs to be taken to illustrate what the Mactaquac landscape might look like post-dam removal. NB Power put together a website for the Mactaquac project with basic visualizations for the three options (Figure 17). However, these visualizations are limited, in that they do not show roads or landmarks for example, giving community members only a limited idea of what the landscape could look like (NB Power, 2014d). Aesthetic concerns have been lessened when dam removal proponents have employed artists or digital visual simulations of the restored river (Sarakinis & Johnson, 2003). Further, remediation plans need to be divulged and need to be discussed openly with the public.



a. Visualization of option 1, repowering the dam, by rebuilding the spillway and powerhouse.



b. Visualization of option 2, retaining the headpond (no power), only the earthen dam is maintained

Figure 17. Visualizations of the three options for the future of the Mactaquac Dam and headpond landscape



c. Visualization of option 3, river restoration

Figure 17 (Continued). Visualizations of the three options for the future of the Mactaquac Dam and headpond landscape

By incorporating the public voice into the planning and discussion of the potential dam removal it is likely more community members will support the resulting plan, where their views and ideas are incorporated, as they will feel a part of its development. Plans that incorporated new elements, such as walking trails and public parks along the post-dam river channel, which would bring benefit and aesthetic improvement to the landscape, have also aided in increasing support for other dam removal cases (Sarakinis & Johnson, 2003). Undertaking a design charette (Lindsey, Todd, Hayter, & Ellis, 2009), to help plan and visualize what the landscape could look like if the dam were to be removed, could help the community feel more informed. For example, a ‘welcome back the intervale’ or other river-scape features may help the community to view the potential removal in a new and potentially more positive way. The affected communities need to see what the landscape, lifestyle and community will become and feel confident that they will be able to adjust and succeed in their new home and new landscape. These methods will help

support the communities in their transition from a period of release to a period of reorganization and adjustment.

5.8 RECOMMENDATIONS FOR FURTHER RESEARCH

Analyzing the Mactaquac case through the adaptive framework illustrates periods of instability and stability and what has enabled residents and communities to persist through the transitional periods that take place in between. Explicit testing of this alternative framework needs to be undertaken. Similar frameworks exploring transitions have been used in energy landscape research, such as the dwelling-journey spiral in the case of dam construction and community displacement (Million, 1992; Seamon, 1989), and the stages of acceptance (“U curve”) in the cases of wind power and wind project acceptance (Warren et al., 2005; Wolsink, 1994, 2007). The dwelling-journey spiral outlines the stages of involuntary displacement (resulting from dam construction); from struggling to stay, to searching for the new, and finally into starting over and wanting to settle (Million, 1992). The stages of acceptance framework recognizes that people often (1) support wind energy in theory, (2) oppose specific wind farm projects during the proposal and construction phase, and (3) support wind projects after construction once they are in use (Warren & McFadyen, 2010; Wolsink, 1994, 2007). We propose the expansion of energy studies research through the use of the adaptive framework and resilience theory as an alternative method to understanding the landscape, community and social transitions that can occur as a result of energy infrastructure implementation and the renewable energy transition (Wilson, 2012).

Mactaquac is a specific example of a transition forced by the implementation and potential removal of a hydropower dam but the situation is not unique. Renewable energy is being

implemented at a rapid rate around the world, and much research is going into the social implications. However, we propose that research needs to move forward into understanding how adjustment occurs, how resiliency in both the landscape and community is affected and how person-place bonds are being affected. Understanding resilience, adaptation transitions, and attachment, as they pertain to energy landscape research, will be important. There is a need to understand how to increase the resiliency of place attachment, community dynamics and landscape for those facing landscape transformations as a result of energy infrastructure implementation.

5.9 CONCLUSION

Renewable energy landscapes can become valued in similar ways to natural landscapes. Citizens may not be against renewable energy landscapes *per se* but rather resistant of change, particularly problematic with the move from traditional ‘out of sight, out of mind’ non-renewable energy production to renewable energy infrastructure and production in the landscape. Research needs to continue to explore positive and negative perceptions of energy landscapes and understand how to make the transition to renewable energy landscapes easier for those directly affected.

This discussion recognizes that people can seek periods of stability and regularity in place and view these positively. On the other hand people can view periods of instability and change in their valued places as stressful and negative. Research in place attachment in combination with the adaptive cycle shows great promise in understanding some of the social processes associated with renewable energy transitions. By analyzing renewable energy implementation as a disturbance through the adaptive cycle, we can recognize the state of existence of a community,

as it was in the past, how the community exists in the present, and how it may be in the future. It can also be seen when looking at the transition of the physical landscape through the framework. This will allow an understanding of what elements of the community and/or landscape people perceive positively and which they view negatively. It will allow an understanding as to how to catalyze periods of instability and support place attachment and community attachment through periods of uncertainty and change.

A fair consideration of all three future options for the Mactaquac Dam requires more effort on the third, dam removal, which is currently the option that involves the most unanswered questions. The success of potential dam removal rests on the success of the utility and/or dam removal proponents to incorporate the communities in not only the decision process, but also the planning and management process for the future of the landscape and thus the community. Presenting the communities with more knowledge is the first step, but further incorporation into the project is needed (Johnson & Graber, 2002). Concerned citizens need to be actively involved in the future of the dam, and the potential dam removal proposal, in order to feel confident in the future of the landscape and community.

It is well recognized that social factors can be the cause of energy projects being rejected and or slowed. In order to move forward successfully with much needed renewable energy projects, there must be recognition as to how people develop emotional bonds to place, how people can value both the pre-energy landscape and the energy-in-place landscape (as was evident in the case of the Mactaquac Dam and headpond), and most importantly how policies and programs can support this adaptation and transition. Supporting communities, catalyzing place attachment

bonds, and encouraging adaptation and adoption to build a sustainable future will be crucial for a successful global energy transition.

CHAPTER 6 CONCLUSION

Renewable energy infrastructure development has and will continue to have major transformational effects on the landscapes of communities and individuals around the world (Nadaï & van der Horst, 2010). It is likely that this shift to renewable energy landscapes will occur faster than personal aesthetic views will adapt, undermining the possibility of seamless acceptance (Selman, 2010). For these reasons, it is crucial that research be conducted that delves deeper into the social attachment to landscape that exists and understand how one can learn to not only accept but also appreciate renewable energy production in the landscape.

The study looked at the impacts of the Mactaquac Dam, specifically, the effects of its construction in the 1960s, the impacts of its existence in the present landscape, and lastly the effects of its potential removal on the future landscape. 20 interviewees across four cohorts were interviewed: those who were adults and property owners before the dam; those who were children at the time of dam construction; those who grew up on the headpond; and those who moved to the headpond area as adults. A conceptual framework, the Baselines of Acceptability Model, was developed from various theories to identify when and how landscape norms were set in the region. A majority of the sample viewed the transitional stages negatively, whereas stable (pre-dam and headpond) landscapes were viewed positively (Figure 10). These identified patterns illustrated that despite the general negative views towards dam construction, the present dam-in-place landscape is valued by most of the study population due to its numerous personal and society benefits. The present landscape, with the dam in place, is of great importance to the community, so much so that most residents of this sample view dam removal negatively. The capacity of all four interviewed cohorts to view the present landscape as positive, despite the

chaos of the transition to this state, indicates that generationally set baselines may not necessarily drive acceptance of hydropower infrastructure. Rather, results suggest that baselines are malleable and change as citizens and communities find new benefits and amenities from the new energy landscape.

Recognizing that baselines appear to be malleable and influenced by experience in the landscape in the case of the Mactaquac Dam and headpond, the study explored the explanatory potential of the adaptive cycle and resilience theory as it relates to place value and attachment in the context of renewable energy transitions. I believe that there is value in these concepts, as there were apparent cycles of positive and negative views in the communities in the case of the Mactaquac Dam. Negative views were apparent in times of uncertainty and instability, recognized as periods of release or disturbance (i.e. dam construction or dam rebuild/removal). Positive views were felt during periods of stability and regularity (i.e. pre-dam landscape and present landscape), recognized as periods of conservation in the adaptive cycle. By analyzing renewable energy implementation as a disturbance through the adaptive cycle, the state of a community can be recognized, as it existed in the past, how the community exists in the present, and how it may exist in the future. We can also understand the physical landscape transition as well as the resiliency of place attachment and place bonds within the community. I believe research needs to look at the development of renewable energy landscapes as cycles going through transition and adaptation, at the personal, community and global levels. This will allow researchers to find ways to catalyze periods of instability, by supporting place attachment and community attachment through these periods of uncertainty and change.

Energy infrastructure will continue to change the face of our present landscapes as the global community strives for energy security and sustainable energy methods. Increasing public involvement and public knowledge about renewable energy landscapes, promoting energy landscapes as a means of achieving local energy needs and positive environmental outcomes, and connecting people and communities with the development of energy in their landscapes will aid in supporting communities facing an energy transition. Understanding that landscape perceptions can change over time will be crucial to the success of renewable energy landscapes, at both the community and global levels. As the global community continues to move forward in renewable energy development and production, it is crucial to recognize the social impacts and begin to frame this transition as a movement for global sustainability, energy security and environmental benefit. We must look to catalyze and lessen the negative periods and support communities as they adapt their aesthetic preferences and find new meaning and value in the energy landscapes of the future.

REFERENCES

- Adams, C. A., & Bell, S. (2014). Local energy generation projects: assessing equity and risks. *Local Environment*, (July 2014), 1–16. doi:10.1080/13549839.2014.909797
- Adger, W. N., Dessai, S., Goulden, M., Hulme, M., Lorenzoni, I., Nelson, D. R., ... Wreford, A. (2009). Are there social limits to adaptation to climate change? *Climatic Change*, 93(3-4), 335–354. doi:10.1007/s10584-008-9520-z
- Agnew, J. (2011). Space and Place. In J. Agnew & D. Livingston (Eds.), *Handbook of Geographical Knowledge* (pp. 316–330). London: Sage Publications Ltd.
- American Rivers. (2014). Questions about Removing Dams. Retrieved April 13, 2015, from <http://www.americanrivers.org/initiatives/dams/faqs/>
- Anderson, C., Beazley, K., & Boxall, J. (2009). Lessons for PPGIS from the application of a decision-support tool in the Nova Forest Alliance of Nova Scotia, Canada. *Journal of Environmental Management*, 90(6), 2081–2089. doi:10.1016/j.jenvman.2007.08.031
- Ansar, A., Flyvbjerg, B., Budzier, A., & Lunn, D. (2014). Should we build more large dams? The actual costs of hydropower megaproject development. *Energy Policy*, 69, 43–56. doi:10.1016/j.enpol.2013.10.069
- Antrop, M. (2005). Why landscapes of the past are important for the future. *Landscape and Urban Planning*, 70(1-2), 21–34. doi:10.1016/j.landurbplan.2003.10.002
- Antrop, M. (2006). Sustainable landscapes: contradiction, fiction or utopia? *Landscape and Urban Planning*, 75(3-4), 187–197. doi:10.1016/j.landurbplan.2005.02.014
- Arriaza, M., Cañas-Ortega, J. F., Cañas-Madueño, J. a., & Ruiz-Aviles, P. (2004). Assessing the visual quality of rural landscapes. *Landscape and Urban Planning*, 69(1), 115–125. doi:10.1016/j.landurbplan.2003.10.029
- Babbitt, B. (2002). What goes up, may come down. *Biological Science*, 53(8), 656–658.
- Baker, S. E., & Edwards, R. (2012). *How many qualitative interviews is enough? Expert voices and early career reflections on sampling and cases in qualitative research. National Centre for Research Methods Review Paper. National Centre for Research Methods (NCRM).* doi:10.1177/1525822X05279903
- Balfe, M., Doyle, F., & Conroy, R. (2012). Using Facebook to Recruit Young Adults for Qualitative Research Projects. *CIN: Computers, Informatics, Nursing*, 30(10), 511–515. doi:10.1097/NXN.0b013e31826e4fca

- Batel, S., Devine-Wright, P., & Tangeland, T. (2013). Social acceptance of low carbon energy and associated infrastructures: A critical discussion. *Energy Policy*, *58*, 1–5. doi:10.1016/j.enpol.2013.03.018
- BC Hydro. (2015). Site C: Clean Energy Project. Retrieved from <https://www.sitecproject.com>
- Beckley, T. M. (2003). *The Relative Importance of Sociocultural and Ecological Factors in Attachment to Place. Understanding Community- Forest Relations.*
- Beckley, T. M., Stedman, R. C., Wallace, S. M., & Ambard, M. (2007). Snapshots of What Matters Most: Using Resident-Employed Photography to Articulate Attachment to Place. *Society & Natural Resources*, *20*(10), 913–929. doi:10.1080/08941920701537007
- Bell, D., Gray, T., & Haggett, C. (2005). The “Social Gap” in Wind Farm Siting Decisions: Explanations and Policy Responses. *Environmental Politics*, *14*(4), 460–477. doi:10.1080/09644010500175833
- Bell, D., Gray, T., Haggett, C., & Swaffield, J. (2013). Re-visiting the “social gap”: public opinion and relations of power in the local politics of wind energy. *Environmental Politics*, *22*(April 2015), 115–135. doi:10.1080/09644016.2013.755793
- Berger, P. T., & Luckmann, T. (1967). *The social construction of reality: A treatise in the sociology of knowledge.* Garden City, NY: Anchor Books.
- Bisset, K. (2013). Costs to refurbish Point Lepreau nuclear plant could be a 3.3 billion: PMO memo. Retrieved from <http://atlantic.ctvnews.ca/cost-of-refurbishing-point-lepreau-nuclear-plant-could-be-3-3-billion-pmo-memo-1.1362644>
- Bohlen, C., & Lewis, L. Y. (2009). Examining the economic impacts of hydropower dams on property values using GIS. *Journal of Environmental Management*, *90*, S258–S269. doi:10.1016/j.jenvman.2008.07.026
- Boon, F. P., & Dieperink, C. (2014). Local civil society based renewable energy organisations in the Netherlands: Exploring the factors that stimulate their emergence and development. *Energy Policy*, *69*, 297–307. doi:10.1016/j.enpol.2014.01.046
- Born, S. M., Genskow, K. D., Filbert, T. L., Hernandez-Mora, N., Keefer, M. L., & White, K. a. (1998). Socioeconomic and Institutional Dimensions of Dam Removals: The Wisconsin Experience. *Environmental Management*, *22*(3), 359–370. doi:10.1007/s002679900111
- Bourgoin, S. (2013). *Disregarded Sentiments: Discovering the Voices of Opposition to the Mactaquac Dam.* Saint Mary’s University, Halifax NS.
- Boyd, A. ., & Paveglio, T. . (2015). “Placing” Energy Development in a Local Context: Exploring the Origins of Rural Community Perspectives. *Journal of Rural and Community Development*, *10*(2), 1–20.

- Braun, V., & Clarke, V. (2006). Using thematic analysis in psychology. *Qualitative Research in Psychology*, 3(2), 77–101. doi:10.1191/1478088706qp063oa
- Brehm, J. M., Eisenhauer, B. W., & Stedman, R. C. (2012). Environmental Concern: Examining the Role of Place Meaning and Place Attachment. *Society & Natural Resources*, 26(February 2015), 1–17. doi:10.1080/08941920.2012.715726
- Brown, G., & Reed, P. (2012). Values Compatibility Analysis: Using Public Participation Geographic Information Systems (PPGIS) for Decision Support in National Forest Management. *Applied Spatial Analysis and Policy*, 5(4), 317–332. doi:10.1007/s12061-011-9072-x
- Brown, G., & Weber, D. (2012). Measuring change in place values using public participation GIS (PPGIS). *Applied Geography*, 34(2), 316–324. doi:10.1016/j.apgeog.2011.12.007
- Brown, P., Tullos, D., Tilt, B., Magee, D., & Wolf, A. T. (2009). Modeling the costs and benefits of dam construction from a multidisciplinary perspective. *Journal of Environmental Management*, 90, S303–S311. doi:10.1016/j.jenvman.2008.07.025
- Brown, R. B., Dorius, S. F., & Krannich, R. S. (2005). The Boom-Bust-Recovery Cycle: Dynamics of Change in Community Satisfaction and Social Integration in Delta, Utah. *Rural Sociology*, 70(1), 28–49. doi:10.1526/0036011053294673
- Bryman, A. (2012). *Social research methods* (4th ed.). New York, New York: Oxford University Press.
- Canadian Nuclear Safety Commission (CNSC). (2013). Point Lepreau Generating Station. Retrieved from <http://nuclearsafety.gc.ca/eng/reactors/power-plants/nuclear-facilities/point-lepreau-nuclear-generating-station/index.cfm#a1>
- Canadian Rivers Institute. (2011). *THE SAINT JOHN RIVER : A State of the Environment Report*. (S. D. Kidd, R. A. Curry, & K. R. Munckittrick, Eds.). Fredericton, N.B: Canadian Rivers Institute. Retrieved from http://www.unb.ca/research/institutes/cri/_resources/pdfs/criday2011/cri_sjr_soe_final.pdf
- Carlisle, J. E., Kane, S. L., Solan, D., & Joe, J. C. (2014). Support for solar energy: Examining sense of place and utility-scale development in California. *Energy Research & Social Science*, 3, 124–130. doi:10.1016/j.erss.2014.07.006
- Cass, N., & Walker, G. (2009). Emotion and rationality: The characterisation and evaluation of opposition to renewable energy projects. *Emotion, Space and Society*, 2(1), 62–69. doi:10.1016/j.emospa.2009.05.006
- Castleden, H., Garvin, T., & Huu-ay-aht First Nation. (2008). Modifying Photovoice for community-based participatory Indigenous research. *Social Science and Medicine*, 66(6), 1393–1405. doi:10.1016/j.socscimed.2007.11.030

- CBC News. (2013). Nuclear Commission probes Point Lepreau leak. Retrieved from <http://www.cbc.ca/news/canada/new-brunswick/nuclear-commission-probes-point-lepreau-leak-1.2415811>
- CBC News. (2014). Mactaquac Dam becomes an election issue. Retrieved from <http://www.cbc.ca/news/canada/new-brunswick/mactaquac-dam-becomes-an-election-issue-1.2770982>
- Chu, J. L., & Snider, C. E. (2013). Use of a social networking web site for recruiting Canadian youth for medical research. *Journal of Adolescent Health, 52*(6), 792–794. doi:10.1016/j.jadohealth.2012.12.002
- Clark-Ibanez, M. (2004). Framing the Social World With Photo-Elicitation Interviews. *American Behavioral Scientist, 47*(12), 1507–1527. doi:10.1177/0002764204266236
- Cohen, J. J., Reichl, J., & Schmidthaler, M. (2014). Re-focussing research efforts on the public acceptance of energy infrastructure: A critical review. *Energy, 76*, 4–9. doi:10.1016/j.energy.2013.12.056
- Coleby, A. M., van der Horst, D., Hubacek, K., Goodier, C., Burgess, P. J., Graves, A., ... Howard, D. (2012). Environmental impact assessment, ecosystems services and the case of energy crops in England. *Journal of Environmental Planning and Management, 55*(3), 369–385. doi:10.1080/09640568.2011.6039
- Council of Canadian Academies. (2015). *Understanding the Evidence: Wind Turbine Noise*. Ottawa Ontario.
- Council of Europe (CE). (2000). European landscape convention.
- Creswell, J. W. (2013). *Qualitative Inquiry and Research Design: Choosing Among Five Approaches* (3rd ed.). Washington DC: Sage Publications Ltd.
- Daniel, T. C. (2001). Whither scenic beauty? Visual landscape quality assessment in the 21st century. *Landscape and Urban Planning, 54*(1-4), 267–281. doi:10.1016/S0169-2046(01)00141-4
- Davenport, M. a., & Anderson, D. H. (2005). Getting From Sense of Place to Place-Based Management: An Interpretive Investigation of Place Meanings and Perceptions of Landscape Change. *Society & Natural Resources, 18*(March 2015), 625–641. doi:10.1080/08941920590959613
- Devine-Wright, P. (2005). Beyond NIMBYism: Towards an integrated framework for understanding public perceptions of wind energy. *Wind Energy, 8*(2), 125–139. doi:10.1002/we.124

- Devine-Wright, P. (2007). Reconsidering public acceptance of renewable energy technologies: a critical review. In M. Grubb, T. Jamasb, & M. Pollit (Eds.), *Delivering a Low Carbon Electricity System: Technologies, Economics and Policy*. New York, New York: Cambridge University Press.
- Devine-Wright, P. (2009). Rethinking NIMBYism: The role of place attachment and place identity in explaining place-protective action. *Journal of Community & Applied Social Psychology, 19*, 426–441. doi:10.1002/casp
- Devine-Wright, P. (2011). Place attachment and public acceptance of renewable energy: A tidal energy case study. *Journal of Environmental Psychology, 31*(4), 336–343. doi:10.1016/j.jenvp.2011.07.001
- Devine-Wright, P., & Clayton, S. (2010). Introduction to the special issue: Place, identity and environmental behaviour. *Journal of Environmental Psychology, 30*(3), 267–270. doi:10.1016/S0272-4944(10)00078-2
- Devine-Wright, P., & Howes, Y. (2010). Disruption to place attachment and the protection of restorative environments: A wind energy case study. *Journal of Environmental Psychology, 30*(3), 271–280. doi:10.1016/j.jenvp.2010.01.008
- Dickison, J. J. (2006). *Making New Brunswickers Modern: Natural and Human Development in the Mactaquac Regional Development Plan 1965-1975*. University of New Brunswick.
- Dincer, I. (2000). Renewable energy and sustainable development: a crucial review. *Renewable and Sustainable Energy Reviews, 4*(2), 157–175. doi:10.1016/S1364-0321(99)00011-8
- Downing, J. a., Prairie, Y. T., Cole, J. J., Duarte, C. M., Tranvik, L. J., Striegl, R. G., ... Melack, J. M. (2006). The global abundance and size distribution of lakes, ponds, and impoundments. *Limnology and Oceanography, 51*(5), 2388–2397. doi:10.4319/lo.2006.51.5.2388
- Doyle, M. W., Stanley, E. H., Harbor, J. M., & Grant, G. S. (2003). Dam removal in the United States: Emerging needs for science and policy. *Eos, Transactions American Geophysical Union, 84*(4), 29. doi:10.1029/2003EO040001
- Doyle, M. W., Stanley, E. H., Orr, C. H., Selle, A. R., Sethi, S. a., & Harbor, J. M. (2005). Stream ecosystem response to small dam removal: Lessons from the Heartland. *Geomorphology, 71*(1-2), 227–244. doi:10.1016/j.geomorph.2004.04.011
- Eaton, W. M., Gasteyer, S. P., & Busch, L. (2014). Bioenergy futures: Framing sociotechnical imaginaries in local places. *Rural Sociology, 79*(2), 227–256. doi:10.1111/ruso.12027
- Edelheim, J. . (2010). Lighthouses as attractors: following Moominpappa. In *Arts, islands and islomania, 6th International Small Island Cultures Conference* (Vol. 422). Guernsey, C.I. UK.

- Edenhofer, O., Hirth, L., Knopf, B., Pahle, M., Schlömer, S., Schmid, E., & Ueckerdt, F. (2013). On the economics of renewable energy sources. *Energy Economics*, *40*, S12–S23. doi:10.1016/j.eneco.2013.09.015
- Fereday, J., & Muir-cochrane, E. (2006). Demonstrating Rigor Using Thematic Analysis : A Hybrid Approach of Inductive and Deductive Coding and Theme Development. *International Journal of Qualitative Methods*, *5*(1), 80–92. doi:10.1063/1.2011295
- Fernandez-Jimenez, L. A., Zorzano-santamaria, P., Garcia-garrido, E., Lara-santillan, P., Zorzano-alba, E., & Falces, A. (2015). Site selection for new PV power plants based on their observability. *Renewable Energy*, *78*, 7–15. doi:10.1016/j.renene.2014.12.063
- Ferrar, K. S. (2005). *Power for Progress: The Mactaquac Development and Regional Development Plans, 1964-2003*. University of New Brunswick, Fredericton NB.
- Firestone, J., Bates, A., & Knapp, L. A. (2015). See me, Feel me, Touch me, Heal me: Wind turbines, culture, landscapes, and sound impressions. *Land Use Policy*, *46*, 241–249. doi:10.1016/j.landusepol.2015.02.015
- Folke, C., Carpenter, S. R., Walker, B., Scheffer, M., Chapin, T., & Rockström, J. (2010). Resilience thinking: Integrating resilience, adaptability and transformability. *Ecology and Society*, *15*(4). doi:10.1038/nnano.2011.191
- Forster, S. E., Jones, L., Saxton, J. M., Flower, D. J., Foulds, G., Powers, H. J., ... Williams, E. a. (2010). Recruiting older people to a randomised controlled dietary intervention trial--how hard can it be? *BMC Medical Research Methodology*, *10*, 17. doi:10.1186/1471-2288-10-17
- Fried, M. (2000). Continuities and Discontinuities of Place. *Journal of Environmental Psychology*, *20*(3), 193–205. doi:10.1006/jevps.1999.0154
- Giuliani, M. ., Ferrara, F., & Barabotti, S. (2003). One attachment or more? In G. Moser, E. Pol, Y. Bernard, M. Bonnes, J. . Corraliza, & M. . Giuliani (Eds.), *People Places and Sustainability* (pp. 111–122). Seattle, WA: Hogrefe & Huber.
- Glover, T. D., Stewart, W. P., & Gladdys, K. (2008). Social Ethics of Landscape Change: Toward Community-Based Land-Use Planning. *Qualitative Inquiry*, *14*(3), 384–401. doi:10.1177/1077800407309409
- Government of New Brunswick. (2013). Mactaquac Project First Nations engagement process begins with choice of partner. Retrieved April 15, 2015, from http://www2.gnb.ca/content/gnb/en/news/news_release.2013.11.1222.html
- Graf, W. L. (Ed.). (2003). Dam Removal Research: Status and Prospects. In *The Heinz Center's Dam Removal Research Workshop*. doi:10.1002/bies.201200088

- Graham, K., & Rudolph, D. (2014). Geography, Communities and Energy Futures: Alternative Research Paths. *Scottish Geographical Journal*, 130(February 2015), 143–151. doi:10.1080/14702541.2014.927616
- Greenland-Smith, S. (2014). *Farmer Perceptions of Wetland Ecosystem Goods and Services*. Dalhousie University, Halifax NS.
- Greider, T., & Garkovich, L. (1994). Landscapes: The social construction of nature and the environment. *Rural Sociology*, 59(1), 1–24.
- Guba, E. G., & Lincoln, T. S. (1994). Competing paradigms in qualitative research. In N. K. Denzin & Y. S. Lincoln (Eds.), *Handbook of qualitative research* (pp. 105–117). London: Sage Publications Ltd. Retrieved from http://steinhardtapps.es.its.nyu.edu/create/courses/3311/reading/10-guba_lincoln_94.pdf
- Gunderson, L. H., & Holling, C. S. (2002). *Panarchy: Understanding transformations in human and natural systems*. Washington DC: Island Press.
- Gustafson, P. (2001). Meanings of Place: Everyday experience and theoretical conceptualizations. *Journal of Environmental Psychology*, 21, 5–16. doi:10.1006/jevp.2000.0185
- Haacke, P. (2011). *The Vertical Turn : Topographies of Metropolitan Modernism* By. University of California, Berkeley.
- Holloway, I., & Wheeler, S. (2013). *Qualitative research in nursing and healthcare* (3rd ed.). John Wiley & Sons.
- International Energy Agency. (2014). *World Energy Outlook 2014*. Paris, France. Retrieved from <http://www.iea.org/Textbase/npsum/WEO2013SUM.pdf>
- IPCC. (2011). *Summary for Policymakers*. (O. Edenhofer, R. Pichs-Madruga, Y. Sokona, K. Seyboth, P. Matschoss, S. Kadner, ... C. von Stechow, Eds.) *IPCC Special Report on Renewable Energy Sources and Climate Change Mitigation*. New York, New York: Cambridge University Press. Retrieved from http://www.unclearn.org/sites/www.unclearn.org/files/inventory/ipcc_summary_for_pm.pdf
- IRENA. (2015). *Renewable Energy and Jobs - Annual Review 2015*. Abu Dhabi, United Arab Emirates.
- Jacobsen, T. (2006). Bridging the Arts and Sciences: A Framework for the Psychology of Aesthetics. *Leonardo*, 39(2), 155–162.

- Jacquet, J. B., & Stedman, R. C. (2013). The risk of social-psychological disruption as an impact of energy development and environmental change. *Journal of Environmental Planning and Management*, 0(February 2015), 1–20. doi:10.1080/09640568.2013.820174
- Johnson, B. D., Dunlap, E., & Benoit, E. (2010). Structured Qualitative Research: Organizing “Mountains of Words” for Data Analysis, both Qualitative and Quantitative. *Substance Use & Misuse*, 45(5), 648–670. doi:10.3109/10826081003594757.Structured
- Johnson, S. E., & Graber, B. E. (2002). Enlisting the Social Sciences in Decisions about Dam Removal. *BioScience*, 52(8), 731–738.
- Jones, C. R., & Eiser, J. R. (2010). Understanding “local” opposition to wind development in the UK: How big is a backyard? *Energy Policy*, 38(6), 3106–3117. doi:10.1016/j.enpol.2010.01.051
- Jones, R. A., Anderson, L., Gibson, J. F., & Goff, T. (2010). *Assessment of Atlantic Salmon Stocks in South Western New Brunswick (Outer Portion of SFA 23): An Update to 2008*. Dartmouth, Nova Scotia.
- Jorgensen, B. S., & Stedman, R. C. (2001). Sense of Place As an Attitude: Lakeshore Owners Attitudes Toward Their Properties. *Journal of Environmental Psychology*, 21(3), 233–248. doi:10.1006/jevp.2001.0226
- Jorgensen, B. S., & Stedman, R. C. (2006). A comparative analysis of predictors of sense of place dimensions: attachment to, dependence on, and identification with lakeshore properties. *Journal of Environmental Management*, 79(3), 316–27. doi:10.1016/j.jenvman.2005.08.003
- Kahneman, D. (2011). *Thinking Fast and Slow*. Toronto, ON: Anchor Canada.
- Kaldellis, J. K., Kapsali, M., Kaldelli, E., & Katsanou, E. (2013). Comparing recent views of public attitude on wind energy, photovoltaic and small hydro applications. *Renewable Energy*, 52, 197–208. doi:10.1016/j.renene.2012.10.045
- Kaplan, S. (1987). Aesthetics, Affect and Cognition: Environmental Preference from an Evolutionary Perspective. *Environment and Behavior*, 19(1), 3–32. doi:0803973233
- Kapp, J. M., Peters, C., & Oliver, D. P. (2013). Research recruitment using facebook advertising: Big potential, big challenges. *Journal of Cancer Education*, 28(1), 134–137. doi:10.1007/s13187-012-0443-z
- Karimi, S. (2005). Thirteen Years After Rio: The State of Energy Efficiency and Renewable Energy in Canada. *Bulletin of Science, Technology & Society*, 25(6), 497–506. doi:10.1177/0270467605282980

- Keilty, K., Sherren, K., Beckley, T., & Marmura, H. (2014). Rebuild , rewild or decommission : Consulting locals about the fate of the Mactaquac Dam, Canada, using floating focus groups. Paper presented at the International Symposium on Society and Resource Management 2014, Hanover Germany.
- Kenny, J. L., & Secord, A. G. (2010). Engineering modernity: Hydroelectric development in New Brunswick, 1945-1970. *Acadiensis*, 39(1), 3–26.
- Kim, S., Toda, Y., & Tsujimoto, T. (2015). Geomorphological and riparian vegetation responses following a low-head dam removal: a study based on literature review. *International Journal of River Basin Management*, (May 2015), 1–10. doi:10.1080/15715124.2015.1012207
- Klein, C. A. (1999). On dams and democracy. *Oregon Law Review*, 1–94. Retrieved from <http://ssrn.com/abstract=1266162>
- Kyle, G., & Chick, G. (2007). The Social Construction of a Sense of Place. *Leisure Sciences*, 29(3), 209–225. doi:10.1080/01490400701257922
- Laborde, S., Imberger, J., & Toussaint, S. (2012). A wall out of place: A hydrological and sociocultural analysis of physical changes to the lakeshore of Como, Italy. *Ecology and Society*, 17(1). doi:10.5751/ES-04610-170133
- Lawson, P. M., Farnsworth, G., & Hartley, M. A. (1985). *The Nackaiwc Bend*. Nackawic, New Brunswick: Town of Nackawic.
- Le Dû-Blayo, L. (2011). How Do We Accommodate New Land Uses in Traditional Landscapes? Remanence of Landscapes, Resilience of Areas, Resistance of People. *Landscape Research*, 36(4), 417–434. doi:10.1080/01426397.2011.583010
- Lejon, A. G. C., Renofalt, B. M., & Nilsson, C. (2009). Conflicts Associated with Dam Removal in Sweden. *Ecology and Society*, 14(2). Retrieved from <http://www.ecologyandsociety.org/vol14/iss2/art4/>
- Lindsey, G., Todd, J. A., Hayter, S. J., & Ellis, P. G. (2009). *A Handbook for Planning and Conducting Charettes for High-Performance Projects*. Washington DC.
- Lothian, A. (1999). Landscape and the philosophy of aesthetics: is landscape quality inherent in the landscape or in the eye of the beholder? *Landscape and Urban Planning*, 44(4), 177–198. doi:10.1016/S0169-2046(99)00019-5
- Low, S. M., & Altman, I. (1992). Place attachment: A conceptual inquiry. In S. M. Low & I. Altman (Eds.), *Place attachment* (pp. 1–12). New York, New York: Plenum Press.
- Manzer, M. A. (1996). *Dam the Mactaquac Region*. Saint Thomas University, Fredericton NB.

- Manzo, L. C. (2005). For better or worse: Exploring multiple dimensions of place meaning. *Journal of Environmental Psychology*, 25(1), 67–86. doi:10.1016/j.jenvp.2005.01.002
- Manzo, L. C., & Perkins, D. D. (2006). Finding Common Ground: The Importance of Place Attachment to Community Participation and Planning. *Journal of Planning Literature*, 20(4), 335–350. doi:10.1177/0885412205286160
- Matthews, R., & Selman, P. (2006). Landscape as a focus for integrating human and environmental processes. *Journal of Agricultural Economics*, 57(2), 199–212. doi:10.1111/j.1477-9552.2006.00047.x
- McCafferty, D. (2011). Activism vs. Slacktivism. *Communications of the ACM*, 54(12), 17. doi:10.1145/2043174.2043182
- McLachlan, C. (2009). “You don’t do a chemistry experiment in your best china’: Symbolic interpretations of place and technology in a wave energy case. *Energy Policy*, 37(12), 5342–5350. doi:10.1016/j.enpol.2009.07.057
- McLachlan, C. (2010). Technologies in place : symbolic interpretations of renewable energy. *Sociological Review*, 181– 199.
- Miller, C. A., Richter, J., & O’Leary, J. (2015). Socio-energy systems design: A policy framework for energy transitions. *Energy Research & Social Science*, 6, 29–40. doi:10.1016/j.erss.2014.11.004
- Million, M. . (1992). *“It was Home”: A Phenomenology of Place and Involuntary Displacement as Illustrated by the Forced Dislocation of Five Southern Alberta Families in the Oldman River Dam Flood Area*. Saybrook Graduate School and Research Centre.
- Mims, M. C., & Olden, J. D. (2013). Fish assemblages respond to altered flow regimes via ecological filtering of life history strategies. *Freshwater Biology*, 58(1), 50–62. doi:10.1111/fwb.12037
- Mitchell, S. (2012). St. John River – restoring this complex system requires a holistic view and long-term commitment. Retrieved from <http://blog.wwf.ca/blog/2012/09/18/st-john-river---restoring-this-complex-system-requires-a-holistic-view-and-long-term-commitment/>
- Mody, L., Miller, D. K., McGloin, J. M., Freeman, M., Marcantonio, E. R., Magaziner, J., & Studenski, S. (2008). Recruitment and retention of older adults in aging research. *Journal of the American Geriatrics Society*, 56(12), 2340–2348. doi:10.1111/j.1532-5415.2008.02015.x
- Nadaï, A., & van der Horst, D. (2010). Introduction: Landscapes of Energies. *Landscape Research*, 35(2), 143–155. doi:10.1080/01426390903557543

- Namy, S. (2007). Addressing the Social Impacts of Large Hydropower Dams. *The Journal of International Policy Solutions*, 7, 11–17.
- NB Power. (2013). Mactaquac Proect. Retrieved March 17, 2015, from <http://www.nbpower.com/html/en/about/future/mactaquac.html>
- NB Power. (2014a). About Mactaquac Generating Station. Retrieved May 22, 2015, from <http://www.mactaquac.ca/about-mactaquac-generating-station/>
- NB Power. (2014b). Comparative Environmental Review. Retrieved from <http://www.mactaquac.ca/comparative-environmental-review/>
- NB Power. (2014c). *NB Power 's 10-Year Plan: Fiscal Years 2016 to 2025*. Fredericton.
- NB Power. (2014d). Project Description- Mactaquac Project. Retrieved March 30, 2015, from <http://www.mactaquac.ca/project-description/>
- NB Power. (2014e). What is the Mactaquac Project? Retrieved March 17, 2015, from <http://www.mactaquac.ca/>
- NB Power. (2015a). 2.8 million NSERC grant allows Canadian Rivers Institute to study the health of the St. John River. Retrieved from <http://www.nbpower.com/en/about-us/news-media-centre/news/2015/28-million-nserc-grant-allows-canadian-rivers-institute-to-study-the-health-of-the-st-john-river/>
- NB Power. (2015b). Smart Grid. Retrieved from <https://www.nbpower.com/en/smart-habits/smart-grid>
- Nüsser, M. (2003). Political ecology of large dams: a critical review. *Petermanns Geographische Mitteilungen*, 147, 20–27. Retrieved from [http://www.sai.uni-heidelberg.de/geo/pdfs/Nuesser_2003_PoliticalEcologyOfLargeDams_PGM_147\(1\)_20-27.pdf](http://www.sai.uni-heidelberg.de/geo/pdfs/Nuesser_2003_PoliticalEcologyOfLargeDams_PGM_147(1)_20-27.pdf)
- O'Neill, B. (2007). *Indifferent Or Just Different?: The Political and Civic Engagement of Young People in Canada*. Retrieved from http://www.academia.edu/download/30522554/48504_en.pdf
- Onat, N., & Bayar, H. (2010). The sustainability indicators of power production systems. *Renewable and Sustainable Energy Reviews*, 14(9), 3108–3115. doi:10.1016/j.rser.2010.07.022
- Owen, R. J., Duinker, P. N., & Beckley, T. M. (2009). Capturing old-growth values for use in forest decision-making. *Environmental Management*, 43(2), 237–48. doi:10.1007/s00267-008-9133-3

- Parkhill, K. A., Butler, C., & Pidgeon, N. F. (2014). Landscapes of threat? Exploring discourses of stigma around large energy developments. *Landscape Research*, (February 2015), 1–17. doi:10.1080/01426397.2013.775232
- Parkins, J. R., Hempel, C., Beckley, T., Stedman, R. C., & Sherren, K. (2015). Identifying energy discourses in Canada with Q method: Moving beyond the environment versus economy debates. *Environmental Sociology*, 1–11. doi:10.1080/23251042.2015.1054016
- Pasqualetti, M. J. (2011). Opposing Wind Energy Landscapes: A Search for Common Cause. *Annals of the Association of American Geographers*, 101(4), 907–917. doi:10.1080/00045608.2011.568879
- Pauly, D. (1995). Anecdotes and the shifting baseline syndrome of fisheries. *Trends in Ecology & Evolution*, 10(10), 430. Retrieved from <http://www.ncbi.nlm.nih.gov/pubmed/21237093>
- Petrova, M. A. (2013). NIMBYism revisited: Public acceptance of wind energy in the United States. *Wiley Interdisciplinary Reviews: Climate Change*, 4(December), 575–601. doi:10.1002/wcc.250
- Pohl, M. M. (2002). Bringing down our dams: Trends in American dam removal rationales. *Journal of the American Water Resources Association*, 38(6), 1511–1519. doi:10.1111/j.1752-1688.2002.tb04361.x
- Poma, A., & Gravante, T. (2015). Analyzing Resistance from below: A Proposal of Analysis Based on Three Struggles against Dams in Spain and Mexico. *Capitalism Nature Socialism*, 26(February), 59–76. doi:10.1080/10455752.2014.995688
- Powell, K. (2010). Making Sense of Place: Mapping as a Multisensory Research Method. *Qualitative Inquiry*, 16(7), 539–555. doi:10.1177/1077800410372600
- PowerShift Atlantic. (2013). Overview: How the PowerShift Atlantic solution works. Retrieved from http://www.powershiftatlantic.com/how_it_works.html
- Propst, D. B., Mcdonough, M. H., Vogt, C. A., & Pynnonen, D. M. (2008). Roving Focus Groups : Collecting Perceptual Landscape Data in Situ. *International Journal of Qualitative Methods*, 7(3), 1–14.
- Proshansky, H. M., Fabian, A. K., & Kaminoff, R. (1983). Place-identity: Physical world socialization of the self. *Journal of Environmental Psychology*, 3(1), 57–83. doi:10.1016/S0272-4944(83)80021-8
- Prowse, T. D., Wrona, F. J., & Power, G. (2013, August 8). Threats to Water Availability in Canada - Dams, Reservoirs and Flow Regulation. Retrieved April 9, 2015, from <https://www.ec.gc.ca/inre-nwri/default.asp?lang=En&n=0CD66675-1&offset=7&toc=show>

- Ramo, D. E., Hall, S. M., & Prochaska, J. J. (2010). Reaching young adult smokers through the Internet: Comparison of three recruitment mechanisms. *Nicotine and Tobacco Research*, 12(7), 768–775. doi:10.1093/ntr/ntq086
- REN21. (2014). *Renewables 2014 Global Status Report*. Paris, France.
- River Alliance of Wisconsin, & Trout Unlimited. (2000). *Dam Removal: A Citizen's Guide to Restoring Rivers*. Madison, Wisconsin.
- Rose, G. (2014). On the relation between “visual research methods” and contemporary visual culture. *The Sociological Review*, 62(1), 24–46. doi:10.1111/1467-954X.12109
- Ryan, M. M., & Ogilvie, M. (2001). Examining the effects of environmental interchangeability with overseas students: a cross cultural comparison. *Asia Pacific Journal of Marketing and Logistics*, 13(3), 63–74. doi:10.1108/13555850110764838
- Rygg, B. J. (2012). Wind power-An assault on local landscapes or an opportunity for modernization? *Energy Policy*, 48, 167–175. doi:10.1016/j.enpol.2012.05.004
- Samuelson, W., & Zeckhauser, R. (1988). Status quo bias in decision-making. *Journal of Risk and Uncertainty*, 1(7-59), 7–59.
- Sandelowski, M. (2001). Focus on research methods real qualitative researchers do not count: The use of numbers in qualitative research. *Research in Nursing and Health*, 24(3), 230–240. doi:10.1002/nur.1025
- Sarakinos, H., & Johnson, S. E. (2003). Social Perspectives on Dam Removal. In W. L. Graf (Ed.), *Dam Removal Research: Status and Prospects* (pp. 40–54). Washington DC: The Heinz Center.
- Scannell, L., & Gifford, R. (2014a). Comparing the Theories of Interpersonal and Place Attachment. In L. C. Manzo & P. Devine-Wright (Eds.), *Place Attachment: Advances in theory, methods, and application* (pp. 23–36). New York, New York: Routledge.
- Scannell, L., & Gifford, R. (2014b). Interpersonal and Place Attachment. In L. C. Manzo & P. Devine-Wright (Eds.), *Place Attachment: Advances in theory, methods, and application* (pp. 23–36). New York, New York: Routledge.
- Seamon, D. (1989). Reconciling Old & New Worlds: The dwelling- journey relationship as portrayed in Vilhelm Moberg's “Emigrant” novels. In D. Seamon & R. Mugerauer (Eds.), *Dwelling, Place & Environment* (pp. 227–245). New York, New York: Columbia University Press Morningside Edition.
- Selman, P. (2010). Learning to Love the Landscapes of Carbon-Neutrality. *Landscape Research*, 35(2), 157–171. doi:10.1080/01426390903560414

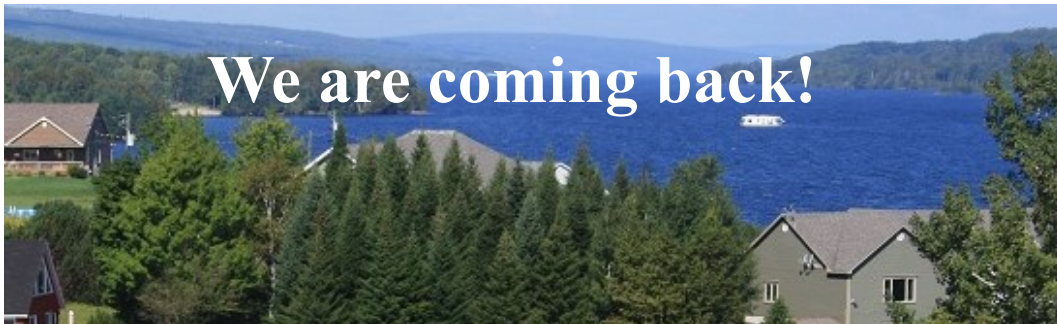
- Shafiee, S., & Topal, E. (2009). When will fossil fuel reserves be diminished? *Energy Policy*, 37(1), 181–189. doi:10.1016/j.enpol.2008.08.016
- Shaker, E., & Doherty-Delorme, D. (Eds.). (2004). *Missing Pieces V: An Alternative Guide to Canadian Post-secondary Education* (5th ed.). Ottawa Ontario: Canadian Centre Policy Alternatives.
- Shaw, C. (2014). Could B.C.'s Site C dam's "clean" fuel dirty energy? Retrieved from <http://www.cbc.ca/news/canada/british-columbia/could-b-c-s-site-c-dam-s-clean-power-actually-fuel-dirty-energy-1.2879785>
- Sherren, K., Fischer, J., & Fazey, I. (2012). Managing the grazing landscape: Insights for agricultural adaptation from a mid-drought photo-elicitation study in the Australian sheep-wheat belt. *Agricultural Systems*, 106(1), 72–83. doi:10.1016/j.agsy.2011.11.001
- Sherren, K., Fischer, J., & Price, R. (2010). Using photography to elicit grazier values and management practices relating to tree survival and recruitment. *Land Use Policy*, 27(4), 1056–1067. doi:10.1016/j.landusepol.2010.02.002
- Si, Z. (1993). *A Theoretical Framework for Social Impact Analysis with Special Reference to Population Relocation at the Macataquac Dam Project of the Saint John River*.
- Sovacool, B. K. (2014). What are we doing here? Analyzing fifteen years of energy scholarship and proposing a social science research agenda. *Energy Research and Social Science*, 1, 1–29. doi:10.1016/j.erss.2014.02.003
- Sovacool, B. K., Ryan, S. E., Stern, P. C., Janda, K., Rochlin, G., Spreng, D., ... Lutzenhiser, L. (2015). Integrating social science in energy research. *Energy Research & Social Science*, 6, 95–99. doi:10.1016/j.erss.2014.12.005
- Spencer, S. (2011). *Visual research methods in the social sciences: Awakening visions* (1st ed.). New York, New York: Routledge.
- Statistics Canada. (2012). *Focus on Geography Series, 2011 Census. Statistics Canada Catalogue no. 98-310-XWE2011004*. Ottawa Ontario. Retrieved from <http://www12.statcan.gc.ca/census-recensement/2011/as-sa/fogs-spg/Facts-pr-eng.cfm?Lang=Eng&GK=PR&GC=13>
- Stedman, R. C. (2002). Toward a Social Psychology of Place: Predicting Behavior from Place-Based Cognitions, Attitude, and Identity. *Environment and Behavior*, 34(5), 561–581. doi:10.1177/0013916502034005001
- Stedman, R. C. (2003). Is It Really Just a Social Construction?: The Contribution of the Physical Environment to Sense of Place. *Society & Natural Resources*, 16(8), 671–685. doi:10.1080/08941920309189

- Stewart, W. P., Liebert, D., & Larkin, K. W. (2004). Community identities as visions for landscape change. *Landscape and Urban Planning*, 69(2-3), 315–334. doi:10.1016/j.landurbplan.2003.07.005
- Stigka, E. K., Paravantis, J. A., & Mihalakakou, G. K. (2014). Social acceptance of renewable energy sources: A review of contingent valuation applications. *Renewable and Sustainable Energy Reviews*, 32, 100–106. doi:10.1016/j.rser.2013.12.026
- Stokols, D., & Shumaker, S. . (1981). People in places: a transactional view of settings. In J. Harvey (Ed.), *Cognition, Social Behaviour, and the Environment*. New Jersey: Erlbaum.
- The Atlantic Salmon Conservation Foundation. (2013). Humphreys Brook Restoration and Stewardship project – dam removal. Retrieved from http://salmonconservation.ca/en/news/humphreys_brook_restoration_and_stewardship_project_dam_removal/
- The Daily Gleaner. (2013). A dam decision. Retrieved from <http://canadianriversinstitute.com/MDnews5.pdf>
- The Town of Nackawic. (2012). About Nackawic. Retrieved March 25, 2015, from http://nackawic.com/about_nackawic.htm
- The World Commission on Dams. (2000). *Dams and Development: A new framework for decision making*.
- Tilt, B., Braun, Y., & He, D. (2009). Social impacts of large dam projects: a comparison of international case studies and implications for best practice. *Journal of Environmental Management*, 90 Suppl 3, S249–57. doi:10.1016/j.jenvman.2008.07.030
- Tonge, J., Moore, S., Ryan, M., & Beckley, L. (2013). Using Photo-Elicitation to Explore Place Attachment in a Remote Setting. *The Electronic Journal of Business Research Methods*, 11(1), 41–50.
- Trancik, J. E. (2014). Back the renewables boom. *Nature*, 507(7492), 4–6. doi:10.1038/507300a
- Tuan, Y.-F. (1974). *Topophilia: A study of Environmental Perceptions, Attitudes, and Values*. Englewood Cliffs, NJ: Prentice Hall.
- Tuan, Y.-F. (1977). *Space and Place: The perspective of experience*. Minneapolis, MN: University of Minnesota Press.
- Turner, C. (2007). *The Geography of Hope: A Tour of the World we Need*. Toronto, ON: Penguin Random House Canada.

- Van der Horst, D. (2007). NIMBY or not? Exploring the relevance of location and the politics of voiced opinions in renewable energy siting controversies. *Energy Policy*, 35, 2705–2714. doi:10.1016/j.enpol.2006.12.012
- Van der Horst, D., & Vermeylen, S. (2012). Ownership Claims, valuation practices and the unpacking of energy-landscape conflicts. *International Review of Sociology*, 22(3), 37–41. doi:10.1080/03906701.2012.730822
- Vorkinn, M., & Riese, H. (2001). Environmental Concern in a Local Context: The Significance of Place Attachment. *Environment and Behavior*, 33(2), 249–263. doi:10.1177/00139160121972972
- Waldo, Å. (2012). Offshore wind power in Sweden-A qualitative analysis of attitudes with particular focus on opponents. *Energy Policy*, 41, 692–702. doi:10.1016/j.enpol.2011.11.033
- Walker, B., Holling, C. S., Carpenter, S. R., & Kinzig, A. P. (2004). Resilience, Adaptability and Transformability in Social – ecological Systems. *Ecology And Society*, 9(2), 5. doi:10.1103/PhysRevLett.95.258101
- Walker, B. J. ., Wiersma, B., & Bailey, E. (2014). Community benefits, framing and the social acceptance of offshore wind farms: An experimental study in England. *Energy Research & Social Science*, 3, 46–54. doi:10.1016/j.erss.2014.07.003
- Walker, B., & Salt, D. (2006). *Resilience Thinking*. Washington DC: Island Press.
- Walker, C., Baxter, J., & Ouellette, D. (2015). Adding insult to injury: The development of psychosocial stress in Ontario wind turbine communities. *Social Science & Medicine*, 133, 358–365. doi:10.1016/j.socscimed.2014.07.067
- Warren, C. R. (2014). Scales of Disconnection: Mismatches shaping the geographies of emerging energy landscapes. *Moravian Geographical Reports*, 22(2), 7–14. doi:10.2478/mgr-2014-0007
- Warren, C. R., Lumsden, C., O’Dowd, S., & Birnie, R. V. (2005). “Green On Green”: Public perceptions of wind power in Scotland and Ireland. *Journal of Environmental Planning and Management*, 48(6), 853–875. doi:10.1080/09640560500294376
- Warren, C. R., & McFadyen, M. (2010). Does community ownership affect public attitudes to wind energy? A case study from south-west Scotland. *Land Use Policy*, 27(2), 204–213. doi:10.1016/j.landusepol.2008.12.010
- West Coast Environmental Law. (2014). Not In Your Breadbasket. Retrieved from <http://wcel.org/resources/environmental-law-alert/not-your-breadbasket-0>

- West, J., Bailey, I., & Winter, M. (2010). Renewable energy policy and public perceptions of renewable energy: A cultural theory approach. *Energy Policy*, *38*(10), 5739–5748. doi:10.1016/j.enpol.2010.05.024
- Willbond, S. (2012). *Migration: Interprovincial, 2011/2012*. Retrieved from <http://www.statcan.gc.ca/pub/91-209-x/2014001/article/14012-eng.htm>
- Wilson, G. A. (2012). *Community resilience and environmental transitions*. New York, New York: Routledge.
- Witze, A. (2015). Let the river run: Removing two dams from the Elwha is a can't-miss restoration experiment. *Science News*, *187*(1), 22–26.
- Wolsink, M. (1994). Entanglement of Interests and Motives: Assumptions behind the NIMBY-theory on Facility Siting. *Urban Studies*, *31*(6), 851–866. doi:10.1080/00420989420080711
- Wolsink, M. (2000). Wind power and the NIMBY-myth: institutional capacity and the limited significance of public support. *Renewable Energy*, *21*, 49–64. Retrieved from <http://www.sciencedirect.com/science/article/pii/S0960148199001305>
- Wolsink, M. (2007). Wind power implementation: The nature of public attitudes: Equity and fairness instead of “backyard motives.” *Renewable and Sustainable Energy Reviews*, *11*, 1188–1207. doi:10.1016/j.rser.2005.10.005
- Wolsink, M. (2012). The research agenda on social acceptance of distributed generation in smart grids: Renewable as common pool resources. *Renewable and Sustainable Energy Reviews*, *16*(1), 822–835. doi:10.1016/j.rser.2011.09.006
- Wüstenhagen, R., Wolsink, M., & Bürer, M. J. (2007). Social acceptance of renewable energy innovation: An introduction to the concept. *Energy Policy*, *35*, 2683–2691. doi:10.1016/j.enpol.2006.12.001
- Wylie, J. (2011). Landscape. In J. . Agnew & D. . Livingstone (Eds.), *Handbook of Geographical Knowledge* (pp. 300–315). London: Sage Publications Ltd.
- Wyrick, J. R., Rischman, B. a, Burke, C. a, McGee, C., & Williams, C. (2009). Using hydraulic modeling to address social impacts of small dam removals in southern New Jersey. *Journal of Environmental Management*, *90 Suppl 3*, S270–8. doi:10.1016/j.jenvman.2008.07.027
- Zarfl, C., Lumsdon, A. E., & Tockner, K. (2015). A global boom in hydropower dam construction, 161–170. doi:10.1007/s00027-014-0377-0

APPENDIX A RECRUITMENT FLYER

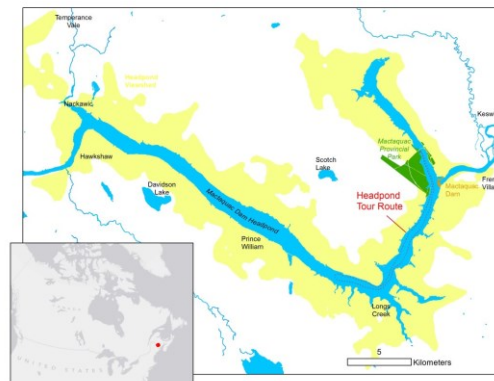


Have your say about the Mactaquac headpond

We are returning to the area, after last year's houseboat tours, to undertake individual interviews on land with people connected to the Mactaquac area (yellow area on the map).

We need you if:

- > You were a local landholder or business owner when the headpond was flooded
- > You were a child when the headpond was flooded
- > You grew up near the headpond
- > You moved to the area more recently as an adult



What & when

Share your thoughts and memories about the landscape, in a one-hour individual interview in a place convenient to you, at a time convenient to you, this summer.

Why

This independent research will convey a local perspective to decision-makers at NB Power and the provincial government



Take part

- > Contact Kristina Keilty with questions or to sign up: machheadpond@gmail.com
- > More info at tinyurl.com/machheadpond



APPENDIX B TELEPHONE SCRIPT

Hello, my name is Kristina Keilty and I am a graduate student at Dalhousie University. I am conducting a study to understand people's experiences of the Mactaquac Dam headpond area and I am interested in having you participate in my study. I am looking to speak with individuals from the local communities who live nearby or on the headpond. I am contacting you because I understand you have lived in the Mactaquac area. I am very interested in hearing what you have to say. There is no preparation or specific knowledge that you must have to be part of the study. Your commitment to this project would be a one on one interview for an hour and a half.

The interview will be set up in a mutually agreed upon location that is readily accessible to you. You are welcome to bring photographs of the area if you feel that will help you express yourself in the interview, but this is not a requirement. We will also talk about the future of the area, especially the dam. Everything that we discuss will be kept confidential. If you are interested in participating I have four screening questions I would like to ask before we continue. (This is where I went through Appendix B, if telephoning and they agreed to participate)

I will be telephoning you soon to try to schedule an interview at a time convenient for you. If you have any questions or will be interested in participating, but will be difficult to reach by phone, please call us at [902-483-3442](tel:902-483-3442). If we are not available please leave us a message. Or if you prefer please contact us through e-mail at machheadpond@gmail.com. If you prefer, you can also reach my supervisor, Dr. Kate Sherren, at kate.sherren@dal.ca.

Thank you very much for your time.

APPENDIX C SCREENING QUESTIONS

Upon making contact with the PI, interested parties were told briefly about the study and what their involvement would entail (if the screening questions were a part of the original telephone call the section below was not used).

(“Thank you for your interest in the study. I am Kristina Keilty, a graduate student at Dalhousie University and I will be leading the research study. The study is interested in understanding how current and past residents of the Mactaquac area value the headpond and the surrounding landscape. This area has been chosen because it is a landscape that has changed significantly within the last 50 years, and may yet change again. If you participate you will be asked to complete a one on one interview that will take approximately 90 minutes. I will be organizing interviews in a mutually agreed upon location, easily accessible to you. If you are interested, I’ll ask you a few more questions to see if you meet the criteria for the study. Are you interested?”)

Those parties still interested were asked a set of four screening questions so that the most appropriate mix of individuals could be chosen in each category. Diversity is desirable in gender, age and geography (which part of the headpond they live(d) near), as well as membership in existing interest groups (question 3). I am looking for people who have or had a minimum residency in the area of 5 years.

1. What is your connection with the Mactaquac headpond?
 - a. Where did you live?
 - b. When did you live there?
 - c. How long did you live there?
 - c. How old were you at that time?
 - d. Do you live nearby now?
2. Are you associated with any formal groups or companies with interests on the headpond (this is okay, but want a distribution)?
 - a. WWF?
 - b. Friends of Mactaquac Lake?
 - c. NB Power?
 - d. TransCanada pipeline?
 - e. Local politics? E.g. LSDs, municipalities, etc.
3. Are you willing to be audio recorded? Throughout the interview I will be using a recorded to capture the thoughts and stories you share. Are you comfortable with this? Your audio recording will never be made public.
4. How can I contact you? (by phone, email or postal mail)

APPENDIX D INFORMATION LETTER



Project Title: Changing Landscape Values: Understanding Baselines of Acceptability on the Mactaquac Dam Headpond

Lead Researcher: Kristina Keilty, MES Candidate 2015,

School for Resource and Environmental Studies, kkeilty@dal.ca

Other Researcher: Dr. Kate Sherren, Assistant Professor

School for Resource and Environmental Studies, kate.sherren@dal.ca

Funding Provided: SSHRC

Dear Participant,

We invite you to take part in a research study being conducted by Kristina Keilty who is a graduate student at Dalhousie University, as part of her Masters of Environmental Studies thesis project. Your participation in the study is voluntary and you may withdraw from the study at any time. The study is described below. This description tells you about the risks, inconvenience, or discomfort which you might experience. Participating in the study might not benefit you, but we might learn things that will benefit others. You should discuss any questions you have about the study with Kristina Keilty.

Purpose of the Study

The goal of the study is to understand resident experiences of the Mactaquac area, before and after the flooding of the headpond. The landscape has undergone a great change through its history and faces a potential change again in the coming years. This research hopes to understand how one's experience with the landscape shapes their personal feelings about it over time, and how that influences their preferences for its future. The overall goal of the study is to understand how to promote a renewable energy future, while maintaining an acceptable landscape in our cherished places.

Study Design

The study will consist of individual interviews between the participant and the researcher. Participants are welcome to bring photographs of the area if you feel that will help you express yourself in the interview, The interview will begin with a discussion of how the individual experienced the Mactaquac area's present and past landscapes. The next sections will be focused

on how the individual thinks other people feel about the dam. The interview will conclude with a discussion about the Mactaquac Dam landscape and the future. The researcher will provide a map of the area showing the inundated area to help the individual explain their stories if they like. Interviews will take place in an easily accessible location for the participant within the Mactaquac area. Locations may include a participant's home, local community centre or senior's home. Completing the interview will require approximately an hour and a half (90 minutes).

Who can take part in the research study?

We are interested in talking to people who were or are currently resident in the Mactaquac headpond area. We are looking for four specific cohorts of people:

1. Those who were residents and landowners in the Mactaquac area prior to the dam being built (1967). This group will consist of older adults aged 65 and over.
2. Those who were children (<15) when the dam was being built. This group will be aged between 50 and 60.
3. Those who have grown up in the Mactaquac area having never seen the landscape prior to construction. This group will be between 18-47
4. Those who have moved into the area more recently (<10 years) as adult amenity migrants, to live in the area or on the Mactaquac headpond. This group will be any age above >30

We are interested in people who lived in the area for a minimum of 5 years. You must be willing to have your interview recorded for data analysis purposes.

How many people are taking part in the study?

We are interested in talking to 5-7 people from each of these four groups. The total number of interviewees will be 20-28.

Who will be conducting the research?

The lead researcher will be Kristina Keilty, a graduate student from the School for Resource and Environmental studies at Dalhousie University. Her supervisor, Dr. Kate Sherren, was a resident of Nackawic from 1977-1991, and her family maintains a cottage at Davidson Lake, but she will not be involved in data collection.

Possible risks and discomforts

The study aims to have minimal risks and discomforts for the participants. The interview locations will be chosen by the participant to allow the space to be easily accessible and comfortable. We understand there may be bad memories arise from reviewing historical pictures but participants are only asked to share what they are comfortable with. We do not want to revisit memories that cause undue distress.

Possible benefits

There are no direct benefits to those participating in the study. However, the conclusions drawn from this research could indirectly benefit the larger community in New Brunswick by informing government, industry and NGO decision-making about the local landscape and energy system about local opinions.

If you decide to stop participating

You are free to leave the study at any time. If you decide to stop participating at any point during the study, you can also decide whether you want any of the information that you have contributed to that point to be removed or if it can be used.

Confidentiality and Anonymity

The participants of the study will remain anonymous in all written reports or publications released and will be referred to only by a numerical code assigned by the research team. All your identifying information will be kept in a separate file, in a secure place. All electronic records will be kept secure in a password-protected, encrypted file on the researcher's personal computer. Your name and personal information will not be released. This means that **you will not be identified in any way** in our publications.

Data will be retained under lock and key and/or password protected until the completion of the larger project that is supported by a SSHRC grant set to be completed by September 2016. At the time of study completion hard copy documents will be shredded and digital copies will be securely deleted from all computer hard drives and external hard drives.

Questions

If you have any questions concerning the study please contact the lead researcher Kristina Keilty by phone at [902-483-3442](tel:902-483-3442) or by email at macheadpond@gmail.com. If you prefer, you can also reach my supervisor, Dr. Kate Sherren, at kate.sherren@dal.ca.

Problems and Concerns

If you have any ethical concerns about your participation in the study, you may contact Catherine Connors, Director, Research Ethics, Dalhousie University at (902) 494-1462, ethics@dal.ca

Lead Researcher

Kristina Keilty

Masters of Environmental Studies Candidate

School for Resource and Environmental Studies,
Dalhousie University

kkeilty@dal.ca

902 483 3442

Graduate Supervisor

Dr. Kate Sherren

Assistant Professor

School for Resource and Environmental Studies,
Dalhousie University

kate.sherren@dal.ca

902-494-1359

APPENDIX E INFORMED CONSENT



Project Title: Changing Landscape Values: Understanding Baselines of Acceptability on the Mactaquac Dam Headpond

I have read the explanation about the study. I have been given the opportunity to discuss it and my questions have been answered to my satisfaction. I hereby consent to take part in the study. However I realize that my participation is voluntary and that I am free to withdraw from the study at any time. I consent to participate the interview process under the conditions stated above, with the specific permissions indicated below.

I consent to the interviewer using an audio recorder to capture my thoughts and stories on the Mactaquac area landscape during the interview.	YES	NO
I consent for direct quotes from the interview to be used anonymously in project reports and publications.	YES	NO
Please put me on your mailing list for research findings and invitations from the study. My permission will be sought before my contact details are used for any other purpose.	YES	NO
I would like to receive a copy of the transcript produced from interview for approval, and will provide any changes within two weeks of receiving it.	YES	NO

Participant:

Signed:

Date:

Researcher:

Signed:

Date:

APPENDIX F INTERVIEW GUIDE

The interview process is much faster and efficient if I tape record the interview, because I don't have to write everything down. Do you mind if I record the interview?

First, do you have any questions for me before we start?

Section 1: ~30 minutes

What has it been like living here?

- What changes have you noticed? (*Prompt with: loss of farms, new highway, suburbanization if not mentioned*)
- What do you think it was like before? What are you basing your opinion on?
- Do you have a particular attachment to any special part of this landscape?

If yes, prompt with the following if they do not describe the place on their own:

- *Why?*
- *Where is it?*
- *How did you form this attachment?*
- *Did something special or important happen there?*

Section 2: ~10 Minutes

- Does it seem normal to you, the way it looks now? Why or why not?
- Do you like the way it looks now? Why or why not?

Section 3: ~10 minutes (*used as a control question to understand what other landscapes they may be basing their opinions on*)

- Have you lived elsewhere? (*If **no** skip next two questions, if yes continue with next two questions*)
 - How old were you?
 - How does that influence how you see this landscape?
- Have you been to other dams and headponds like this?

Section 4: ~10 minutes

- How do you think [*insert one of the other 3 cohorts*] feel about this area? Why do you feel this way? What are you basing your opinion on?
- How do you think [*insert one of the other 3 cohorts*] feel about this area? Why do you feel this way? What are you basing your opinion on?
- How do you think [*insert one of the other 3 cohorts*] feel about this area? Why do you feel this way? What are you basing your opinion on?

(The follow bullets outline the 4 cohorts, ask about the 3 that the interviewee is NOT from)

- Those who were landowners when the dam came in
- Those who were children when the dam was built
- Those who grew up with the dam and headpond in place
- Those who moved into the area more recently, as adults to live on the headpond

Section 5: ~10 minutes

- What should be done with the dam and why? (*Prompt with the 3 options, remove, rebuild, or remain in place without removing power, if they do not already know them*)
- What do you think [*insert one of the other 3 cohorts*] would like to see happen with the dam? Why do you feel this way? What are you basing your opinion on?
- What do you think [*insert one of the other 3 cohorts*] would like to see happen with the dam? Why do you feel this way? What are you basing your opinion on?
- What do you think [*insert one of the other 3 cohorts*] would like to see happen with the dam? Why do you feel this way? What are you basing your opinion on?

(The follow bullets outline the 4 cohorts, ask about the 3 that the interviewee is NOT from)

- Those who were landowners when the dam came in
- Those who were children when the dam was built
- Those who grew up with the dam and headpond in place
- Those who moved into the area more recently, as adults to live on the headpond

Section 6: ~10 minutes

- What other energy options are appropriate here? (*Prompt with: What energy options do you think could be socially acceptable here? What energy options do you think would be technically possible here? Renewable energy options or non-renewable traditional energy options?*)
- Why do you feel those energy options would be best?
- What other kinds of development are appropriate here? (*Prompt with: tourism, manufacturing, big industry*)

Section 7: ~10 minutes

- How important do you think the local perspective is in making decisions about this area? (*Prompt with: the future of the dam, energy more generally, other development*)
- Anything else you want me to know or is there anything else that you want to share with me to finish up?

APPENDIX G SCATTERPLOT DIAGRAM

