Uniting Democracy and Science: A Comparison of Public Participation Models in Natural Resource Management

Chloe Begg
Uniting Democracy and Science: A Comparison of Public Participation Models in Natural Resource Management

Chloe Begg

Supervisor: Hans Peter Hansen
Evaluator: Nadarajah Sriskandarajah
# Contents

1. **Introduction** ................................................................. 1

2. **Methodology** ................................................................. 4
   2.1 Research Design .......................................................... 4
   2.2 The Role of Theory ...................................................... 5
   2.3 Critical Theory and Interdisciplinarity ................................ 5
   2.4 Case Studies ............................................................... 6
      2.4.1 Strengths and Weaknesses ...................................... 7
      2.4.2 Multiple Case Studies ........................................... 7
      2.4.3 The Comparative Approach .................................. 7
   2.5 Interviews ................................................................. 8
      2.5.1 Interview Techniques ........................................... 8
   2.6 Approach to Results and Analysis .................................. 10
   2.7 Limitations ............................................................... 11

3. **Democratic Theory** ...................................................... 11
   3.1 An Introduction to Democratic Theory .............................. 12
      3.1.1 A Brief Contextualization of Democracy .................... 12
      3.1.2 Discourses of Citizen Involvement ............................ 13
      3.1.3 Stakeholder Involvement ...................................... 15
      3.1.4 Earth Democracy and the Commons .......................... 17
   3.2 Knowledge Production ................................................ 18
      3.2.1 Types of Knowledge ............................................ 18
      3.2.2 Knowledge Systems in Natural Resource Management ...... 19
      3.2.3 Citizen Science .................................................. 20
   3.3 Democratic Natural Resource Management .......................... 21
      3.3.1 Systems and Natural Resource Management .................. 21
      3.3.2 Resilience ........................................................ 21
      3.3.3 Social-Ecological Interaction in Natural Resource Management .................. 22
      3.3.4 Managing the Commons ....................................... 23

4. **Public Participation In Natural Resource Management Projects** 24
   4.1 Public Participation Defined ........................................ 25
   4.2 Benefits and Challenges of Public Participation in the Environmental Context .... 26
      4.2.1 Benefits .......................................................... 26
      4.2.2 Challenges ....................................................... 27
   4.3 Models of Public Participation ...................................... 28
      4.3.1 Arnstein’s Ladder of Participation ............................ 29
      4.3.2 CAISE Model ..................................................... 29
      4.3.3 Consultative, Functional, Collaborative, and Transformational .... 29
      4.3.4 Consultation, Functional Participation, Interactive Participation, Self-Mobilization and Connectedness .................. 30
   4.4 Citizen Science ......................................................... 30
      4.4.1 Benefits and Challenges of Citizen Science ................. 31
   4.5 Freshwater Management ............................................... 32

5. **Natural Resource Management Projects In Canada And Sweden** 33
   5.1 Canada ................................................................. 33
Uniting Democracy and Science: A Comparison of Public Participation Models in Natural Resource Management

CHLOE BEGG


Abstract: Given current environmental crises, many citizens have taken personal concern towards the issues and seek to become involved in the solutions. The integration of democracy and knowledge production plays an important role in this situation, in order to include the values and interests of citizens in the traditionally scientifically driven world of natural resource management. Public participation in natural resource management has manifested in a variety of ways given societal and environmental circumstances, as well as political legislation of nations. Emergent models bear many similarities and difference, which creates the opportunity to understand how models can learn from one another. This research studies two cases of public participation in natural resource management, with two different models of participation: Ontario, Canada with a primarily top-down participation model, and the communities around Lake Tämnaren, Sweden, with their bottom-up model. This research seeks to understand if the models of participation affect the outcomes of the projects and how democracy plays a role in the different models. To compare these two cases, interviews were conducted (12 participants in Canada and 6 participants in Sweden), along with field observations and document analysis. Results of the research indicate the models of participation have different challenges and advantages to one another, but the main obstacle in both scenarios relates to the support in terms of finances and resources available to the projects. The research concludes there is a need for bottom-up approaches to public participation in order to sustain deliberative democracy in the projects, but with top-down support there is much more immediate action taken towards solving issues at hand.

Keywords: Sustainable Development, Natural Resource Management, Public Participation, Democracy, Knowledge Production

Chloe Begg, Department of Earth Sciences, Uppsala University, Villavägen 16, SE- 752 36 Uppsala, Sweden
Uniting Democracy and Science: A Comparison of Public Participation Models in Natural Resource Management

CHLOE BEGG


Summary:
Examples of environmental crises are not hard to find. All over the globe, people and the environment are suffering due to our own actions. However, great attempts to mitigate or change negative environmental effects are underway; this research finds some of these attempts in the field of natural resource management. The four pillars of this research are: water, democracy, knowledge, and citizens. Water, a basic necessity of life; democracy, the stage of many modern societies; knowledge, the power of understanding; and citizens, the people we are. Complex interactions of these elements can be explored from many different perspectives, but this research focuses on interactions on the community level and works to understand how local people are involved with the management of water resources in their close proximity.

Water is generally considered a public good, a resource to be shared among all people, and therefore arguably must be cared for by all people. While the privatization of common resources has been debated in the past, research indicates that where citizens and communities care for their own resources, they are able to exercise their democratic rights and create a future for the collective. Democracy and the production of knowledge also play strong roles in the case of public participation in natural resource management, where the humanistic side of science is a more central component and creates the possibility for more positive and sustainable outcomes.

The research turns to two different cases to study these themes, both with different models of public participation in water based natural resource management projects. The cases take place in: Ontario, Canada where a top-down approach to management is studied, and the other at Lake Tämnaren, Sweden where a bottom-up approach is studied. By using these two cases, the described themes are investigated and understood in new ways. Interviews are utilized in order to better understand the two cases, and the results indicate many similarities and differences between the two scenarios. In conclusion, this research finds that natural resources management projects regardless of the models need more support and funding to move forward, and additionally that the top-down model is able to take action quickly, but the bottom-up model works to serve the interest of all participants of the project. This trade-off between the two models must be balanced in the future to bring democracy and science together.

Keywords: Sustainable Development, Natural Resource Management, Public Participation, Democracy, Knowledge Production

Chloe Begg, Department of Earth Sciences, Uppsala University, Villavägen 16, SE- 752 36 Uppsala, Sweden
1. Introduction
On global and local scales, sustainability crises are increasing. Entire ecosystems, geographic areas, nations, and species are currently under threat, with mounting problems projected for the future. These crises do not have a single cause and effect relationship, but rather is it multi-centered with a variety of causal factors (Hansen et al., 2016a). In light of these effects, humans and society have produced solutions to mitigate causal effects and manage with more care for the future. One of these solutions birthed the field of natural resource management (NRM). NRM cannot be contained to the physical and natural world, as it is deeply connected to social aspects of human interactions (Kofinas, 2009), and therefore should be studied as such. In addition, as these issues are caused primarily by human activity (O’Hare et al., 2005), and also affect the lives of humans globally, they must be dealt with from a political standpoint. In essence, the sustainability crisis is one that deeply affects the environment and our societies, and so we must question how societies will look at and act towards the issues in the future.

When dealing with these crises from a political standpoint, democracy will play a strong role in in shaping our understandings. To deepen our current conceptualization of democracy in the perspective of the present socio-ecological crises, critical theory might function as an inspiration. Critical theory emerged with the so-called Frankfurt School as a school of thoughts trying to understand and identify totalitarian tendencies in modern society. Further, as a theory, it "aims to give us knowledge of society: its structure and its dynamics and its life-world" (Nielsen, 1992, p.264). Critical theory has emancipatory characteristics in the way it is able to imagine something better for humans while seeking new possibilities for liberation (Sumner, 2003), and uses the emancipatory interest in knowledge as its guiding principle (Alvesson and Skölberg, 2000). In addition, the production and use of knowledge in modern society plays and important role in democracy. According to critical theory, without the integration of a humanitarian approach and the involvement of citizens themselves, a modernized society spearheaded by science and technology alone may have devastating and de-humanizing results (Habermas, 1962).

Today, Western democratic models tend to rely heavily on representative democracy; citizens are often at the mercy of politicians to care for their interests. For natural resource management and environmental science, this can pose issues where politicians are elected based on their self-serving interests (Crick, 2002), and lack the foresight of long-term environmental planning in the interest of the environment and society as a whole. Thus, the recent renunciation from politicians concerning environmental policy creation and implementation questions whether politicians and financial institutions have the ability to propose and complete long-term environmental strategies (Polk & Knutsson, 2008).

Given the deeply worrying issues concerning the environment and lack of effective political action, recent historical events indicate a certain level of dissatisfaction from citizens. From this frustration numerous movements arose such as: People’s Climate March, Plane Stupid, Camp for Climate Action, Hands Off Our Forests (among many
others), indicating the concern citizens are feeling towards the failures of their leaders. Large-scale movements and public acts of protest generally gain media attention and reach wide audiences with their message, but small community based projects are also taking action, and arguably doing so in a more collaborative and action-oriented way. Citizens in communities around the world are acting in attempt to create the type of world and society they seek for the future. This type of action brings to light the idea that citizens need not pin their interests solely on their representative politicians, but can share in the responsibility given their interests and needs. Hansen et al. (2016a) note this is this shared responsibility should be woven into the political culture of nations, therefore citizens must strive to actively aid in common affairs, while supported by politicians and society.

In NRM, these citizen acts manifest in many different ways, but public participation in NRM is becoming common in political legislation and framework directives in developed democratic states. From the statements in these political directives, the implementation to involve citizens may also take on various models. The way in which public participation is implemented in NRM is important to explore considering its momentous link between the political or elite sphere of representative leadership and everyday citizens with interests and concerns.

Two main emergent models of public participation in NRM are the focus of this research: top-down and bottom-up. While the models have many differences and similarities, this research examines how citizens are participating in natural resource management projects, and the challenges that these projects face in society today. This categorization of models is not to say that citizen participation in NRM projects must be fit into only one of these models and not bear characteristics of the other. Further to this, the research aims to go beyond this dichotomy and understand how knowledge is produced in different projects, and for whom the knowledge is serving. I focus in on two cases: public participation in NRM in Canada and Sweden, to investigate the different implementation strategies of the two nations including their emergent models of participation, and to understand the success and challenges of individual projects.

In Canada, public participation in relation to NRM is examined in the Province of Ontario, a province of abundant lakes and humans. Many of the people are concentrated in cities, while a much smaller portion of the population lives in more rural communities and in many cases in closer proximity to a shared water resource. Ontario hosts a great number of projects that involve interested citizens in the management of water resources. Formal projects in the province generally occur where organizations or governmental organizations collaborate with interested citizens to better understand and create change in their local water resources. The projects have the tendency to use upper management to create and guide the outcomes, in contrast to the model studied in Sweden. In Sweden, the surrounding communities of Lake Tämnaren, located in central Sweden, is studied for their somewhat opposite approach. The people living or owning properties in this area have organized themselves to gain community support for the idea of restoring their lake to prior, more desirable, conditions. By the citizens’ initiative to make changes and take
control of the project, the overall model is different from that in Ontario, gaining a more bottom-up perspective on the involvement of citizens in NRM.

The management of shared common water resources in both these cases is no easy task. From the natural science perspective, the all the lakes involved in the projects studied have fairly similar issues. In Ontario, phosphorus levels are often a concern given that elevated levels result in algal blooms and excessive plant growth that create adverse lake conditions. For this and other unwanted compounds often found in the lakes, monitoring programs in Ontario are the main NRM projects found, along with many other projects aimed at educating and reaching out to local citizens. For Lake Tämnaren, there are also issues relating the level of phosphorous in the water, and excessive plant growth is also present due to this and since the lake is very shallow, which allows sunlight to reach the bottom of the lake in increase growth. The level of the lake must be raised in order to alleviate many of the issues, which is the primary concern of then citizens involved in the project occurring in this area. In both Sweden and Canada, public institutions or legislative frameworks are involved in the implementation and follow-through of the NRM projects. The stakeholder and governmental role in the participation of the public in NRM projects concerning common resources is of great interest since they tend to hold the decision-making power and influence over outcomes.

The problem highlighted by this research is summarized as a concern for effective democratic citizen participation in NRM projects. The described top-down and bottom-up models present the opportunity to understand structural arrangements of democracy within different projects. The production of knowledge in both these models may also vary, which allows the research to explore the intersection of knowledge and democracy from a critical viewpoint and explore the risks stemming from societies governed by experts and technical knowledge alone. By looking into how we can include the values and interests of citizens without discontinuing active knowledge production, this research has the ability to understand the important links between knowledge and democracy while discovering the different ways in which public participation is implement in two different nations.

To operationalize this problem, I use the following research questions:

1. How do democratic structures change with differing models of public participation in citizen science projects in NRM?
2. Can the model of public participation influence the outcomes of a natural resource management project?

The first question uses the basis of two models, top-down and bottom-up projects, which are analyzed for their uses of democracy and the role that citizens play in the projects. The second question guides the investigation of the two models presented to understand how projects are carried out over time, and if the models present different benefits and challenges to the outcomes.

Following these research questions, ideas concerning the way in which public institutions and improved legislation can support democratic processes in NRM projects are also
explored. Here the intention is to provide a reflection on the challenges faced by the projects studied, and how the broader context of society and politics can facilitate more progress in this field. By doing so, I will explore how values of citizens and the production of knowledge is integrated in projects, and how this can be furthered in a democratic format. The ideas presented with regards to this topic are quite circumstantial, and do not offer one best practice, but simply complement the processes already in action to bring forward more holistic projects in the future.

Given the issues and questions presented, this research aims to offer new ideas concerning the operation of citizen science projects, and influence public thinking towards managing common resources in the future. This research also aims to provide insights into how governments should embrace citizen action in NRM, not only out of necessity to help with future problems, but out of the democratic rights of the citizens.

To begin, the methodology chapter outlines the conceptualization of the research by outlining the use of theory as well as an in depth description of the methods used. The following two chapters present the main theoretical underpinnings. The first of these chapters present democratic theory, including subtopics such as stakeholder involvement, knowledge production, and democratic NRM. The second of the two chapters delves more into the details public participation in NRM based on current literature. Chapter 5 continues from here to present the background of the cases studied, with the results then presented in Chapter 6. The next chapter provides a breakdown of the results and examines the research in terms of the theory presented for an overall discussion of the findings. Finally, conclusions to the researched questions are drawn in Chapter 8.

2. Methodology
This chapter presents methodological considerations of this research, as well as an in depth description of the methods chosen. The selection of theoretical design and the rationale for multiple case studies is first presented, which aims to explain the choices and thought behind the design of the research. Following this, the methods are explained in more details, including the intention of the interviews and the collection of documents to research the cases discussed in this research.

2.1 Research Design
This research is inherently qualitative since it leans heavily on human interactions and their settings, therefore touching on many factors that cannot be capture in a quantitative format (Berg, 2009). True to this form, the research primarily surrounds how humans are arranging themselves within their societal context, given their different cultures, social norms, and rituals (Berg, 2009), and seeks to better understand the everyday life of citizens (Lincoln & Gubba, 1994). Additionally this research is both analytic and descriptive in nature, since it aims to both determine how public participation in NRM is implemented in both countries, but also explore the wider context of the effect of the projects studied.
2.2 The Role of Theory

Berg (2009) defines theory as “a general and more or less comprehensive set or statements or propositions that describe different aspects of some phenomenon” (p.21). Differences in the use of theory can be categorized by theory before research and research before theory models. The theory before research model begins with an idea, and then advances to disprove or refute them based on the theory of the subject (Popper, 1968). The research before theory approach takes an opposite approach where “research plays an active role: it performs at least four major function which help shape the development of theory. It initiates, it reformulates, it deflects, and it clarifies theory” (Merton, 1968, p. 103).

Berg (2009) argues for a different use of theory, one that integrates both the theory before research and research before theory models. This alternative method is called the spiraling research approach, which uses an active and changing progression of research rather than a linear progression described in the other two methods (Figure 1). Berg (2009) illustrates the use of this method through this statement:

“In the proposed approach, you begin with an idea, gather theoretical information, reconsider and refined your idea, begin to examine possible designs, reexamine theoretical assumptions, and refine these theoretical assumptions and perhaps even your original or refined idea. Thus, with every two steps forward, you take one or two steps backward before proceeding any further.” (p.26)

Fig. 1. The spiraling research approach (Model after Berg, 2009, p.26)

This research utilizes the spiraling method described by Berg (2009). In this sense, the idea for this research was formulated and theory was consulted prior to the research, however the idea was continuously re-formulated and the theory was also re-examined throughout the research process in order to refine the assumptions and research.

2.3 Critical Theory and Interdisciplinarity

By using the foundations and influence of critical theory, this research gains a better understanding of societal and environmental interactions, and question the norms of the realms in which the cases studied reside. The research therefore not only is able to take a step back and critically examine the challenges of the given cases, but it is also able to narrow in and dissect the nuances of the cases and the research itself. By doing so, the
outcomes of the research will allow us to open up to the possibilities of changing relationships, and changing the societal standards expressed today.

In research, foundations of critical theory spur a methodology that advances with an air of suspicion in order to scrutinize the data, research design, researcher, and interpretation of the findings alike (Sumner, 2003). Therefore it aims to increase awareness of political and social phenomena, while allowing the researcher to reflect upon status quo realities (Alvesson & Sköldberg, 2000). Critical theory methodologies also note that "societal conditions are historically created and heavily influenced by the asymmetries of power and special interests, and they can be made the subject of radical change" (Alvesson & Sköldberg, 2000, p. 110). Therefore overall, critical theory research overall aims intensify awareness surrounding the political nature of social phenomena, and allows for reflection on the part of the researcher where realities that are taken for granted are concerned.

Additionally this research takes on an interdisciplinary approach, therefore gaining the ability to investigate new hybrid spaces where contemporary and complex issues can be examined (Sumner, 2003). Critical theory is inherently interdisciplinary in the sense that it approaches social theory in a manner that combines political economy, sociology, cultural theory, philosophy, anthropology, and history. In the same sense, interdisciplinarity can be perceived as critical since it looks beyond the traditional boundaries of disciplinary practices in order to understand phenomena in new ways (Sumner, 2003).

This research deals broadly with issues relating to the environment and sustainability. Those researching sustainability are often crossing borders of disciplines, which allows interdisciplinarity to become a good candidate for sustainability research given the complexities of these issues (Sumner, 2003). Critical reflections on environmental issues are equality important. As Shiva (2005) notes, mainstream definitions of sustainability and sustainable development such as that central to the Brudtland report often align themselves with ideas of neo-liberal globalization and promotes neo-liberal economics by focusing on developing instead of nature itself. Critical theory therefore is able to bring these kinds of established ideas under scrutiny, which challenges our relationships with many of the conventions of contemporary society.

2.4 Case Studies
A case study is a “method involving systematically gathering enough information about a particular person, social setting, event, or group to permit the researcher to effectively understand how the subject operates or functions” (Berg, 2009, p. 317). Data may be collected for case studies from a variety of sources including: interviews, personal observations, artefacts, and internal or external documents in order to better understand the phenomena at hand and increase the validity of the research (Yin, 2003). The case study approach is recommended as a method where research looks to answer “how” and “why” questions, the behaviour of the subjects of research cannot be manipulated to answer the research questions, the researchers seeks to understand contextual conditions of a topic at hand, or boundaries are undefined for the researched subject area (Yin, 2003).
2.4.1 Strengths and Weaknesses
Bhattacherjee (2012) notes that case studies possess unique strengths with their detail oriented methods in comparison to other research techniques. Case studies have the ability to be theory building (interpretive) or can be used for theory testing (positivist). In the theory building case this is an advantage where theoretical constructs may be shaped as the research progresses. Additionally, research questions can be adapted during the progression of the research should the original questions prove to be irrelevant, which is a much more difficult task to undertake in more positivist forms of research. Case study is also able to uncover much more detailed information to create stronger and more in depth research results, and can study a phenomenon at varying levels of analysis (from individual to organization for example) and therefore the researcher is able to analyze data collected on these varying levels.

Bhattacherjee also notes there are some weaknesses associated with case study research. As there is no experimental control for this method, the validity of the data collected may not be as strong in comparison to other methods. Additionally the inferences made using case studies depends highly on the researcher, therefore novice researchers may miss some more nuanced results, which may lead to critiques of subjectivity in the results. Lastly, inferences related to the results of the research can become quite contextualized given the context of the case, and therefore is applied to other cases with great difficulty, if at all.

In relation to the weaknesses this case studies, this research attempts to mitigate these effects by creating more generalizability using a multiple case design. This allows the results to represent phenomena that is more widely spread among the cases studied, and will give create more understanding and validity in the conclusions drawn.

2.4.2 Multiple Case Studies
Case studies can either be quite focused, or they can encapsulate a more broad view of society and human life (Berg, 2009). In the case of this research, a mixture of these approaches is used. While there is some research that was quite project specific, this research also looks to the wider climate of Canada and Sweden to understand the political implementation of public participation in NRM. Yin (2003) notes that when multiple cases are used in a research, the researcher has a greater ability to investigate differences or similarities between and within cases. Projects in Canada are so varied that looking at multiple projects was necessary in order to draw overall conclusions, while the case in Sweden was more focused in one single direction and therefore it was the only project studied.

2.4.3 The Comparative Approach
A comparative case study, as intended for this research, uses multiple cases in order to replicate results from one case, or to investigate contrasting situations, which frequently gives rise to more compelling and robust results (Yin, 2003; George & Bennet, 2004). The cases for this research are analyzed in both a contrasting and comparative way based on their characteristics and their management projects. Additionally, George and Bennet
(2004) note that there is now significant acceptance that by using a combination of within-case analysis alongside cross-case analysis within a single research project, the conclusions drawn will yield much stronger results. This approach was also taking into account in this research, where each of the cases were analyzed separately, and then used in a comparative way to draw the overall results. The cases used in a comparative case study must be chosen carefully in order for the results to be seen across similar cases or in comparison to theoretical perspectives (Yin, 2003).

2.5 Interviews
Since case studies necessitate several forms of data collection, the method for this research used a few varying methods. The principal survey method was interviews, for which the technique and details of outline below, after which the additional methods are explained.

2.5.1 Interview Techniques
A sampling method was first established in order to determine how participants for the interviews would be reached, and who would be contacted. All selected participants were based on their current or prior involvement with freshwater NRM projects in their local areas. Since not many contacts were known prior to the research, the snowball sampling method was chosen, whereby known contacts were sought out and interviewed in a purposive manner, and then asked for further suggestions of participants they thought would contribute well to the research. While the snowball sampling method may not always lead to a representative sample of a population, it may be used where it is not possible to use another framework (Bhattacherjee, 2012), as was the case for this research.

The interviews for this research were conducted in a semi-structured format. Bernard (2006) notes several benefits to the semi structured interview process such as allowing the participants to express their own points of view while following the specific themes of the research. The semi-structured questions were selected since the researcher is targeting to receive information from the respondents, however would prefer to facilitate answers where leads may be followed up (Trochim, 2005). The questions had several approaches in terms of subject matter, ranging simple background information to more in depth questions concerning involvement and success of NRM projects (Kraus & Allen, 1998). Since participants took on different roles within their community projects, not all interviews sought out the exact same questions (for example interviewing a person in a research role in comparison to a volunteer citizen), but rather themes remained consistent for all interviews. The formats of the interviews were predetermined, as were sample questions to ask based on the participant’s involvement in a project. This was set in an interview guide (see Appendix A for samples questions and the interview guide). The interview guide was established in order to create continuity among the interviews and cases studied. The interviews were structured such that they began with questions pertaining to facts and background information about the participants and the projects in which they are involved. The interviews began with these questions in order to establish a common ground and understanding between the researcher and interviewee. The next set
of questions related more to the interest and motivation of the participants, and how they have been influenced their projects. In addition, questions relating to the perceptions of the participants on their projects and wider views of public participation in NRM were asked. In the final portion of the interviews, the participants were asked to clarify any contradictions or more detailed points of interest, along with questions prompting the participants to speculate reasons behind certain outcomes of their project that they had previously discussed. This last section of the interview remained the most un-structured portion, with questions generally tailored to the topics discussed earlier on in the interview. All interviews ended with the opportunity of the participant to ask questions about the research, and add any additional thoughts they deemed important but were not prompted to share.

The questions asked within this structure of the interviews were brainstormed in advance, but the main focus of the interviews was to cover certain themes, which were consistent throughout all the interviews where the individual questions were not. The themes consisted of: democracy, public participation, knowledge production, and citizen science. For democracy, the interviews focused on how participants in the project fuel democratic processes, and how the model of the project influences this. Public participation was explored by focusing on the level of engagement of the citizens, how the participants in the project felt towards the democratic processes at play, and to better understand the power structures in the project. In terms of knowledge production, the interviews explored ideas of the effect that citizens have on producing knowledge given their level of engagement and the model of participation used in the project. Finally, citizen science was used as a theme to understand how this idea is used as a means for public participation, and how it is shaping the project.

All interviewees were asked in advance if they would grant permission to be recorded since this eliminates the need to remember what participants said and therefore increased the reliability of the interview, all interviewees agreed. During two of the Swedish interviews Google Translate was used in order to translate technical terms that the participants did not know in English. At the end of the interview the respondents were thanked and asked whether they would prefer to remain anonymous in any write-up or presentation associated with the research. After the interviews were conducted, the data was summarized and partially transcribed for important quotations. The written summary and quotations intended for the results of the research was sent back to the participants to provide them with the opportunity to clarify, add, change, or delete any of the information before the data was included in any of the results. The summaries from the results are attached in Appendix B.

This research uses two main cases, using projects in Ontario, Canada and a project in Sweden. In Canada, 11 interviews were conducted with 12 participants, and in Sweden 6 interviews were conducted with 6 participants (for a total of 18 participants and 17 interviews). 8 of the interviews were conducted over Skype or the telephone due to location and time restraints, and the remaining 10 were conducted in person.
2.5.2 Anonymity and Ethical Considerations

Ethical considerations are often identified and worked through in the planning stages of research (Berg, 2009), which will be the intention of this research. Without any conflicts of interest identified, the main ethical consideration for this research concerns involving and engaging humans during the project. While the research does not focus on matters that generally very sensitive, the participants were fully informed of the research process and received written information in advance that includes the aim and purpose of the study, as well as the voluntary aspect of the interview. After each interview was completed, the participants were asked whether or not they would like to remain anonymous in future reports and presentations. This insured that the participants were voluntarily involved and informed of all potential risks, as well this will avoid having to use implied consent with the participants (Berg, 2009). Where interviews were recorded, prior to the start of the recording the participants were asked verbally if they agreed for the interview to be recorded, and they were informed the recordings would be used only for transcribing and summarizing the interviews. The recordings were stored where only the researcher could access the information.

2.5.3 Additional methods

In addition to the interviews, several other methods for gathering information were used. All additional material is included in the Appendix. The following methods were used to collect the additional information:

- Personal observations when visiting the studied sites (Appendix C)
- Surveys sent out to Lake Associations in Ontario for background information such as their formation, projects, and interest from members (Appendix D)
- The websites for the projects (Appendix E)
- Reports and documents send via email from the participants of the research. These documents included data from the projects studied, background information on the projects, challenges encountered, etc. (Appendix F)
- Documents brought into the interview from the participants such as maps, newspaper clippings, and personal photographs (Appendix G)

2.6 Approach to Results and Analysis

Following the theoretical perspectives and background information on the cases, the results from the methods described are presented. The results are broken down into five categories in order to organize them in terms of the themes of the research. The sections include: motivation of the citizens and researchers, the level of public engagement and involvement in the projects, the role of democracy and government involvement, knowledge production, and the main challenges of the projects.

While the presentation of the results themselves is a level of analysis given the chosen content and its organization, the subsequent chapter provides a further level of analysis in order to link the results to the theory. In this chapter, the discussion is broken down into six sections for ease of organization and grouping of main ideas and arguments put forth. The section in this chapter examine: the models of public participation, the benefits and challenges among the different projects, the role of the Commons, stakeholder
involvement, the intersection of democracy and knowledge production, and how we are able to further the institutionalization of public participation in government and public institutions.

2.7 Limitations
This research works within the capacity of certain limitations. Firstly, the participants interviewed were based on their willingness and availability. Many of the participants contacted did agree to take part in an interview, while some did not reply after contact (none denied interviews when contacted). There was some speculation from one of the Swedish participants that those contacted for an interview concerning the Lake Tämnaren case were reluctant to participate given the language of the interview was English. Therefore participants were further contacted to suggest a Swedish interview with a translator, but no more participants agreed to an interview. There is also a difference in the number of interviews conducted for each case, with 12 participants in Ontario and only six for the Lake Tämnaren case. The Ontario interviews were first conducted, followed by the Lake Tämnaren interviews, therefore the intention was to try and conduct close to the same number as in Ontario. The attempts were made to contact several people but in many cases no replies were received, again perhaps due to the language issue. The discrepancy in number of participants from each case may create slight differences in the results, in comparison to research with equal numbers of participants.

The language of the interview posed another limitation for the other Swedish interviews as well. While all the Swedish participants were fluent in English, some more technical concepts or words were not known in English. Google Translate did help in these circumstances, but the interviews may have transpired in a slightly different manner had they been conducted in Swedish.

Since Ontario is a very large province and resources did not permit too much travel, some of the interviews were conducted over Skype (as noted in section 2.5.1). These interviews did produce very fruitful discussions, but again may have transpired differently if they had occurred in person.

Lastly, the results of this research could be arguably interpreted as case specific and not broadly applicable to other scenarios of public participation in NRM. Therefore the cases themselves could be interpreted as a limitation. However, it should be noted that the basic principles of participation identified and the recommendations for the cases could be applied in varying circumstances given basic foundations.

3. Democratic Theory
The theoretical frameworks introduced in this section create the backdrop for the conception and design of the research. These theoretical ideas present the perspective from which the research is approached and analyzed. Democratic theory is first presented, with two subsequent sections of knowledge production and NRM. While the latter two sections are concepts in and of their own, they are presented under the umbrella of democratic theory as the foundation of the research.
3.1 An Introduction to Democratic Theory

The influence of democracy has reached many political systems around the world (Stoll-Kleemann and Welp, 2006). Democratic theory is categorized under the wider scope of political theory, and is “primarily concerned with examining the definition and meaning of the concept of democracy, as well as the moral foundations, obligations, challenges, and overall desirability of democratic governance” (Laurence, 2015). In the interest of remaining concise and for the purposes of this research, democratic theory will not be explored in its entirety, rather focusing on certain aspects. First, democracy is contextualized for the purposes of this research, which includes concepts of vertical and horizontal democracy. The subsequent section introduces the theory of deliberative democracy, with a focus on the ideas of citizen involvement stemming from the works of Jürgen Habermas. Finally, the environmental side of democracy is presented through the theory of Earth Democracy and the concept of the Commons. It must also be noted that here democratic theory is primarily, explored from the works of privileged Anglo-American and Western European authors, with the inclusion of works from authors with backgrounds in South Asia (Shiva, 2005; Ojha et al., 2007). While this does not represent democracy from a global perspective, it speaks to the political outcomes in the parts of the world where this research is focused.

3.1.1 A Brief Contextualization of Democracy

Defining democracy is no easy task, particularly since the definitions tend to carry varying social, moral, and political agendas (Crick, 2002). In etymological terms, the word democracy is traced back to Greek origins of demos (the people, the mass, the mob) and kratos (to rule). Beyond these basic meanings, a wide variety of democratic foundations and practices may have arisen (Laurence, 2015). Crick (2002) outlines the uses beyond these origins, beginning with Machiavelli’s Discourse where democracy is presented as a concept where laws are able to protect all citizens, but these laws are not useful unless active citizens collectively make them. Democracy is afterwards used in the events of the French Revolution, along side the writings of Rousseau. Here democracy is presented in the sense that all citizens have a right to be involved with public matters, and decision need not be always taken by those living in a higher society, which in some manners presents as an argument for the liberation of classes. Lastly Crick notes the use of democracy in the American Constitution, European Constitution, it’s presentation in Japan and Germany after the Second World War, and in authors such as John Stuart Mill and Alexis de Toqueville. In democracy here, all citizens may participate if they care to do so, but there must be a mutual respect for fellow citizens by abiding to a regulatory legal framework that protects and also limits rights. This most contemporary use is how the majority of people in Western developed states view democracy today, where the power lies with the people, but individuals are legally protected.

3.1.1.1 Horizontal and Vertical Democracy

The theoretical framework of democracy comprises two dimensions, vertical democracy and horizontal democracy. Vertical democracy consist of a “chain of representation,
steering and accountability relations between the electors and the elected, the representatives and political authorities (administrators) and political authorities and civil servants (executive agencies) respectively” (Koopenjan et al., 2009, p.2). Vertical democracy is thus the well-known representative format of democratic nation states, organizations, and so on, and their tiered interactions. In addition to this, democracies necessitate “some kind of horizontal affect, a bond between the individuals who make up the demos that sustains their commitment to sharing in rule with one another” (Ferguson, 2012, p. 23). This notion echoes the arguments put forth by Habermas (1996) where a vertical representative structure is equally dependent on establishing legitimate participation among the democracy, which Hansen et al., (2016b) establish as the horizontal dimension to modern democracy. Bernhardt (2014) also notes that the ability to horizontally communicate creates informational advantages, most specifically it is able to increase the quality and speed at which information is generated since it is created through an inclusive and decentralized process.

Hansen et al. (2016b) further link these concepts to the manner in which democracy has expressed itself after the Second World War on opposing side of the Atlantic Ocean following the rise and fall of a totalitarian regime. The authors note that while Northern Europe emerged from the war with a greater focus on public engagement, the political culture in the United States of America turned towards confining the public’s engagement to casting ballots for the political elite to make decisions, fearing repercussions of entrusting too much power with the citizens. More broadly speaking, Crick (2002) also explains that the development of the liberal state in North America and Europe in the past two centuries has “created a framework within which people could lead their private and commercial lives with a minimum of interference” (p.110). Crick notes that few citizens outside of politics are now active in political parties, and public interventions are often limited to citizens voting in elections. Party leaders at times will be more interested in election tactics which allow short term success and proper presentation in the media, without advocating for the long term needs of a nation.

3.1.1.2 Citizenship in Democracies
A citizen is broadly defined as “a person who legally belongs to a country and has the rights and protection of that country” and “a person who lives in a particular place” (Merriam-Webster, 2016). For the Greeks, citizenship was believed to be the highest end for humans, and one achieved immortality through services to the political rule (Crick, 2002). Nielsen et al. (2016) note that citizens are able to address collective issues, for example the social-ecological crisis, which should permeate political culture insofar that citizens must actively seek initiatives, but these actions should be supported by society at large. Crick (2002) also notes that in order for citizens to be effective in their demands they should possess some practical knowledge to understand how to leverage their power in order to meet their particular intentions.

3.1.2 Discourses of Citizen Involvement
Hansen et al. (2016b) note that the discrepancy and imbalance of power between the vertical and horizontal dimensions of democracy here described, is one of the most
fundamental problems of contemporary democracy. This section dives deeper into the theories of citizen involvement in democracy today, based on recent discourses. The chosen concepts and theories are highlighted due to their understanding and framework for citizen involvement in democracies, which will have considerable applications for the role of the public in NRM, as discussed in this research.

3.1.2.1 Habermas and the Public Sphere
In contemporary discussions regarding democracies and citizen action, many authors refer to the works of Jürgen Habermas. Through his linguistic and philosophical theories, Habermas helped shape deliberative democracy by arguing that free and voluntary discussions in decision-making is necessary to attain a discourse that is equal for all parties involved (Webler and Tuler, 2000), and anyone interested in a particular decision should be able to participate and initiate discourse in order to arrive at a consensus (Smith and McDonough, 2001). Habermas emphasizes the idea and role of the public sphere, which is described as the opposite to private, and means open to all but not necessarily free from all state relations (Habermas, 1962). Historically speaking, Habermas explains the bourgeois, being a collection of private people who came together as a public, essentially created the public sphere, but subsequently the role of citizens has been weakened due to the overpowering representation of government institutions, the market, and those who hold positions of power (Habermas, 1962). In other work, The Theory of Communicative Action (1984), Habermas argues there must be reasoned argumentation for decisions, rather than action taken from the strategic perspective, namely from those power-holders mentioned above. Habermas argues that this should be achieved through a consensus dialogue with the public to avoid implementation of the sole interests of those in positions of power.

3.1.2.2 Political Attentiveness
Allenspach (2011) notes that Giessel (2006) argues that the theory of political systems support states that in order for a political system and democracy to be successful, the support of its members is essential. This directly implicates that political critique creates a threat towards a political system, however many scholar have noted that political critique may be helpful in order to refine a political system. Geissel crosses the two concepts of political dissatisfaction and political attentiveness to emerge with four types of critical citizens: attentive-satisfied, attentive-dissatisfied, inattentive-satisfied, and inattentive-dissatisfied. She notes that those who become involved with the political system are generally those that are attentive, whether they are satisfied or not. From this classification, Geissel classifies citizens as “resources” or “threats” and determines that politically attentive citizens have attributes that can be used as resources to a democracy, again not depending on their degree of satisfaction.

On the idea of political attentiveness, Stoll-Kleemann and Welp (2006) also note that there have been claims of a decline in representative democracy due to the disinterest of citizens. While in part this may be seen in the decreased voting rates of some democratic nations, disinterest may also appear where participatory processes are becoming too time
consuming and costly. These authors suggest both these claims reinforce the idea that democracy and participatory procedures must be continuously updated.

3.1.2.3 The Practice of Deliberative Democracy

Theorists of deliberative democracy are not always in agreement with all concepts, however they do unite on two fronts: “democracy should be understood as the exchange of reasoning rather than merely as the confrontation of contending interests” and “the justification of policies in liberal democracies should be more democratic” (Weinstock & Kahane, 2010, p.1). The exchange of reason, rather than a dominant pluralist view, is encouraged in deliberative democracy, and therefore finds a strong foundation in the work of Habermas (Weinstock & Kahane, 2010). However, Fishkin (2010) notes that contemporary situation in the exchange of reason and communication has left us with a situation where:

“…we have empowered a public that generally lacks the information and attention required for the value of deliberation, in the name of processes that embody a degree of political equality (via equal counting of votes or, in the case of opinion polls, random sampling). Even in the best circumstances, we seem to face a forced choice between politically equal but relatively non-deliberative masses and politically unequal but relatively more deliberative elites.” (Fishkin, 2010, p. 194)

Fishkin (2010) thus suggests that an institutional design must meet both the requirements of deliberation and political equality. Again, this circles back to the work of Habermas (1984) on the theory of communicative action and the necessity for the public consensus and reasoned argumentation over the interest of the elites.

3.1.3 Stakeholder Involvement

Stakeholders are separate from the term ‘public’ and can be defined as “any group of people organised, who share a common interest or stake in a particular issue or system” (Grimble & Wellard, 1997). Stakeholder participation can be a complex system, with a multitude of purposes, interactions, and degrees of involvement, and can use a variety of methods and solutions for a project (Luyet et al., 2012).

Hansen et al. (2016b) explore stakeholder governance from a more critical lens, spawning from the notion that stakeholder governance does not have democratic origins, but rather stemming from theories propagated through business administration and business economics in the 1980’s. Based on this emergence, stakeholder involvement in NRM maintains it’s roots of efficiency and drive towards certain performance centered objectives. Hansen et al. (2016b) argue the efficiency approach and drive towards objectives lays the foundation of the stakeholder tactics, which inherently impose limitations and create cause for ethical questions to arise. Thus, stakeholder theory is largely based on “enterprise about who shall control benefits and interests” (Hansen et al., 2016b, p.22). On the same note, Ahsby (2003) argues that a major differentiation occurs between stakeholder participation in NRM where power relations are structured. These power differences may surface in international or regional authorities, and also on
the local level between wealthy, high status or male citizens in contrast to poor citizens or those belonging to minority groups. Walker and Stashok (2010) also argue the power and authority of stakeholders must be properly distributed in order for transformation required for sustainable development to occur.

Where stakeholder governance has influenced other sectors for decades, Hansen et al. (2016b) note that this type of participation in NRM projects only took off in the 1990’s following the 1992 Rio De Janeiro Earth Summit. In the passing decades, stakeholder participation has taken many models (further discussed in Section 4.3). Hansen et al. additionally argue that in NRM today,

“…participation is typically equivalent to the inclusion of ‘stakeholder participation’ equating those who participate with ‘stakeholders’. We argue in the following that this is not an answer to the democratic outcry for more (or better) participation, but in fact a reproduction of the exact same problem we are trying to overcome by engaging the public. Neither is it fundamentally different to elitist authoritarian governance.” (p.17)

Ashby (2003) argues that in order to ‘democratize’ NRM, there must be a broad set of stakeholders involved, who will represent a variety of values and objectives in relation to the resource in question. However, Hansen et al. (2016b) note that where participation is defined by governing institutions, there is often a bias towards the involvement of influential stakeholders and “that the stakeholder dominance of western democratic political systems holds the risk of gradually eroding the cultural reproduction of democracy by marginalising the majority of citizens” (p.45). The authors also point to Habermas (1962) noting that with the rise of dominating stakeholders such as experts, interest groups, and governmental institutions, there is a lack of power and function allocated to citizens. The authors additionally draw from Borgström (2012) arguing that public participation in NRM often serves mostly in the role of fulfilling the requirements of a protocol, without an entirely extensive participation from citizens. These critiques come back to the theory of vertical and horizontal democracy presented in section 3.1.1.1, where in the arguments presented here have a distinct lack of horizontal democracy, where multiple perspectives from stakeholders and citizens alike are not considered resulting in the exclusion of values, experiences, and knowledge from the public (Hansen et al., 2016b).

Ashby (2003) notes that researchers are among the stakeholder groups, they offer different kinds of knowledge and can at times have competing views on how to manage natural resources. In development research, the researchers are often looking towards traditional ideas of control and objectivity, while they are challenged to see that their impacts on NRM will have a certain dependency on other stakeholders. Should there be a joining of the forces where all the stakeholders are concerned, they will increase the likelihood that they will reach their desired outcomes, and therefore the quality of the science is dependent on cooperation of all stakeholders (Ashby, 2003).
3.1.4 Earth Democracy and the Commons
Shiva (2005), activist and scholar, brought the idea of Earth Democracy to light and describes it as “the awareness of connections, and the responsibilities that flow from them” (p.1). Earth democracy is seen as an ancient worldview, which is expressed in growing political movements and argue for greater peace, justice, and sustainability. Additionally the idea of privatization is seen as a senseless ideology of corporate globalization, in a world driven by the market. Earth democracy cannot be seen simply as a concept, but rather it is shaped by the practices of people who are retrieving “their commons, their resources, their livelihoods, their freedoms, their dignity, their identities, and their peace” (Shiva, 2005, p.5).

Shiva also notes that movements to defend the earth as a common good for all people, are appearing in global and local spaces, and that even where Earth Democracy is rooted locally, there is a connection to the world as a whole. McCormick (2009) discusses this further and describes these movements as “Democratic Scientific Movements”, or DSMs, that “contest expert knowledge and critique research findings as biased and politically driven. They aim to legitimate lay knowledge in science processes, government policies, and public discourse” (p.3). McCormick points to Rachel Carson as the initiator these movements, although Shiva (2005) notes the issues of democratic management of resources dates back to the enclosure in Europe starting in the 18th century. McCormick (2009) argues that to enable DSMs, knowledge must be democratized, which includes legitimization of lay knowledge for policy-making, public discourse and scientific discourse and is generally facilitated through collaborations between experts, scientists, and lay people. Shiva (2005) further notes that Earth Democracy supports Living Economies, Living Democracies, and Living Cultures. “Democracy” has become an abused term due to the promise of globalization and the promise of free trade markets and open up societies, which has shown results of trade rules that empower corporations to lead dictatorships of basic needs. From an alternative perspective, Living Democracy, allows citizens to reclaim decision-making powers and internalize social and ecological costs within local production and consumption systems, and in this sense returns the decision-making power to the citizens (Shiva, 2005).

Shiva (2005) argues that the Commons are the highest expression of democracy. The Commons are defined as “land or resources belonging to or affecting the whole or a community (Oxford, 2016). Similarly, Ostrom et al. (1999) define common-pool resources as (CPRs) as natural and human constructed resources where the one users exploitation of the resource diminishes its availability to all the other users. Additionally, the term communing refers to “the practice of creating, managing, cultivating and renewing the Commons” (Hansen et al., 2016a, p.5), positioned in terms of political, cultural and economic practices.

Issues with the Commons first began with the enclosures in England in the 18th century, however have come a long way in our contemporary societies, which now include the closure of commons such as knowledge, water, biodiversity, and public services (Shiva, 2006). In contexts where basic needs of unmet due to the closure of the Commons, people are often driven to extremism and violence (Shiva, 2005). Issues also arise where
resources are overexploited or degraded due to some users disconcert for other users and the health of the resource (Ostrom, 1999). The management of the Commons has been a topic of discussion for many decades. While some argue for the privatization of these resource in order to control their use (based off the works of Garrett Hardin), other argue effective governance of common resources can be attained through methods aside from institutional control. The literature that weighs the benefits and challenges of managing the Commons if further elaborated upon in section 3.3.4.

3.2 Knowledge Production
Where knowledge is integrated in sustainable NRM, the roles associated with the knowledge produced must be carefully considered to understand the information coming from academics, scientists, and the public (O’Brien et al., 2013). Knowledge production is explored here to emphasize roles taken in the projects studied, in terms of who is producing knowledge for the projects to move forward, and who is using the knowledge produced to implement change in the future. The distinctions are important to recognize in order to further analyze the democratic structures in the models of the projects studied, and understand where data and ideas are created and realized. Theories of knowledge production can vary across many topics, however this section aims to explore theory surrounding the interaction of scientists or experts and the public in the management of natural resources, including the types of knowledge produced in these settings. This section also explores the rationale behind using citizen science as a means to research knowledge production, and how these two concepts are related.

3.2.1 Types of Knowledge
There exist many different types of knowledge, coming from various types of people. Here the main types come from scientists and the public, a boundary that has been explored in the literature by several different authors.

Ojha et al. (2007) note that since the European Enlightenment in the sixteenth and seventeenth century, there has been a great expansion of the human agency’s ability to learn and innovate. Since this time, science has become the dominant perspective in which humans explore and understand both the social and physical world, which many cases has resulted in the ‘overscientisation’ of the social and political circumstances due to application from the physical world. Ojha et al. continue this idea by introducing main perspectives by notable authors to understand theoretical issues associated with knowledge systems. Firstly, Habermas (1971, 1987) divides knowledge into two domains: technological knowledge that explores how humans utilize nature to increase their own purpose, and communicative knowledge that explores how humans are able to better understand one another to generate more positive relationships and increase social justice. By defining these two domains, Habermas attempted to draw out the communicative domain in the process of learning from the more technical domain (Ojha et al., 2007), and in doing so brought to light more deliberative approaches to governance (Dryzek, 2000).

Building on this framework, Bhattacherjee (2012) defines scientific knowledge as “a generalized body of laws and theories to explain a phenomenon or behavior of interest
that are acquired using the scientific method” (p.5). Authors such as McCormick (2009) discuss the difference between scientists and the public in terms of knowledge production in the situation of public participation. McCormick points to Bell (1999) who claims that rather than government establishments, knowledge and technology create the main infrastructure of the postindustrial society. In turn this portion of society is ever growing in its creation of new knowledge and the elite members of this class are constituted of scientists. From a slightly contrary perspective, lay knowledge, possessed by social movements or affected peoples (McCormick, 2009), is based in community membership and conceptions of the public (Nelson, 1990), insofar as being more attuned to cultural variations. In this way local or lay knowledge “is less about whose knowledge is more accurate and more geared toward the recognition that there are multiple bodies of knowledge and value systems tied to those set of understandings” (McCormick, 2009, p.31).

From these authors, we can derive that knowledge production cannot be separated from the political sphere of democracy, and there must be some semblance of a balance between citizen knowledge and value systems, along with the more technical and scientific knowledge coming from traditional power holders. The means of doing so in this research is explored through citizen science, which is further elaborated in the sense of knowledge production in section 3.2.3.

3.2.2 Knowledge Systems in Natural Resource Management
From a historical standpoint, the governance of natural resources has generally been represented through the power, knowledge, and interest of actors who are able to influence the management of resources (Ojha et al., 2007). In line with this, Kofinas (2009) notes that conventional approaches tend to become quite focused on the scientific components, and ignore more integrated approaches to knowledge production. To integrate these parts, we must recognize the range of social-ecological interactions, which Kofinas argues necessitates more than simple public participation in decision-making processes. He argues there is a need for more collaborative processes for knowledge co-production and problem solving on multiple scales. Wynne (1989) also argues that systematic and experiential sources of knowledge are necessary when exploring the effects of humans on natural environments, and notes that experiential knowledge is necessary to collect experiences from the past. In reference to historical ideas of knowledge production, O’Brien et al. (2013) note this format has been challenged where suggestions to further engage stakeholders, which strives for more collaborative models in resources management, known as ‘Mode 2’.

Public participation in management processes allows for the recognition of self-worth of citizens, while appreciating their role and citizen credentials (Stoll-Kleemann and Welp, 2006). Additionally, scientific knowledge can at times be seen as ambiguous, contested, or lacking in values and preferences of those affected by particular decisions (Renn, 2006). Therefore there is a need for public involvement and deliberation in NRM to attempt to overcome such hurdles.
Ojha (2007) creates four categories for social agents in NRM, which each informed by different systems of knowledge. The categories at play are: formal political agents, civil society groups, techno-bureaucrats, and development agencies/professionals (see Figure 2).

![Diagram: Four types of knowledge systems in local level NRM](Model after Ojha, 2007, p.13)

**3.2.3 Citizen Science**

Citizen science is used in this research as a unique opportunity to gain a greater perspective on some of the theoretical notions outlined above. Where traditionally scientific knowledge was regarded as a means to study both physical and social worlds, as seen there was an emergence of a greater need to integrate a variety of forms of knowledge and work with knowledge systems to sustainably manage natural resource. O’Brien et al. (2013) look into this idea further by turning to Costanza (2003) and Carolan (2006) and summarize that more contemporary ideas of science lean towards formats of knowledge production that cross disciplinary boundaries, and use a multi-scaled approach in order to derive more democratic visions of science. Citizen science is a way in which interdisciplinary approaches can be facilitated, and where citizens can cross over to the realm of scientific knowledge to aid the management of resources. In this way, citizen science integrates a variety of actors including: researchers, citizens, and facilitators to produce knowledge in new integrated formats.

There are still many questions associated with this practice where the production of knowledge is occurring in citizen science projects, power balances, equity, values, and politics will play significant roles in these cases. Therefore this research will utilize...
citizen science for its unique platform to understand the issues and benefits of the format in the production of knowledge. The emphasis in this research given the two models of citizen involvement in the two cases in question leans towards the production of knowledge where contrasts are seen between production for the use of experts and researchers, and the production of knowledge that is an integration of citizen perspectives and scientific understandings.

3.3 Democratic Natural Resource Management
Theories of NRM are intensively explored through literature and scholastic textbooks. From a scientific perspective, there are certain principles that scientists suggest in order to sustainably manage resources, but considering the close relationships of people and resources, there is also a significant portion of these theories which must be dedicated to more socially oriented interactions. This section first begins with the scientific basis for the sustainable management of resources, which is not in itself exhaustive, but rather summarizes important concepts for the basis of this research, including the management of water resources. Beyond this, this section will also explore concepts surrounding resource management and human relationships.

3.3.1 Systems and Natural Resource Management
The notion that society is dependent on nature is certainly not new (Chapin et al., 2009). Chapin et al. (2009) note that over centuries this idea has been explored by diverse groups of people including: ancient Greek philosophers (Boudouris & Kalimtzis, 1999), economists (Malthus, 1798), geographers (Butzer, 1980), and concerned ecologists and conservationists (Leopold, 1949; Carson, 1962). With urgent contemporary environmental issues, many authors argue that there is a need to approach problems from a systems perspective. Whether we are looking at the world, a region, or a community, it should also be understood as a “social-ecological system” which consists of both physical components (organisms, water, rocks, etc.) as well as the products that arise from human activities (infrastructure, food, money, etc.) (Chapin et al., 2009). In this system, humans will influence ecosystem dynamics through their activities, while remaining dependent on resources and services provided by these ecosystems (Turner et al., 2003). In most cases, social-ecological systems are open system, which refers to the fact that there is a flow of the physical components and human activities into and out of the system. This renders it impossible to look solely within the borders of a system to understand the processes, and rather one must look beyond the borders of systems for a complete understanding. Under this umbrella, sustainable resource stewardship projects must consider interactions between ecological, cultural, and economic components in order to maintain successful outcomes (Chapin et al., 2009). While these authors note the systems approach is fairly encompassing, some authors such as Nielsen et al. (2016) argue that in order for societies to be sustainable, they “could never be related to a systems level alone (state and/or market), but must be located, furthered and cultured at the level of everyday life” (p.2).

3.3.2 Resilience
Since it is no longer possible to manage systems in a way that they will change from past states, a more flexible and contemporary approach must be used. In this sense, managers
must work to maintain the functional properties of a system that are of importance to the society dependent on the resources, under conditions which may be continuously changing. Therefore, the management of resources must work towards building resilience, which is facilitated through resilience-based ecosystem stewardship (Chapin et al., 2009).

3.3.3 Social-Ecological Interaction in Natural Resource Management

Traditional approaches to NRM have tended to focus on quite heavily on scientific elements for decision-making, while ignoring knowledge production from more integrated source. For a more integrated approach, decision-makers must consider a broad range of social-ecological factors, while understanding the potential of uncertainty for predicting outcomes associated with these factors (Holling, 1998). Noting this, Kofinas (2009) further elaborates on this style of NRM by exploring adaptive co-management. Adaptive co-management approaches challenges associated with resource management with intentional efforts and across multiple scales in order to maintain the properties of a social-ecological system, and understand the emergent conditions of the situation. Adaptive co-management pushes beyond simple public participation in decision-making process; it necessitates a collaborative process of knowledge co-production, and seeks to involve stakeholders on multiple levels (Kofinas, 2009).

Kofinas (2009) outlines the notion of social-ecological governance and adaptive co-management for the management of natural resources. Adaptive co-management can be defined as “multilevel and cross-organizational management of ecosystems” (Young et al., 2008, p.161), while social-ecological governance is understood as in a similar way as the efforts which are made to achieve societal goals within relationships between humans and the environment (Young et al., 2008). Kofinas (2009) notes that a flexible approach must be taken towards the management of natural resources due to directional changes in factors that control social-ecological systems; these changes necessitate an understanding of the processes and mechanisms that cause and react to the changes. This process requires management techniques that look beyond the control of resources and people, but rather utilizes the social-ecological governance methods. Social-ecological governance may involve citizens, NGOs, government agencies, business, and communities among others in order to address the problems associated with sustaining social and natural assets as ecosystem services are maintained (Folke et al., 2009).

Berkes et al. (2009) point towards the implementation of co-management in natural resource contexts, which requires the sharing of power between the resource users and those that are responsible for managing them. These kinds of arrangements can take on many forms, however they so not always result in the intended power sharing structure, this great care must be taken in order to develop healthy working relationships. Often new pathways of communication must be ensured in order for the decision-making processes supports various perspectives.
3.3.4 Managing the Commons

Much debate has surrounded the role of institutions in resource management, mostly centered on how to avoid a Tragedy of the Commons (Kofinas, 2009). Hardin (1968), explores the sociological dilemmas of managing the Commons, drawing from the work of Lloyd, an economist, who published a pamphlet in 1833 concerning overgrazing from cattle on shared lands. Hardin re-introduces the idea by arguing that humans will act in self-interest towards common natural resources, without regard other users within a group, resulting in the significant degradation of common resources (Hardin, 1968). Thus Hardin proposed that rational users of a given common resource would impose demands on the resource until the expected costs outweighed the benefits. In other terms, the users would not heed to the costs imposed on others by their actions, therefore leaving a common resource open to devastating overuse with potentially destructive outcomes. Hardin argued that the solution to this issue is either socialism or the privatization of common resources, and concludes "freedom in the commons brings ruin to all" (Hardin, 1968, p. 1244). While many of the concepts Hardin refers to are regarding Commons in terms of global wide scales, many still consider his insights decisive for the management of any Commons (Feeny et al., 1990).

While Hardin’s work has been revered historically as influential in NRM (Ostrom, 2002), it has also been quite heavily criticized and deemed an oversimplification (Feeny et al., 1990; Ostrom et al., 1999; Ostrom, 2002, 1999; Dietz et al., 2003). The oversimplification stems from the fact that Hardin notes that to be able to sustain common resources in the long term, institutional arrangements must be established (centralized government and private property). Therefore Hardin’s situation assumes that the user is unable to create solutions to the management of a common resource (Dietz et al., 2003). Hardin does not consider the idea that in many situations, social groups have prevailed to develop and maintain their own management protocols through self-governing institutions (Feeny et al., 1990), which has been occurring for thousands of years (Ostrom et al., 1999). Although these social groups have at times come up short in sustainably managing their Commons, so have Hardin’s proposed state and market managed arrangements (Ostrom et al., 1999; Dietz et al., 2003).

Since Hardin proposal for institutional management of the Commons, several alternatives have been suggested, which focus on effect governance of the Commons, managed by the people and not external institutions. Dietz et al., 2003 summarize prominent literature to note that effective governance is achieved when:

- Resources are monitored and understood at a low cost
- Rates of change of the resources, population, and technology are moderate
- Communities are engaged in social networks to increase trust and reduce the cost of ensuring behavior compliance
- Outsiders can be excluded; and
- Users are able to support rules and effective monitoring processes

Ostrom et al. (1999) also note that the solutions to dealing with common-pool resources (CPRs) come from a variety of institutions and many different scales. They note that empirical and theoretical research since Hardin’s article demonstrates that the tragedy of
the Commons is real, but it can also be avoided and many other alternatives involving a diversity of institutional arrangement exist (Ostrom, 1999). Ostrom et al. (1999) recommend that where users depend on a resource for their livelihood and have the ability to make their own rules, will understand how their actions affect the resource, while positively perceiving the restrictions imposed. Therefore, as Dietz et al. (2003) note, with trust among users and low cost monitoring abilities, resource users are able to manage Commons without external intervention.

Shiva (2005) also argues for the democratization of resources in contrast to the privatization proposed by Hardin. Extensive research also supports the notion that while there are many models for the social-ecological governance, there is no one single model that can be used as a best practice to represent all resource use issues (Ostrom et al., 2007). Kofinas (2009) emphasizes that there is no one universal solution for the management of a Commons. Successful management, however, will have engagement at the community level, and will prove to be important for local residents.

In a similar context, Berkes et al. (2009) also note that the involvement of people in conservation efforts necessitates the creation of a local stake for the community. In this sense, people need to be connected to their land and resources in order to have the motivation to act in conservation scenarios. However, communities are not generally stand-alone scenarios; they are embedded in larger systems of the social-ecological context. In the contemporary world, communities generally have some sort of connection and interaction with a variety of agencies such as: regional and national governments, NGOs, neighboring communities, etc. It is especially difficult to draw boundaries for communities in the use of the Commons without privatizing the resources. This situation therefore necessitates conservation and management strategies that will work across scales and boundaries to foster sustainable actions (Dietz et al., 2003).

In cases where communities share their use of Commons with other communities or wider regions, proper resource management is essential to reduce the likelihood of resource scarcity or degradation. This situation may necessitate an approach where there is a type of “co-management”, a shared power and decision-making opportunity between governments and communities. Formal and informal co-management situations have been seen as critical to foster both social-ecological resilience and support conservation initiatives and local and regional scales (Berkes et al., 2009).

4. Public Participation In Natural Resource Management Projects
Concerns over environmental issues growing in the 1970’s and 1980’s can be viewed as the first public critique towards this area. In 1987 the Brundtland report was released which stated the first definition of sustainable development as “development that meets the needs of the present without compromising the ability of future generations to meet their own needs” (United Nations, 1987, p. 39). Runnels and Andrew (2013) note that the public was excluded for many years in research-decision making, but in the years after the Second World War this began to change. In 1992 the Earth Summit in Rio de Janeiro took place, where public participation in environmental decision-making was highly
emphasized, with the final document stating: “environmental issues are best handled with participation of all concerned citizens, at the relevant level” (United Nations, 1992).

In recent years, public participation in environmental decision-making has come into context as a democratic right (Reed, 2008), and involving citizens in decision-making processes rest on the belief that an engaged citizen has more merit than a passive citizen (Arnstein, 1969; Irvin & Stansbury, 2004). Inviting the public to participate in the decision making process involved in nature resources has been an objective for European and American policies (Renn, 2006). For much of Europe, this notion is manifested in the United Nations Economic Commission for Europe’s 1998 Arhus Convention, signed with the intent of allowing for access to information, public participation in decision-making matters, and access to justice in environmental matters. The Convention currently has 47 signatories (UNECE, 2016). Chapin (2009) notes cultural connections to the environment are able to foster ideas and actions of stewardship, since people find and identity in the human-nature relationship. Additionally, much of the acceptance and promotion of public participation spurred from an increased knowledge and interest in environmental decisions and policy influencing sustainable development (Reed, 2008).

This chapter provides an overview of the current status of public participation in NRM from the perspective of developed nations, in addition to defining the concept and understanding the benefits and challenges associated with the practice.

4.1 Public Participation Defined
Since the Rio de Janeiro hosted the Earth Summit in 1992, the term ‘public participation’ has become increasingly popularized (Hansen et al., 2016b). Luyet et al. (2012) note that current literature points a variety of definitions for public participation. This can be assumed since participation is a flexible term, often used as an umbrella concept (Nelson & Wright, 1995), and can be understood in many ways under varying contexts with room for interpretation (Reed, 2008). The definitions tend to depend on those who are participating, and on the various decision-making processes at play (Luyet et al., 2012). For a few examples, Renn et al. (1995) define public participation as “forums for exchange that are organised for the purpose of facilitating communication between government, citizens, stakeholders and interest groups, and business regarding a specific decision or problem” (p.2), and Stoll-Kleemann and Welp (2006) lean towards the definition of a “process that provides individuals with an opportunity to influence public decisions” (p.21).

The importance of public participation is not only stressed at global conventions such as the Earth Summit, but also in the works of many authors. Renn (2006) notes that public participation is a necessary process given that the public may have values that differ from those of experts; therefore these must be accounted for in the implementation of scientific policy. In doing so, public participatory processes should combine the values and preferences of citizens, as well as technical expertise in a rational decision-making process. Hansen et al. (2016b) note that participation in many nations is now institutionalized, which creates an obligation on the part of the politicians to integrate the
process into their policies, and ensure its implementation. Additionally, the inclusion of various existing values, experiences, and types of knowledge in the participatory process will create an inclusive approach, and work to understand possible futures in light of current environmental crises (Hansen et al., 2016b).

4.2 Benefits and Challenges of Public Participation in the Environmental Context
In facilitating public participation in environmental decision-making, it is important to have an understanding of the benefits and challenges associated with this process. This section will first explore the benefits of participation, followed by some of the challenges.

4.2.1 Benefits
Much has been described by the current literature in terms of the benefits of public participation in environmental decision-making and NRM. These benefits are summarized in (Reed, 2008) and (Marshall & Jones, 2005) as:

- Lowering the risk of marginalizing a particular group in the decision-making process (Reed, 2008),
- Increasing public trust in decision-making with a transparent process (Marshall and Jones, 2004; Reed, 2008),
- Empowering the public by allowing for the co-generation of knowledge and increasing the participants knowledge base on an issue (Marshall and Jones, 2004; Reed, 2008),
- Promoting social learning by building relationships (Reed, 2008),
- Creating more robust research by including a variety of ideas and perspectives resulting in better resource management decisions (Marshall and Jones, 2004; Reed, 2008),
- Reducing potential conflict among the stakeholders (Marshall & Jones, 2004),
- Creating a space to address multiple problems at once, including: social, economic and environmental issues (Marshall & Jones, 2004),

More specifically in terms of public participation in government decision-making processes, citizen engagement benefits can be seen also from a two-tiered perspective (Irvin & Stansbury, 2004), where participation is used as a transformative tool for social change (Nelson & Wright, 1995). This is particularity important where governments are required to make difficult decisions; with greater public involvement in the process citizens are much more likely to be informed and understanding of the choices of the government (Irvin & Stansbury, 2004). The advantages for the citizens and government are summarized in Table 1.
Table 1 - Advantages of citizen participation in government decision-making (Irvin & Stansbury, 2004, p.56).

<table>
<thead>
<tr>
<th></th>
<th>Advantages to citizens</th>
<th>Advantages to the government</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Decision process</strong></td>
<td>Education (learn from experts)</td>
<td>Education (learn from citizens)</td>
</tr>
<tr>
<td></td>
<td>Persuade and inform government</td>
<td>Build trust with citizens</td>
</tr>
<tr>
<td></td>
<td>Gain activist skills</td>
<td>Increase legitimacy of decisions</td>
</tr>
<tr>
<td><strong>Outcomes</strong></td>
<td>Achieve desired outcomes</td>
<td>Achieve desired outcomes</td>
</tr>
<tr>
<td></td>
<td>Increase control over policy</td>
<td>Avoid costs of litigation</td>
</tr>
<tr>
<td></td>
<td>Ensure better policy and implementation</td>
<td>Ensure better policy and implementation</td>
</tr>
</tbody>
</table>

4.2.2 Challenges
In a general context, living in a pluralist society with a variety of value systems and worldviews, the task of decision-making can be very difficult. This is strongly linked to decisions regarding resource management since interdependent economic, ecological, and social factors create uncertainty and competing interests, allowing for decision-making to become quite difficult (Reed, 2006).

Public participation, while it saves time for the researchers in helping collect data, can be quite an investment of time and resources. This is due to the need for projects to be properly facilitated to avoid confusion and chaos, as well encouraging people to participate can sometime be a taxing process (Stoll-Kleeman & Welp, 2006). Power structures may also pose difficulties, especially where some are not willing to share power (Stoll-Kleeman & Welp, 2006) and where participation reinforces existing privileges of certain groups (Nelson & Wright, 1995). Reed (2008) also notes that where claims that public participation has resulted in higher quality and more durable decisions, such claims have rarely been tested, resulting in a “growing disillusionment in environmental managers” (p. 2418).

Stoll-Kleeman and Welp (2006) note that where there is a lack of a “bottom-up” approach, sincere local involvement in nature conservation related projects could become an implementation barrier. In these scenarios the communities will lack empathy towards the issues, and the researchers may neglect the experiences of the wider public when they are making and implementing decision. Similarly Reed (2008) notes there is a risk of “consultation fatigue” where from the participants where the process is not properly facilitated, therefore the public will have less involvement and influence in final decisions. In traditional “top-down” methods there is also concern that where citizens collect the data, their participation may not be authentic if the organizing stakeholders to not use this information in a deliberative way (Marshall and Jones, 2004).

Additionally where proper participation is not taken into account, the heterogeneity of the participating citizens and stakeholders will not be accounted for (Reed, 2008). Therefore, many times those who are affected by the decision are not well represented in the
participatory process; often times those who do participate have a higher than average socioeconomic status and do not represent the overall environmental and economic views of the population (Marshall and Jones, 2004).

It must also be noted that even where the proper principles of involvement and best practices are applies, critical situations can occur. By simply applying the best examples of public participation, there is no guarantee for success in any particular case, therefore despite best efforts, public participation is not stagnant by nature and may not always result in a successful turnout due to this characteristic (Luyet et al., 2012).

As with the advantages of citizen participation in government decision-making, there are also some disadvantages to this process. Table 2 summarizes these disadvantages.

<table>
<thead>
<tr>
<th>Table 2- Disadvantages of citizen participation in government decision-making (Irvin &amp; Stansbury, 2004).</th>
</tr>
</thead>
<tbody>
<tr>
<td>Disadvantages to citizens</td>
</tr>
<tr>
<td>Decision process</td>
</tr>
<tr>
<td></td>
</tr>
<tr>
<td></td>
</tr>
<tr>
<td></td>
</tr>
<tr>
<td></td>
</tr>
<tr>
<td>Outcomes</td>
</tr>
<tr>
<td></td>
</tr>
<tr>
<td></td>
</tr>
</tbody>
</table>

4.3 Models of Public Participation

Citizen science projects work in a variety of capacities, some working to assist researchers in the collection of data (Silvertown, 2009), while others focus more towards empowering “citizens as scientists” where citizens and scientists are treated as equals (Lakshminarayanan, 2007). The different capacities of participation from the citizens rely heavily on the model of public participation used in the research (Dickson & Bonney, 2012; Luyet et al., 2012). The varying scales of participation have been traditionally categorized into so called top-down and bottom-up structures (Conrad and Hilchey, 2011), however there are many different forms of citizen science projects, some based more on the desired scientific outcome or the degree of “control” that the citizens participating will have in the project (Dickson & Bonney, 2012). Additionally Berkes et al. (2009) notes that neither top-down not bottom-up directions are more desirable, but rather what is needed is a two way transaction among stakeholders in order to understand systems and observations on many different levels.

The following sections introduce several participatory models used in citizen science projects. Some of the models overlap in characteristics, however this section aims to explore many of the models in the current literature, despite similarities.
4.3.1 Arnstein’s Ladder of Participation
One of the most well known models of public participation is the model proposed by Shelley Arnstein in 1969. Arnstein notes that participation in processes such as government decision is truly the cornerstone of democracy. She proposes a ladder of participation, broken down into eight rungs and grouped into three categories. The first rungs of the ladder begin with the category of non-participation that includes: manipulation (the illusion of citizen participation in used a vehicle for power) and therapy (assumes citizens are powerless and activities engage them to change their opinions). The next rungs of the ladder under the category of tokenism include: informing (citizens are informed or decisions but with a one way flow of information they do not have input), consultation (citizen opinions are invited but often perceived as simple statistics), placation (citizens may have more power but tokenism is often still present). The final rungs of the ladder fall under the category of citizen power and include: partnership (power is distributed among citizens and traditional power holders), delegated power (citizens predominantly have the decision-making power), and citizen power (citizens are in full control and negotiate with other stakeholders if changes to current conditions are requested).

4.3.2 CAISE Model
The Centre for Advancement of Informal Science Education (CAISE) categorizes participation by focusing on the participant’s degree of involvement during the scientific process. The two main categories for participation and design of the projects are the contributory model, and the collaborative model. In the contributory model, the participants primarily collect data for the research, and submit their collection under some supervision of the researcher or facilitator of the project. Alternatively, the collaborative model involves participants to a great degree, and involves them with the development of the project and/or the analysis of the data (Dickson & Bonney, 2012).

4.3.3. Consultative, Functional, Collaborative, and Transformational
Lawrence (2006) uses a similar approach as the CAISE model but progress a bit further in the involvement of citizens. The participation models are organized into four forms: consultative, functional, collaborative, and transformational. Consultative is model by which the public contributes information to some form of a central authority, and functional is similar but also engages the citizens on implementing the policy or decisions. These two models are generally government or community lead, whereby the government has recognized a problem and potentially uses a community level approach to monitor the issue. While these two models generally lead to long-term data sets and are seen to been successful in the short term, they are quite dependent on government funding and have less diversity in their stakeholders. In the collaborative model, the public works more closely with the government or researchers in order to decide what the outcomes of the project should be, and additionally the public contributes to the knowledge creation process. This model involves a variety of stakeholders and individuals, and does not necessarily confine the project to distinct boundaries (for example the inclusion of an entire watershed). This model shares more of the decision-making power than the other models. Finally, the transformative model is where the local
people make and implement the decisions pertaining to their project, and the experts provide support only where needed. In this sense, this model generally takes the approach of community lead and funded, where they may be attempting to get the government to recognize the issues. These projects can be very successful with the support of the community and the stakeholders involved. However, the projects may not be very diverse (especially in terms of participants where the majority are interested activists), and there may be monitoring issues where they are not governed by legislation. Lawrence also notes that more traditional approaches to participation may miss changes which take place in individuals and groups of participations, therefore these changes necessitate that we think about participation, the environment, and governance in a variety of ways.

4.3.4 Consultation, Functional Participation, Interactive Participation, Self-Mobilization and Connectedness
The models proposed by Pretty et al. (1995) take on quite a few similar characteristics as Lawrence (2006). Pretty et al.’s four models of participation are: participation by consultation, functional participation, interactive participation, and self-mobilization and connectedness. In participation by consultation, citizens are consulted about a project insofar as answering questions. This model does not share the decision-making process with the public, and the researchers or experts are not under any obligation to heed to the public views. Functional participation is based on the idea that the public can contribute to a project by helping the researchers or experts to achieve their goals, frequently to meet predetermined objectives. This model is also frequently used to reduce costs of the project. The interactive model invites the public to participate in joint analysis processes and the development of plans for the project in order to strengthen the stakeholders. Finally, in the self-mobilization and connectedness model, the public takes the initiative to independently work on projects and change systems. The citizens develop necessary contacts with external stakeholders to seek out resources and advice.

4.4 Citizen Science
Citizen science is defined as the participation of the public, non-experts, or volunteers in research efforts to collect and/or process data for a scientific enquiry (Kruger & Shannon, 2000; Silvertown, 2009; Dickson & Bonney, 2012), these projects can utilize person of all skill levels, ages, backgrounds, and geographic areas (Gommerman & Monroe, 2012). While not restricted to natural science, the field of environmental science is one area that frequently engages citizen scientists, and has seen many successful projects (Silvertown, 2009), which can vary greatly in size, length of time, and level of participation from citizens (Gommerman & Munrow, 2012). Citizen science projects can be quite widespread and provide vital information for monitoring and assessment of environmental change (Berkes et al., 2009), as well as increase public awareness concerning certain issues (Gommerman & Munrow, 2012).

Silvertown (2009) notes in centuries past, most scientists were normal citizens with other professions to earn an income. At the beginning of the 19th century, we saw the rise of the scientist as a paid profession, however the citizen scientist has never disappeared. In fact the past few decades have seen a fairly dramatic rise in the participation of the public in
research projects (Conrad, 2006; Conrad & Daoust, 2008), which is noted as a valuable addition to NRM (Metzger & Lendvay 2006; Pittman & Dorcas 2006). The recent increase in citizen science projects have been fairly dramatic in the United States of America and Canada has been mostly attributed to increased awareness in public knowledge and unease concerning the anthropogenic effects on ecosystems (Whitelaw et al., 2003; Conrad, 2006; Lawrence, 2006; Conrad & Daoust, 2008) and concern about the adequacy of government headed monitoring of ecosystem (Pollock & Whitelaw, 2005). While the projects often have the capacity to attract a variety of different volunteers, many are already interested in the topic of the project and are interested in volunteering to learn more or help with research conducted in their area (Gommerman & Munroe, 2012).

Questions have been raised which concern the validity of the data that is collected by citizens as opposed to trained expert scientists. Gommerman and Munroe (2012) note that the majority of the studies conducted to answer these questions have found that where there is proper training and support for the volunteers, they are able to acquire data that is of equivalent value as scientists. In addition, many projects will develop fairly elaborate protocols that ensure the proper collection of data and for results that can be used in scientific work.

4.4.1 Benefits and Challenges of Citizen Science

Many of the benefits and challenges of citizen science projects are quite similar to those explored in section 4.2 regarding public participation. However Conrad and Hichley (2011) summarize the benefits and challenges, which are more specific to the citizen science on the community level; Table 3 summarizes these findings.

*Table 3- Benefits and Challenges of Citizen Science on the community level (Conrad and Hichley, 2011, p.282).*

<table>
<thead>
<tr>
<th>Benefits</th>
<th>Challenges</th>
</tr>
</thead>
<tbody>
<tr>
<td>Increase of environmental democracy (knowledge sharing)</td>
<td>Insufficient monitoring practices and quality assurance of data collected</td>
</tr>
<tr>
<td>Broader community and public education</td>
<td>Fragmented data, inaccuracy, lack of objectives</td>
</tr>
<tr>
<td>Greater social capital (volunteer engagement, problem-solving capacity, leadership)</td>
<td>Utility of the data (for decision-making and environmental management)</td>
</tr>
<tr>
<td>Public inclusion in local issues</td>
<td>Lack of proper experimental design</td>
</tr>
<tr>
<td>Data acquisition at low cost</td>
<td>Potential lack of interest</td>
</tr>
<tr>
<td>Increased ecosystem monitoring</td>
<td>Lack of funding</td>
</tr>
<tr>
<td>Drive proactive changes to policy</td>
<td>Monitoring for monitoring sake</td>
</tr>
<tr>
<td>Provide earlier detection to issues</td>
<td></td>
</tr>
</tbody>
</table>

Whitelaw et al. (2003) have noted ways in which projects are able to overcome the challenges outline above. Where there is potential disinterest or dropout in a project, these authors suggest positive reinforcement with the volunteers to ensure they are informed of how they are impacting the project, or to match the citizen’s interests more accurately with their tasks in the project. These authors also suggest collaborations with other organizations that have similar goals in order to improve networking and support for projects, as well as ensure that there is proper funding for a project before it begins for
greater overall success.

As mentioned, there is a great variety in the types of citizen science projects conducted. While some focus on species counts, others may focus on monitoring chemical levels or increasing the density of a forest. This research project specifically focuses in on citizen science projects that are associated with the management of freshwater resources in local communities. Berkes et al. (2009) note the area of watershed stewardship has seen great successful in terms of citizen science projects.

4.5 Freshwater Management
This section provides an overview of information about the management of freshwater resources to provide background information for the subsequent chapter, presenting the cases studied in this research.

Freshwater, which includes groundwater, rivers, lakes are closely linked to terrestrial systems (Magnuson et al., 2006), but only make up about 0.01% of Earth’s water supply, and 0.08% of the Earth’s surface (Dudgeon et al., 2006). The unit used to analyze this connection between aquatic and terrestrial systems is known as a watershed, which links the flow of water, chemicals (nutrients and organic matter), and organisms (Carpenter & Biggs, 2009).

People have been connected to the watersheds where they live for thousands of years as they were used in the past for travel in commerce (Carpenter & Biggs, 2009), while water today is seen as “the ecosystem service that is most likely to directly limit well-being in the twenty-first century” (Chapin, 2009, p.2). Freshwater is most notably used in human societies in economic, cultural, aesthetic, scientific, and educational terms (Dudgeon et al., 2006). Considering this close connection, watersheds should be treated as socio-ecological systems in order to create the most effective management processes (Carpenter & Biggs, 2009) while maintaining the essential roles of aquatic ecosystems in the hydrological cycle (Chapin, 2009).

Freshwater ecosystems are under significant threat due to water pollution, over-exploitation, habitat degradation, species invasion, and flow modification (Dudgeon et al., 2006). Carpenter and Biggs (2009) note that there are several issues with the sustainability of freshwater social-ecological systems, three of which outweigh the others. Firstly, freshwater use in many areas is quite intensive. Often the rate of extraction of water exceeds the rate of re-supply, which puts human needs in direct competition with ecosystem needs. Many cases exist where wetlands are drained, or rivers are fragmented for the benefit of human societies rather than ecosystems. Secondly, the degradation of freshwater supplies by chemical or biological drivers can cause many issues. Pollution from sources such as agriculture and urban water can cause eutrophication and sanitation issues, which are cause problems in many parts of the world. Eutrophication results in blooms of cyanobacteria, along with oxygen depletion, fish kills, and taste or odor issues with drinking water. Eutrophication can be cause by improper sewage discharge, or runoff from fertilizers (phosphorous and nitrogen are often used as a main plant nutrient
which have large environmental impacts). Lastly, since water sources are a basic need of life, where the supply is limited conflicts may arise and management tradeoffs are required. With climate change, much pressure is being put on the institutions that manage these situations and on the ecosystems.

Specific to management of water resources, due to the complexity and specificity of the issues surrounding this resource, more collaborative and integrated management approaches are required than in the past. Traditionally, water management processes have been highly centralized, but many regions are now turning towards more decentralized approaches that further involve the users themselves (Carpenter & Biggs, 2009). Research has indicated that these techniques, where users are involved in the decision-making processes of the rules that govern their water resources, are more likely to abide by the rules and follow through with monitoring processes in comparison to authorities imposing said rules (Dietz, 2003). The involvement of users in this process also facilitates further creativity, which will generate more effective outcomes for the management of water resources (Carpenter & Biggs, 2009). Walker and Strashok (2010) note that were citizens are able to work with their specific watersheds in manageable pieces, governments are required to oversee multiple watershed which can become very time consuming, thus governments are increasingly acknowledging citizen groups as an integral part of the water management process where they are able to fill in the gaps.

5. Natural Resource Management Projects In Canada And Sweden
This chapter aims to give an overview of the cases and projects used in this research. As the research focuses on projects in two parts of the world, Canada and Sweden, this section explores public participation in freshwater management projects in each nation to gain a better understanding of the necessary background. In each of the cases, the political atmosphere of public participation in NRM and the projects studied are presented. Before the overview of the specific cases, principles of freshwater management are first presented for additional background information.

5.1 Canada
5.1.1 Political Atmosphere of Public Participation in Natural Resource Management
Politically Canada is arranged using a federal system of parliamentary government. Administratively, the country is organized into Provinces and Territories. Affairs are run under the federal or provincial jurisdiction dependent on their nature, and in some cases under both. The division of this power is stated in the Constitution Act, written in 1867 in the formation of the nation. There is also a third level of political power, which is on the municipality level. This is a community level of politics, managed by the elected Members of Parliament (MPs) at the time of a federal election. Separate from the MPs is the elected position of Mayors who serve on a city level.
Canada has two main political parties who are in power at any given time, the Conservative Party of Canada (right-of-centre) and the Liberal Party of Canada (left-of-centre), with two additional parties with generally less power (among many other less prominent parties). In recent history of this research, the Conservative Party held power for 9 years, with a recent turnover in November 2015 to the Liberal Party.

In Ontario the Environmental Bill of Rights (EBR) was enacted in 1994, which provided rights to people to have a healthy environment, and to have a common goal or protecting and conserving the natural environment, and is followed by both the Ministry of Natural Resources (MNR) and the Ministry of Environment and Climate Change (Government of Ontario, 2015). The MNR takes interest in areas such as resource extraction and concerns with biota, while the Ministry of Environment and Climate Change is more concerned with toxicity and general environmental protection (Rees, 2016). From a federal standpoint, the Canadian Environmental Protection Act (CEPA 1999) was established in 1999 and provides a variety of regulations for environmental issues (Government of Canada, 2009).

In terms of to public participation in NRM and environmental decision-making, CEPA 1999 notes that citizens have the ability to influence environmental problems, and engage with a variety of stakeholders where decisions are being made. The citizens also have the right to report acts that cause the environment significant harm to the Minister who should conduct and investigation of the allegation (Government of Canada, 2013). Specifically relating to water management, the Canada Water Act provides a platform for federal and Provincial/Territorial government to collaborate on water related issues. The gives primary jurisdiction over water management to the Provinces and Territories, except on federal lands (such as National Parks). At times the Provincial authorities will delegate the management of water resources to Municipal authorities. Additionally at times the Federal and Provincial government will collaborate to manage resources, which regularly occurs where monitoring and conservation projects are concerned (Government of Canada, 2015).

A great challenge in water governance relates to the fact that governments are not able to do everything, particularly where financial resources are limited (Walker and Strashok, 2010). One of the ways in which the Province of Ontario deals with this issue is through Conservation Authorities (Participant 1, 2016). In Ontario, there are 38 Conservation Authorities that are “are community-based watershed management agencies dedicated to conserving, restoring, and managing Ontario’s natural resources on a basis” (Conservation Ontario, 2016). Citizens groups are also able to break off small areas of watershed in order to complete work themselves, which is where many community organizations and NGOs who work on a not-for-profit basis come into play. Many of the lakes in Ontario have a Lake Association, which is for the most part a volunteer driven organization that helps to inform citizens living on the lakes about news, concerns, and points of interest; the Lake Associations as “associations that come from the community” (Hunt, 2016). Many of the Lake Associations join larger umbrella organizations that create communication between the Lake Associations resulting in further collaboration. At times the Lake Associations or the umbrella organizations are in close contact with
government representatives (on the Provincial or Municipal level) in order to protect and manage their lake effectively. While for some this has proven to be a useful relationship, in other cases there are difficulties in this type of communication. Walker and Strashok (2010) note, “governments and community members are increasingly recognizing that non-government actors like citizens, non-government organizations, and business are essential to effective water management” (Sustainable Development Characteristics). The authors argue that there is thus a need for greater collaboration between community-based organizations that are involved in a variety of activities including water quality monitoring and water education or outreach, alongside the main decision-makers in order to create sustainable management practices of natural resources.

From previous research in community-based resource management in Canada by Walker and Strachok (2010), there has been an indication that relationships between community groups and decision-makers must be enhanced for effective results and to overcome obstacles. The research also indicates that at times there are conflicting priorities between citizen-based monitoring groups and the traditional decision-makers, which has lead to differing visions of the project at hand. The authors further indicate legislation and the traditional approaches to managing water resources are not properly equipped to undertake the challenges associated with these practices in the future.

Many believe that under the Conservative rule in the past several years, Canadian democracy and support in terms of funding towards scientific pursuits took a heavy hit (Faren, 2015). Many claims were made during this political rule that as scientists became “muzzled” during these years and are now freed upon the political turnover in November of 2015 in conjunction with the election of a new Science Minister (Gatehouse, 2013; Hume, 2015; Plait, 2015).

5.1.2 Projects Studied
As Canada is an extremely large and vast country, this research needed to be focused on a smaller region in order to have a feasible research outcome. For this research, the area of focus is the southern portion of the province of Ontario (Figure 3). Ontario is the most populous province in Canada, with about a population of about 13.6 million and approximately 94% of people are living in the Southern portion. Much of this population lives in larger cities, and a great number of smaller towns scattered across the province. This research mainly focused on the smaller towns or rural areas where people are living near freshwater lakes. The province of Ontario has over 250,000 lakes.
Fig. 3. Province of Ontario in Canada.

Ontario hosts a many citizen science projects with great variety. Many of these projects are focused on species counts, where citizens are engaged in recording frogs, birds, plants, etc. for researchers. While some of these projects can give some indication of the state of a particular natural resource in the presence of certain species, for the purposes of this research these types of citizen science projects were not the main focus. Rather the focus was put on the projects that engaged citizens directly with natural resources. From the available projects to study, water bodies were by far the common resource used in citizen science projects, thus this research focused in on these projects.

In North America, citizen science began primarily in the United States of America where it worked off a model that used the professional retiree as a resource to carry out projects, since this demographic was interested in being engaged in scientific work and had a host of skills to share. The governments could easily use this demographic to fill in gaps with reliable and free labor to collect data, which is generally a time consuming process (Lawrie, 2016).

In Ontario there were a few different options for projects to study, however upon close examination, none of the projects were sufficient to be used as a traditional case study in comparison to the Swedish project studied. This was decided since the projects either were too large in scope to be labeled as community level projects, or they did not have enough citizen participation to justify a comparison. For these reasons, four different projects were studied: the People, Aquatic Plants, and Healthy Lakes project, the Lake Partner Program, the Citizen Scientists of the Rouge Valley, and the Citizen Scientists of the Couchiching Conservancy. The first two projects were studied in more depth since they have more links to Lake Associations and other organizations that span more of the province.

People, Aquatic Plants, and Healthy Lakes
The People, Aquatic Plants, and Healthy Lakes project is a joint collaboration between several stakeholders: the Rideau Valley Conservation Authority (RVCA), The Friends of
the Tay Watershed, and Carleton University. The partnership works with many Lake Associations, which are organized through another entity called the Lake Networking Group (LNG). Through this partnership, the project aims to understand why increased algae blooms and excessive plant growth is occurring on the lakes in South-Eastern Ontario (RVCA, 2016). The project began in 2013 when over 300 people living on the lakes were surveyed by the RVCA about their concerns regarding the algae and plant growth, which showcased the concern of the citizens living on the lakes (Brady, 2016). Since the lake users had concerns with the algal growth on the lake but the records of such growth only goes back until the mid 1990’s, a researcher at Carleton University become involved in the project to take core samples to determine the base level of water quality over the past 150 years (Vermaire, 2016). With a noticeable increase in the presence of algae and aquatic plants over the past decade, the project aims to determine why the excess growth is occurring, and what measured concerned citizens can take. The project also launched an app called “Citizen Water Watch” that allowed citizens to report algal blooms or excessive plant growth on their lakes. Citizens could also report these sighting directly to the project facilitator (Brady, 2016). While the partners are carrying out the project, the local communities presented the initial idea and concern for the lakes in the area. With the issues established, funding was needed to advance with the project; this was acquired through the Ontario Trillium Foundation in 2014 and was granted to the Friends of the Tay Watershed who manage the financial aspect of the project (Participant 1, 2016). The Ontario Trillium Foundation is a provincial source of government funding. This project hosts a website at: http://rvca.ca/programs/algae_watch/index.html

The Lake Partner Program
During the 1970’s in Ontario, phosphorous levels were found to be leading to algal blooms in many lakes, at which time a “self-help” program was created which involved volunteers in monitoring programs to look at lake cores and water clarity. In 1996 the Lake Partner Program (LPP) was established as a Ministry of Environment and Climate change program that provided tools for volunteers to sample lakes, and the samples were subsequently analyzed out of an office in Toronto, Ontario. In 2002 the program headquarters moved to Dorset, Ontario, and after this time the researchers employed by the Ministry to work on this project started to be able to get much higher quality data sets from the sampling procedure (DeSellas, 2016). The LPP is a volunteer-based water quality-monitoring program. The program has a formal partnership with the Federation of Ontario Cottagers’ Association (FOCA), which is another umbrella organization that provides 500 Lake Associations with information and support (Rees, 2016). The program also works closely with other organizations such as: the Lake of the Woods District Property Owners’ Association (LOWDPOA), the Central Algoma Freshwater Coalition (CAFC), and other conservation authorities, Lake Associations, and non-governmental organizations. Currently this program has approximately 600 volunteers per season who sample 550 inland lakes at 800 different locations. The volunteers are sent kits that contain all the necessary instructions and materials to collect water samples, which are then sent with pre-paid postage back to the DESC (DESC, 2016). Historically the water was primarily sampled for phosphorous levels since this is directly attributed to algae levels, but also now is sampled for calcium and chloride concentrations (DeSellas, 2016). This project hosts a website at: http://desc.ca/programs/lpp
Citizen Scientists of the Rouge Valley Conservation Authority

Citizen Scientists was established in 2001, and focuses on monitoring stream health in the Rouge River Watershed in Toronto and the Greater Toronto Area (GTA). As a volunteer driven and not-for-profit group, the organization strives to educate volunteers, foster local stewardship, and monitor local watersheds (Citizen Scientists, 2016). The project is quite hands on, and trains volunteers in the essentials of water quality monitoring, and for this reason attracts a lot of student volunteers who are looking to acquire skills for prospective careers in NRM. The trained leaders are able to help other volunteers in the monitoring process that helped with the efficiency of the project, but was also quite costly if these leaders did not stay on in the long term. The project overall has had difficulty in retaining volunteers from season to season (partly due to the student involvement), but has seen success in collecting a ten year data set which is in the process of analysis and restructuring for subsequent projects in the future. Funding for this project has come entirely from grants (primarily banks or charitable funds, no government funds), which tends to expend a lot of time and resources (Lawrie, 2016). This project hosts a website at: http://www.citizenscientists.ca/Volunteering.html

Citizen Scientists of the Couchiching Conservancy

The Couchiching Conservancy works in the area of Orillia, Ontario and is a non-profit, non-government land trust, which has helped protect 11,000 acres of land since 1993 (Couchiching Conservancy, 2011). With the realization that collecting water quality data is difficult for one researcher alone, a citizen science project was started last year in order to engage local volunteers to help in monitoring the water quality on their properties. The teams of volunteers test the water on their assigned sites twice per month for levels of elements in the water such as phosphorous and nitrogen (Coughlin and Aggerwal, 2016). In the future the project hope to efficiently sample all water entering and leaving their properties and build larger citizen science programs relating to climate change and species adaptation (Hangaard, 2016). The Couchiching Conservancy website can be found at: http://www.couchichingconserv.ca

5.2 Sweden

5.2.1 Political Atmosphere of Public Participation in Natural Resource Management

Sweden is based off of a parliamentary representative democracy, and also has a monarchy. As in Canada, the power of the nation is lead by the Prime Minister, chosen by an election every our years in a multi-party system. The Swedish Constitution determines the way in which the nation is governed, made up by four fundamental laws: the Instrument of Government, the Act of Succession, the Freedom of the Press Act, and the Fundamental Law on Freedom of Expression. Every four years elections are held for all eligible voters to elect members to the Riksdag, Sweden’s primary representative forum. The Riksdag is a decision-making entity, while the Government implements these decisions. (Swedish Institute, 2015).
On the smallest scale, Sweden is divided into 290 municipalities with an elected council in each. The municipalities are responsible for a variety of matters such as housing, water supply, schools, and welfare. The municipalities have the power to make decisions in the areas which they govern thus there may be provide differences in the services they provide, as well as their tax levy on citizens. Regionally, 20 counties govern Sweden. County councils work to oversee matters that are more difficult to coordinate across municipalities. Additionally on the international level, in 1994 a National referendum was held and Sweden joined the European Union (EU) in 1995. As a member, Sweden must abide by legislation, legal acts, and court decisions of the EU. Where certain decisions were made in the past by the Riksdag, they are now decided by the EU (Swedish Institute, 2016).

Sweden has many different political parties, in order to gain official representation in the Riksdag or European Parliament however the parties must gain at least four percent of the vote. The parties with current official representation are: Swedish Social Democratic Party, the Moderate Party, Sweden Democrats, the Green Party, the Centre Party, the Left Party, the Liberals, the Christian Democrats, and the Feminist Initiative. From 2006 to 2014 a four-party coalition government called the Alliance (right-of-centre) maintained rule over the nation, but did not have a majority rule as of 2010. In 2014 the power shifted to a coalition between the Swedish Social Democratic Party and the Green Party (left-of-centre), but did not gain a majority (Swedish Institute, 2016).

In Sweden, the principal overarching environmental law is the Swedish Environmental Code, which came into action in 1999. This code merged fifteen environmental acts that previously governed environmental concerns. The intent of the creation of the Code was to update the Swedish environmental legislation in order to sufficiently address environmental problems and goals for sustainable development. The Environmental Code serves to protect and preserve natural resources, lands, and biodiversity, as well as determine certain environmental quality standards and promotes sustainable development for the future (Swedish Environmental Protection Agency, 2016).

In terms of water management, the EU Water Framework Directive (WFD), which came to fruition in 2000, sets the agenda for the EU. The WFD touches on both the natural science elements of water management through standards of chemical limitations and using practices which make ecological sense, as well as social standards, namely in terms of public participation in the management process. In opposition to the natural science standards, the public participation element is much more open to interpretation and is defined by each Member State (EU, 2000, article 14; Nielsen et al., 2016). For Sweden, the WFD was brought into legislation in 2004, which resulted in the formation of a governmental body called the Water Authorities who were made accountable to the national government. The Water Authorities cover five districts: Gulf of Bothnia, Bothnian Sea, North Baltic Sea, South Baltic Sea and Western Sea. While the Water Authorities are responsible for implementing the WFD on regional and national levels, the local level implementation is covered by the County Administrative Boards (CAB), which includes the elements of public participation. Public participation is stressed in Sweden in terms of the WFD (Vattenmyndigheterna, 2016a), to do so the CABs are able
to use “water boards”. The water boards are forums for which allows everyone to participate in water management, and create a link between various affected stakeholders and the public on local or regional levels (Vattenmyndigheterna, 2016b). Some CABs offer financial support for the operations of the water boards, however this is not always the case (Nielsen et al., 2016).

Hansen et al., (2016b) summarize the Swedish perspective on participation in NRM. During the political leadership of the Social Democratic Party after the 1998 election, nature conservation and outdoor recreation and with greater financial support, new policies favored local level nature conservation including public participation. Despite resistance from the Swedish Environmental Protection Agency (Naturvårdsverket), the national government presented a strong democratic policy for citizen driven governance for NRM in 2005. However, due to a change in party leadership in 2006 and the continued resistance from the Swedish Environmental Protection Agency, the policies aforementioned were no further institutionalized.

5.2.2 Projects Studied
Similar to Ontario, Sweden boasts many lakes, over 97,500. This project focused on a lake in the Uppland County, which has a population of approximately 1,433,000 with the majority living in Stockholm and the surrounding area. The Uppland County is divided into eight municipalities, the focus in the research are the municipalities of Tierp, Heby, and Uppsala (Figure 4).

![Map of Uppland County in Sweden and the three main municipalities of this research located in the Uppland County.](image)

*Fig. 4. Map of Uppland County in Sweden and the three main municipalities of this research located in the Uppland County.*
In opposition to the more traditional citizen science projects conducted in the first case, this case focuses on citizen involvement in the management of freshwater resources in a more unconventional format. For this reason, the management practices explored diverge greatly under different circumstances, thus only one lake and one project was studied in order to fully understand the format utilized.

The focus lake for this case is Lake Tämnaren, which is located about 100 kilometers north of Stockholm and 50 kilometer north of Uppsala in the Uppland County (Figure 5 and 6). With a surface area of approximately 38 square kilometers, it is located at the junction between three municipalities: Uppsala, Heby, and Tierp and falls under the administration of the CAB of Uppsala. The lake is connected to several rivers, the Fyris in the South (flowing out of the lake) and the Tämnaren River to the north. The lake is shallow, ranging from about 1-1.7 meters in depth, with areas in the Southern portion so shallow that they are more of a marshland (Nielsen et al., 2016). The lake used to be much larger that it is today, and the water level has been lowered twice, in 1871 by 1.1 meters and 1951 by about 50 centimeters. The lake continues to get shallower with the land rising following the last glacial period, in addition to agricultural developments releasing soil into the lake, which settles to the bottom (Tofters, 2016). Since the lake is so shallow, there numerous problems for those living around the lake flooding at time of increased precipitation, and mosquito swarms in times of decreased precipitation. The level of the lake by law must not decrease beyond 34.32 meters above sea level, nor exceed 35.24 meters above sea level as decided by a court decision in 1973 (Nielsen et al., 2016), which is an order owned by Uppsala municipality (Tofters, 2016). Around this time Uppsala municipality gave financial compensation to the owners in the south of the lake whose properties where in low laying wetland areas (Tofters, 2016).
In 2007, concerned citizens formed a water board and in 2008 they contacted the CAB of Uppsala to establish the Lake Tämnaren Water Board (TWB), which also worked closely with researchers from the Swedish University of Agricultural Sciences (SLU) in Uppsala. While the first TWB meetings were held in the CAB venue in Uppsala, they soon expanded to include the communities from around the lake to share in their perspectives. While the TWB members were diverse in their interests, the researchers at SLU identified a risk that the water board would be used as an instrument by the authorities of the CAB, and thus it was suggested that the TWB persist as an independent organization and have a primary function of advocacy within the community (Nielsen et al., 2016; Tofters, 2016). In 2014, a new organization took over from the TWB. This organization is called Tämarens Vatten, or Tämnaren Water in English (Nielsen et al., 2016). Since taking over, they have continued to be engaged in community workshops, meetings, and collaboration with University researchers (Nygren, 2016). Since the lake falls between three different municipalities, Tämnarens Vatten has attempted to collaborate with all of them to work together. They received interest from the Tierp and Heby municipalities early on in 2015, and also eventually gained the interest of Uppsala municipality in April 2016, therefore in the future board members from all three will be present at the organization (Nygren, 2016).

TWB depended on financial support from the CAB, the Water District, and donors. In 2009 the TWB received a grant of 100,000 Swedish Kronor from the Water District that was primarily used for venue and food expenses and not salaries to continue the momentum of the organization (Nielsen et al., 2016). Since then the primary income has been from membership fees (including community members, organizations, and municipalities), and from visiting students (approximately 1500 SEK per year) (Nygren,
The issues with the lake can be summarized as follows:

- The lake is shallow which allows more sunlight to reach the bottom of the lake and increases plant and algal growth (Nygren, 2016).
- The lake continues to become shallower as the years pass as farm land is eroded (and carries in harmful nutrients that increase growth as well) (Elvingsson, 2016).
- Water is flowing out of the lake from locks in the north to the Tämnaren River, this is a requirement following the court order owned by Uppsala municipality.
- It is difficult to consider solutions such as dredging the lake to make it deeper since this is a costly process (Tofters, 2016).
- The properties in the south of the lake in the Uppsala municipality region are low lying and therefore are susceptible to flooding if the level of the lake is higher (Toft, 2016).
- It is difficult to get all affected parties and municipalities to collaborate and work together towards a solution (Nygren, 2016).

6. Results

As the results touched on a variety of topics, each of the cases presented are broken down into subsections in order to better understand the information. The subsections include: motivation of those involved with the projects and obstacles to involve the public, public engagement and the structure of the projects studied, democratic themes and government involvement, knowledge production, and overall challenges of the projects. For the purposes of presenting this research, the term ‘participant’ will be used to indicate a participating interviewee, while the term ‘citizen’ indicates a member of the public participating in one of the projects that is being researched.

6.1 Motivations

6.1.1 Ontario

Many of the participants in this research were motivated in their projects due to personal connections to the lakes or rivers and their associated problems. The participants often spent a significant amount of time at their lakes or rivers, and usually felt an emotional connection to the areas of concern (Alps, Lawrie, Hunt, Garrett, Bell, Kilburn, MacDonald, Rees, Miller), and care for the health of their environment in order to enjoy it in the future (Rees). In this sense there is a strong correlation between sense of place and having the motivation to participate and care about a resource or project, with one participant noting:

“They [volunteers] also want to get involved in projects where they can feel a sense of ownership about a particular place. And so we set up this project with that in mind where the volunteers are assigned a site, and that will be their site for as long as they wanted it. And what we find when we do that is a huge amount of buy in” (Hangaard).
Some participants also noted a lack of interest from the public and motivation to become or stay involved with management projects. In many of these circumstances there were a few dedicated members who carried out the majority of the projects (Participant 1, Brady, Lawrie). Suggestions for disinterest in NRM from the public include:

- The condition of the environment is not a priority in comparison to the economy and job security for many Canadians (Alps)
- Until people are personally affected by issues concerning lakes, they do not get involved with management activities (Hunt)
- Some people would prefer to go to their property on the lake and relax for the weekend and simply do not care about the environmental issues (Brady)
- Canada is vast with many remaining natural areas, therefore without an attachment to a certain location people can easily find nature in an alternate location if one is degraded (Lawrie)
- Many people in Ontario are now living in cities and have different ideas of what nature is supposed to look like compared to generations past (Rees), or do not think as much about environment issues when living in a city (Alps)
- Citizens do not want to report negative events such as algal blooms near their property in fear their property value will go down in the future (Brady)
- People are sometimes more interested in very short term “feel good” projects to feel they have made a difference rather than committing to a long term monitoring project (Lawrie)

6.1.2 Lake Tämnaren

The motivation to be involved with the management of the lake is tied to a sense of place and, as well as to restore the lake for future generations (Ohlsson, Ekman). Many of those involved in the organization to restore the lake live at the lake, have summerhouses near the lake, or use the lake for recreational purposes such as boating and fishing (Ohlsson, Ekman). Participants also noted fond memories of growing up near the lake (Tofters, Eriksson), with anecdotes such as:

“I remember when I was a little child in the summer my father and mother took us three children out in a little boat and then we were staying some weeks on a little island in the lake… still I have some images of that” (Tofters)

However, the involvement and interest of the public in Tämnarens Vatten was not immediate and a considerable amount of effort was put into engaging those living around the lake (Ohlsson). It was particularly difficult to convey the messages to those that would be affected by a rising water level (Ohlsson). On top of the fact that Tämnarens Vatten is made up of concerned citizens and therefore is already engaging the public, after a decade or work (including the years as the TWB) the organization has succeeded in many ways to help citizens around the lake understand and interest in the organization (Ohlsson, Nygren). In this sense public involvement has been extremely high in this project, along with strong motivations from the citizens.
6.2 Public Engagement and Involvement in the Projects

6.2.1 Ontario
In general, the engagement of the public in freshwater NRM in Ontario is highly focused towards two objectives: monitoring and education or outreach. In terms of monitoring, projects such as the Lake Partner Program and the Citizen Scientists of the Couchiching Conservancy involve citizens by guiding them in collecting water samples, either on their own with easily accessible remote support or support from their area (DeSellas, Hangaard). In these cases, the citizens are trained in the protocols and very actively engaged to help with research ongoing in their areas of interest, while researchers or coordinators work closely with the citizens to maximize their experience and outcomes of the project. In these two particular projects there has been very high interest from the public to participate and become actively engaged, and the citizens are quite satisfied with their level of engagement (DeSellas, Hangaard). The Citizen Scientists of the Rouge Valley also practiced monitoring, in addition to providing more in depth training programs to increase the leadership role of those who wished to become involved (Lawrie). The People, Aquatic Plants, and Healthy Lakes project also attempted to engage citizens with their Citizen Water Watch program to monitor algal blooms (Brady, Yee, Vermaire). The latter two projects, while they did have very keen interest from some dedicated citizens, they were not always able to retain the interest or reach as many citizens as anticipated, noting:

“You get a lot of people who are really engaged, and it’s sort of the same people I think over and over again, but I’m not sure that you can do much about that, at least you have the people who are really engaged…” (Vermaire)

Outside of the strictly monitoring projects, there is also involvement from citizens in Lake Associations and umbrella groups such as FOCA, LNG, and the CAFC. In all Lake Associations contacted the board members were all volunteers and elected to their positions, as were many of the board members in the umbrella organizations (Miller, MacInnes, Garrett, Bell, Kilburn, MacDonald). Many of the Lake Associations have been operating for decades, and work to protect the health of the lakes and educate the citizens who live at or frequent the lake. The Lake Associations are highly local and are a collaboration of community members concerned for their lake (Hunt, 2016). The Lake Associations, umbrella organizations, and monitoring projects often attempt to share their messages about their concerns for the lakes to educate others and to recruit new members or participants through a wide variety of tactics, including: apps, websites, electronic correspondence, community events, newsletters, television media, radio interviews, community presentations, Facebook pages and open meetings (Brady, Vermaire, DeSellas, Participant 1, Hunt, Garrett, Bell, MacDonald).

6.2.2 Lake Tämnaren
Since the formation of TWB and subsequently Tämnarens Vatten, the organizations have been working to engage citizens around the lake in order to change their perspective about the management of the lake, and to have people join together to restore the lake (Ohlsson, Tofters, Nygren). In the last ten years the organizations have engaged in a lot
of marketing and promotion of the lake (Tofters, Nygren), which was done in hopes to allow the people to form opinions about the lake that would influence the municipalities in order to make the necessary changes to restore the lake (Ohlsson).

In the beginning of the TWB most of the work was done by the secretary and the chairman of the organization to try and engage citizens around the lake, as well as the politicians of the affected municipalities (Ohlsson). There are approximately 4000 citizens who live in the communities around the lake, and 500 of those of those live within 2 kilometers of the lake, and it is estimated that 100 of these citizens have participated in the organizations (Tofters). To engage the citizens there were meeting held in many different areas of the lake, but it was noted that

“it takes time when you work with the local people, we cannot say as perhaps politicians could do earlier- ‘just plan this, and now we do, this and now we decide this’- because we have about 500 people living and staying around the lake” (Tofters)

Therefore it has taken time to engage many people. Many tools have been combined to do so though, including: the creation of a website and Facebook site, posters in local grocery stores, public meetings, advertisements in newspapers, and features on the radio and television (Nygren, Tofters). The collaborations with the researchers from SLU have also helped to understand and guide the issues with the lake (Ohlsson, Nygren). With a more scientific perspective it has been easier to change the opinions of the people living around the lake (Tofters).

Relating to the level of engagement, there has been some keen interest in the project from a variety of people including farmers, landowners, and those who enjoy recreation activities, but it is a bit difficult to get everyone involved (Nygren). There has been some increased interest over the years from new property owners since they are investing for the future and would like to see the lake restored (Ohlsson).

6.3 Democracy and Government Involvement

6.3.1 Ontario

Many of the participants of this research expressed that it is important to involve the public with the issues at hand (Vermaire, Hunt, Participant 1, Hangaard, Alps), expressing positive remarks such as:

“Public participation is important, you know, people have to take that ownership, that responsibility for what’s happening for wherever they are in this world of ours and how you get the most of the communities to participate in the best way.” (Hunt)

“I think that’s important when you’re in that type of project, to have a mix of people, you know you need the scientists to do the science work, but you also need your citizen people, volunteers… I think it’s important to have that mix because it gives you a better balance of the whole outlook of what is going on.” (Alps)
“I feel like the kind of grassroots initiative where you are truly engaging the community in the environment, I think is exactly what society needs right now.” (Hangaard)

The Lake Associations are very locally driven since they are built as organizations by the people and serve the needs of their members and the lake (Hunt), and in some cases they are created by concerned citizens who hope to influence local government on behalf of the community (Garrett). The Lake Associations elect their board members every few years, and they do carry out numerous projects that are of concern to the citizen living or frequently visiting the lake (Garrett, Bell, Kilburn).

However, where larger scale monitoring activities occur, there seems to be a tendency for citizens or organizations to require the support of Conservation Authorities, Conservancies, or the Ministry of Environment and Climate Change. This was noted since the smaller organizations do not have adequate funds and resources in order to carry out detailed projects in the long term in a scientifically defensible way (Rees). For example, Lake Associations have the option to do their own monitoring and testing, but it is much more financially viable to do the monitoring through the LPP since they provide all the necessary resources and support for the project (DeSellas). All of these projects noted that they do provide participating citizens with the opportunity to voice concerns and ask questions where experts are guiding research or management practices. One participating citizen in this model of project noted:

“I felt, there’s scientists in the working group who know a lot of stuff, and a lot of stuff I don’t really understand, but they’ve always been open to questions and ideas…” (Alps)

Additionally some projects such as the People, Aquatic Plants, and Healthy Lakes project began with understanding the concerns of the citizens, and the coordinators and researchers used their input to design the project (Brady), and the project is therefore perceived as a project created by the people (Participant 1).

In relation to the wider context of government involvement, a couple of the projects directly related to the government through Conservation Authorities or as a project of the Ministry of Environment and Climate Change. Many of the other projects that are not directly affiliated noted that they do need interest from the government in order to achieve successful outcomes (Alps), or for guidance and information (Garrett). A couple of participants noted the role of the government is necessary in NRM given the disinterest of the majority of citizens or the mindset of Canadians (Participant 1, Rees), explaining:

“In Canada we think governments should be looking after things, we have an idea of what the role of government in Canada is in terms of taking care of our natural resources and our well being and our social infrastructure and everything else and… whether that’s citizen science or day care programs we kind of have an idea in our heads as what our role as citizens is, but certainly the government plays a strong role, it’s a cultural thing” (Rees)

However, problems arise where citizens are disappointed by the involvement of the government. The government has been in retreat of in terms of financial support and the delivery of programs (Miller), and has been seemingly more concerned with their income
and tax base (Alps). Thus there is a need for volunteers to pick up the pieces, where one participant notes:

“Politics and science don’t mesh really well, because at least in Canada the political terms are 3 or 4 or 5 years, and often the environmentalists require a longer term outlook, so that’s when having continuity delivered through to volunteers particularly who are unpaid and committed in their own right is very important” (Rees)

6.3.2 Lake Tämnaren
While Tämnarens (and TWB) is looking to engage citizens, the members of the board and those heading the organizations over the years are citizens themselves. They too have roots at the lake, and are involved because they are concerned about the future of the lake. They volunteered for the positions they hold and are not compensated financially for their time and effort (Nygren, Ohlsson, Tofters).

The project has created a space for the people to discuss their opinions and understand different points of view. Citizens did take concern however that there was not enough focus on taking action in the project (Ohlsson), and this research reflected that there are two main opinions on what actions need to take place: funding (discussed in section 6.5.2), and government involvement.

As the lake lies in three different municipalities, all of their cooperation is necessary for the proper management of the lake (Nygren). It has been a bit difficult for the municipalities to cooperate together thus far for the following reasons:

- The WFD was not entirely direct in stating how politicians should deal with these types of issues, therefore for a long time nothing was done without short term deadlines for them to meet (Ohlsson)
- The municipalities have different interests. For the municipalities of Tierp and Heby, they have been quite interested in the issues, and would like to see the lake restored to an appropriate water level (higher than the current level) (Eriksson). Uppsala municipality is interested in the lake for its drinking water (Nygren), and some of the properties in the Uppsala portion of the lake are low lying and would be affected by raising the level of the lake (Tofters)
- With the changeover in political leadership in 2014, the organization had to start fresh with their political contact in the Uppsala municipality (Nygren, Eriksson).
- The court order which dictates how much water from the lake is let out into the Tämnaren River is owned by Uppsala municipality, therefore can only be changed by them (Eriksson, Ekman)

While a much smaller portion of the lake is located in Uppsala municipality, they have quite a bit more power in terms of resources and funding than the other two municipalities (Eriksson, Elvingsson). Thus it is absolutely necessary to involve the municipality of Uppsala in any kind of restoration of the lake, which has been met with some difficulty thus far (Nygren, Eriksson). Almost all of the participants noted that in order for anything to be done to restore the lake in the future, they need the support and resources of Uppsala municipality (Eriksson, Elvingsson). Tämnarens Vatten is a critical
actor in the community that acted in gaining the recent support of Uppsala Municipality (Nygren, Eriksson).

6.4 Knowledge production

6.4.1 Ontario
Views and practices of the production of knowledge were fairly varied in the projects across Ontario. Firstly, from the more scientific oriented projects, researchers and coordinators noted that citizen engagement was quite crucial in producing data to spur on the research. In the People, Aquatic Plants, and Healthy Lakes project the researcher noted that if there were enough public interest the citizens would be able to help with the research and also learn more about the issues at hand (Vermaire). Additionally the coordinator for the water-monitoring project of the Couchiching Conservancy noted that although experts play an important role in NRM, they cannot be everywhere, and thus citizens can make important observation on the ground (Hangaard). The same coordinator also noted that not all researchers share this opinion by adding:

“Citizen science happens in Canada, it’s not very organized, it’s not that well spread… but I don’t think it’s being taken seriously enough, and we frankly want to take it seriously, and we want to build a full program in our organization of citizen science.” (Hangaard)

Secondly, while the umbrella organizations such as the LNG group serve well as a platform for sharing knowledge among the Lake Associations (Hunt), the scientific work that is carried out can be removed from the actual citizen engagement (Vermaire).

Thirdly, it was noted that there are some projects that engage the public but are heavily focused on creating outcome and not outputs. One participant noted that a lot of the funding for NRM is going towards projects that have high outputs such as tree planting programs, but rarely does funding go towards allowing projects to produce appropriate knowledge over the long-term to find the best outcomes (Lawrie).

Finally, some engaged citizens were skeptical of the idea that they would be able to impress a serious scientific impact with their efforts

“The notion that citizen scientists can adjust the footprint of this society on the planet without dedicated [and] interested well funded civil servants, it’s just ridiculous… Leaving these matters up to private corporations with their own agendas is dangerous in the long run. The population should be involved to the point of encouraging and understanding everything, but the idea that serious study or policy decision making, any of that kind of thing can be done without a proper scientific background, it’s just not on… the best will in the world is not going to make me into a biologist.” (Participant 1)

6.4.2 Lake Tämnaren
This project worked outside the bounds of traditional citizen science, concerning data collection and analysis from researchers or experts. Rather than using experts to guide research, the community members came up with ideas on their own to put forth to the
other members of the organization (Ohlsson). For example, farmers who have knowledge of generations passed, are able to offer ideas concerning the technical aspects to some solutions that they have tried in the passed or researcher. They can come up with their own ideas and examine them, then discuss with the others (Ohlsson).

There is also lot of networking with people who live around the lake and they often exchange information (Ohlsson). The project also provides a place for people to share their own personal knowledge and experience of living on the lake to advance the process of restoration (Tofters). The organization does collaborate with researchers from SLU, although this is done in a way that harnesses the knowledge the members of the organization already carry with them, and uses this in an understandable way to share and report to other members (Ohlsson).

While this method has resulted in forming many opinions about the lake and changing many perspectives of those living around the lake (Nygren), there is concern that there is not enough that has been done to fix the issues in the decade that TWB and Tämnarens Vatten has existed (Ohlsson).

6.5 Challenges

6.5.1 Ontario
While all the projects studied had their own unique set of challenges, three major trends were seen. The first is concerning the level of engagement from the public. Projects such as those conducted by the Couchiching Conservancy and the LPP did not encounter this problem, and they found their volunteers to be highly self motivated and numerous (Hangaard, DeSellas). Some of the other projects faced challenges in finding motivated citizens to participate; the speculated reasons for this disinterest were presented in section 6.1.1.

The second concerns the demographics of those participating in the projects. Overwhelmingly the participants in these projects were older and retired (DeSellas, Rees, Garrett, Bell, MacInnes, MacDonald), with the only exception being the Couchiching Conservancy project. There have been attempts, especially from Lake Associations, to try and involve younger people more (Hunt, Yee), but in general it is the same people who are participating (Alps, Brady). In all other projects and organizations, it is thought that the older community is more involved for a variety of reasons including:

- Smaller rural communities are losing their youth, which results in a limited number of people who are able to do this kind of work (Miller)
- The retired community tends to have more time on their hands to participate in these kinds of projects, and pay more attention to environmental aspects (Brady, Lawrie, Rees)
- The result of how citizen science is set up in this context being geared towards the professional retiree, is that there is mostly retired people coming out, or students (Lawrie)
• Many of the older volunteers have decades of connections to the water bodies and a sense of commitment to the region (Rees)

The challenge of this circumstance is summarized well by one of the umbrella organization coordinators who noted:

“The people that care the most are the people that are going to live the shortest amount of time, so the people that care about the future really don’t have much of one.” (Rees)

Where the demographics were a bit more diverse in the Couchiching Conservancy project, this was speculated as a result of the low employment rate of the area, resulting in recent graduates from University being unable to find employment and seeking volunteer work (Hangaard). This was also the case for the Citizen Scientists of the Rouge Valley project as recent graduates volunteered to gain experience in water monitoring practices, but did not stay on as long term volunteers once they found employment (Lawrie).

The third challenge synonymous to the great majority of projects is funding opportunities. Some projects managed to secure funding through government sources, such as the LPP that receives funding from the Ministry of Environment and Climate Change to carry out their operations (DeSellas), and the People, Aquatic Plants, and Healthy Lakes project that applied for and received funding from the Ontario Trillium Foundation (Hunt, Brady, Yee, Vermaire, Participant 1). The latter project, although a cooperative among many partners, did have to apply for the funding through the community level organization of the Friends of the Tay Watershed (and not the Rideau Valley Conservation Authority) since Provincial funders are more hesitant to provide financial support to Conservation Authorities (Participant 1). Funding can also come from the private sector (Miller, Alps). For the projects and organizations which reports challenges with obtaining funding, they noted this was primarily due to:

• The grant application processes can be very lengthy (Alps, Lawrie), without a differentiation in effort required for small and large grants (Hangaard).
• The smaller organizations and projects do not have the necessary resources and time to follow through with lengthy application processes (Hangaard, Lawrie)
• Funders are less likely to grant resources to regional projects in comparison to provincial or national projects (Hangaard)
• Funders are often interested in projects that will grant photo opportunities, over those that will create knowledge and long term outcomes (Hangaard, Lawrie)
• Money is tighter following the 2008 economic crisis (Lawrie)
• With many organizations seeking funding, it can become quite competitive (Alps, Hangaard)

To overcome these challenges, many of the Lake Associations will collaborate with other Associations or organizations to create a larger project and have a bigger voice (Alps, Hunt, Vermaire). Many times these associations and organizations have the same vision so individual funding is not necessary (Hunt), but they do need to agree on the same project which is not always straight forward (Alps). Additionally membership fees are
common among the Lake Associations and umbrella organizations in order to have a small income to cover costs (Rees, MacInnes, Bell, Kilburn).

Apart from these three main challenges, one participant also noted “citizen science isn’t very well respected” (Hangaard). While it is respected in certain circles, many biologists and well-respected naturalists do not always expect these projects to have significant scientific results, however the projects to have credible information to use and respect protocols while understanding where information may be unreliable (Hangaard).

6.5.2 Lake Tämnaren
Some of the main difficulties with this project has been outline in the background information, but the challenges for the Tämnarens Vatten and the project can be generalized in two main areas: funding and cooperation from all involved parties.

In terms of funding, while some financial income has occurred from visiting students from SLU, membership fees from citizens and municipalities, and the water authority at in 2014 at the start of the organization (Nygren), more funding is required if they are going to pursue a solution such as dredging the bottom of the lake to make it deeper (Eriksson). There is also a requirement for funding and support from the community if the organization would make use of consultants in order to understand how the restoration of the lake should occur (Tofters). The municipalities are able to help a bit with funding the project, but they have certain requirement to meet which do not allow them to be liberal with their spending, thus it was suggested that Tämnarens Vatten would have a better chance to secure funding if they seek a grant from a private company (Eriksson). Another aspect of the funding ties into the phosphorous content and other nutrients that lie at the bottom of the lake. At this time, the farmers are using fertilizers with nutrients such as phosphorous on their lands. If used properly, the crops would take up most of this, but there would still be some runoff into the lake. The farmers are open to finding solutions such as using the phosphorous from the lake found in the bottom in order to fertilize their field, but this will be a costly process (Möller).

The other challenge is getting all affected parties to cooperate in the management of the lake. This includes: citizens, farmers, politicians, and the members of Tämnarens Vatten. It was noted that it has been difficult in the past to make people realize this is a long-term issue, and that it will take time to see the results and outcomes of the project (Ohlsson, Tofters). For the citizens and the farmers, there are a few still blocking the restoration where it will affect their properties if the level of the water is raised (Tofters). For the politicians, it has been quite slow to gain the support of Uppsala municipality, but with their recent membership in Tämnarens Vatten there is hope for cooperation in the future (Nygren). This is especially important since Uppsala municipality relies on the water in the lake for drinking water, and with a growing population the municipality will need to take an interest in the lake (Nygren), and perhaps help those in the low lying areas that would be affected by raising the level of the lake (Tofters).
7. Analysis

7.1 Examining the Models of Participation

When comparing the overall structure of Ontario projects and Lake Tämnaren, there are several differences and similarities. The Lake Tämnaren project utilized a model of public participation that can be arguably interpreted as delegated power or citizen control given the conceptualization of Arnstein (1969). As Tämnarens Vatten is created and lead by citizens, the responsibility of the project primarily lies with them, while the power to fund or facilitate changes with the lake lies with the three municipalities. In Ontario, similar models can be seen with the Lake Associations as they are made up of concerned citizens hoping to influence others living around the lakes, and sometimes the municipal governments as well. In many ways, the Lake Associations in Ontario parallel the practices seen at Lake Tämnaren, and they primarily adopt the characteristics of the bottom-up approach. In addition, monitoring and outreach programs are run through organizations with paid coordinators or researchers to carry out the project, and also at times run through the Provincial government. In these cases the responsibility is shifting between the citizens and the government to manage the common resources, with power remaining with organizations that have enough resources and funding to carry out the projects. Here the participation model more closely relates to placation or partnership in Arnstein’s theory of participation. Concerning the other models from section 3.3, Ontario takes on the contributory (CAISE) and functional (Pretty et al., 1999; Lawrence, 2006) models, where Lake Tämnaren takes on the collaborative (CAISE), transformational (Lawrence, 2006), and self-mobilization and connectedness (Pretty et al., 1999).

From these theories of participation, I turn to the democratic representation within the models of the projects. In the more classical top-down model, there is a much greater representation of the stakeholders, and even citizens themselves hold certain stakes in outcomes and process of the project. These characteristics are also seen in the descriptions of models categorized above. Vertical democracy is quite strong in these settings, elected members are often appointed to represent a certain group of people and interests, and the coordinators and facilitators involved also represent their own interests, even if this is to serve the citizens. In the Lake Tämnaren project there was also a large focus on representation, but in the sense there was concerted effort put into representing all the interests around the lake and the municipalities. This created arguably a more inclusive approach to the issue. When we link this to the ideas of Habermas, relating to the legitimization of participation where there are strong dimensions of horizontal democracy, the bottom-up approach utilizes horizontal democracy to a greater extent, and therefore bring further legitimacy to the participation of the citizens.

There is also an opportunity here to draw from Habermas in relation to his arguments noting that decision-making processes should stem from reasoned argumentation rather than action in the sense of a strategic perspective. Strategy appears to play a strong role for the stakeholders in both projects, there is a certain achievement or outcomes that the government of public institutions would like to see done. In the case of Ontario, this is facilitated through the coordinated monitoring projects, which has seen success perhaps due to the top-down model employed. With this model, decision are made but in some
cases with a strategic perspective. On the other hand, Lake Tämnaren is using more of a reasoned argumentation scenario in their model of participation, but their shortcoming lie where action based solutions are a timely process. Thus, following the arguments of Habermas, in both cases there are positive and negative outcomes. Since Lake Tämnaren is employing a reasoned argumentation approach, this leaves a space for sound decision-making in the long run. However, there appears to be a trade-off between reasoned argumentation and strategic action. Given the two cases studied, I argue that despite the strong merits of the deliberative process and reasoned argumentation, there must be a space left for action, perhaps not from the stakeholders with specific agendas, but as an important next step in the process to carefully complement the deliberative process.

The models presented in the research are not very clear-cut, and pose many different challenges and benefits to the projects in which they work. While in this section the top-down and bottom-up models where further labeled based on the conceptualization of authors in the theory section, it should be noted that these project can be quite fluid in nature, and at times to not strictly maintain their shape in the theoretical boxes. To explore the projects presented further, the next section presents the benefits and challenges of the models.

### 7.2 Benefits and Challenges of the Different Cases and Models

The emergent models of public participation in NRM detailed above have several benefits and challenges. It should be noted that the identified benefits and challenges are findings that emerged from the cases studied, and therefore may be restricted to these cases. However, these findings could be reasonably applied to similar contexts utilizing comparable models for public participation.

In terms of benefits for the top-down approach, the projects studied indicate that there is a greater likelihood for scientific research to go forward, in many cases creating a database of information that will be useful in the future, as well as present management projects. With this frequent and efficient data collection, a historical record is being created which will also benefit the future management of the resource. In these projects, citizens are also highly encouraged to participate and actively collect the data. This creates an opportunity for citizens to become engaged in the issues where perhaps they may not have been without this style of encouraging participation. In many cases the projects also create a direct link between citizens and researchers, which opens the doors for the citizens to become curious about their resources, and ask questions to the facilitators and researcher who may be more knowledgeable on the issues. Finally, this model overall seems to allow projects to advance more rapidly and ensure that the intended outcomes of the project are tended to fairly rapidly.

For the bottom-up projects, there are also many benefits. In this case, the bottom-up project seemed to show that there was a greater interest from a wider demographic with widespread citizen participation. This seems to indicate that the project took on many different interests and accommodated the values of a variety of people, rather than targeting a certain group to help with the intended aims of the project. This model also
indicated that those involved in the project were highly motivated and interested in pursuing the project since they felt that if they do not go forward with the intended aims then perhaps no one will take on the issues in a timely manner. Finally, in this case the citizens were creating and guiding the project from their own interests in a deliberative format, which ensures they remain power holders in the project and allows them to maintain their own interests in the outcomes.

From the perspective of the challenges in the top-down projects, these projects tend to attract the same committed demographic. This consists primarily of retired professionals who are still interested in being involved with community issues, and at the same time have time of their hands to do so. Secondly, in this model there is a larger stake in the project that is given to the government or public institutions. With this stake they are able to influence the design of the projects, and therefore also the outcomes of the management of the resource. The science of these projects can at times become removed from the citizens, in terms of the project design and the analysis of the data, where there is no active engagement between researchers and citizens. Additionally since there is such great involvement from outside parties, there is a tendency for citizens to adopt a mindset where they believe that others will take care of the projects and they need not become concerned with the issues. This may spur certain apathy among citizens if their interests and values are not accounted for.

Finally the bottom-up approach indicates that they are challenged to find support for their projects in terms of funding and resources, which results in a very slow process since they are not able to move forward with any action on their own. On top of finding financial support for the project, this model attempts to integrate many different interests and values from citizens; therefore the project may become complicated as well as time consuming. Projects with this model also may be at risk if they do not have some kind of guidance from those who understand the process of the management of their resources, and the citizens may become lost in the process and again unable to advance rapidly with their intended project. This model is also quite vulnerable to outside influence from those that that seeking funding or resources; it is quite possible that once they obtain the help they need, this agency will have their own agenda and set a stake in the project that does not reflect the values and interests of the citizens.

7.3 Caring for the Commons
The result of the dimension between vertical and horizontal democracy discussed in section 7.1 also creates a rather interesting perspective towards the responsibility towards the Commons. With strong vertical democracy there comes an idea of responsibility towards serving citizens and their interests, but the stakeholders are also serving with own personal interests in the matter. The former transpired in this research as a generalization where in Canada there is an idea among the citizens that certain stakeholders, mostly the government, have a responsibility to care for common resources. This may be due to historical practices of NRM stemming from expert lead knowledge, or perhaps from the manifestations of public participation already present. There are of course significant anomalies to this situation; Canadians who do take a vested interest
and responsibility in the Commons regardless of government or stakeholder involvement, but they will have to confront the challenges of obtaining resources and funding. Which brings us to the situation of Lake Tämnnaren, the local people feel the responsibility for the lake, but it is difficult to take action without the proper means. Therefore, the responsibility must also come from those with the means, the government, to support the action of the citizens. As a summary for both situations, responsibility must lie with citizens, local groups, and governing organizations to manage the Commons sustainably.

The results of this research also show that in both case studies, the citizens are what Giessel (2006) would label attentive. In the Canadian study, there are more attentive-satisfied citizens in larger projects managed by the government or other organizations, but attentive-dissatisfied citizens are active in the Lake Associations since there are improvements that are necessary. Attentive-dissatisfied citizens are also more commonly found in the Swedish case. I believe this result has a two-fold interpretation. Firstly, where the projects receive financial support, there appears to be more satisfied citizens. However, this support appears to come with the intervention or partnership of an organization or the government who will have a stake in the project. Secondly, this result indicates that overall, there are attentive citizens across a broad scope of projects; indicating that interested and motivated citizens take interest in the management of their Commons. This brings the results into alignment with the views of Östrom (1999), Ostrom et al. (1999), and Dietz (2003) as an indication that The Commons need not be privatized in order to maintain effective and sustainable management practices, and that a decentralized water management strategy is a mutualistic endeavor for citizens and power-holders alike. As some participants of the research did remark concern for inattentive citizens (whether demographically or in terms of their mindset), there is a potential gap in this argument, where perhaps in a society filled with inattentive citizens there is a need for privatization of resources, but this seems unlikely in the cases presented.

The notion of responsibility to care for the Commons brings us to the theory of the Tragedy of the Commons, where Hardin (1968) prominently argues the idea of privatization for the Commons in the interest of their preservation, and others such as Dietz et al. (2003), Ostrom et al. (1999), Ostrom (1999), Feeny et al. (1990), Ostrom (2002), and Shiva (2005) counter this argument in their belief that local level and citizen driven management of the Commons is not only possible but ideal. In the circumstance of privatized resources, the citizens are at the mercy of the entity in power, and are no longer perceived as responsibility for the management of the resource. This again, will cut the deliberative process off, and open and inclusive communication between the stakeholders and citizens is may occur, but will likely be much less fruitful. Both of the cases in this research demonstrate the privatization of resources intended by Hardin is not necessary. Both cases involve citizens who care deeply about the state of the natural environment, especially the resources which are near to them. While some of the projects in Ontario relied a bit more on government or organizational support, they still demonstrate that even with this level of involvement, there is considerable interest from citizens to participate and care for the long-term management of the Commons. For Lake Tämnnaren, interest and involvement in the management and restoration process from Tämnnarenens...
Vatten (and the TWB in years prior) strongly suggests Hardin’s argument of “freedom in the commons brings ruin to all” (1968, p. 1244) falsely describes these cases of community based NRM.

7.4 Stakeholder Involvement
The involvement of the stakeholders in the models and projects discussed are have been emphasized in section 7.2, however here I explore their effects on the projects in broader terms.

The term stakeholder does have the ability to hold negative connotations in this context with the examination of power relations with citizens, especially for the top-down models. Although the stakeholders in the projects have certain interests, this is not to say that their intentions are not what they believe is proper management for the situation. Effectively, many of the stakeholders holding power in these projects do make attempts to involve the citizens, and do take the time to hear the interests of the citizens and answer to their concerns. Where several stakeholders are involved, they often share the power authority and create a collaborative project, which aligns with the arguments of Walker and Strashok (2010) to properly distribute power in order to have effective sustainable development. Bringing Habermas into the conversation, the sharing of power needs to go a step further. Since Habermas argues that with the rise of dominating stakeholders such as experts, interest groups, and governmental institutions, there is a lack of power and function allocated to citizens, projects that involve stakeholders need to ensure that the power and function of the citizens is restored, and does not simply remain a token representation or fill a role where there are not enough resources to do the research by experts only.

For the bottom-up model, there are some different implications for the use of stakeholders. While the citizens are driving the project based on their interests and values, separate from any stakeholders, there is still a necessity to work with the stakeholders in order to facilitate action in the project. For Lake Tämnaren, this needs to be most prominently done with the three municipalities in which boundaries the lake falls. Weinstock and Kahane (2010) note that theorists of deliberative democracy argue that “democracy should be understood as the exchange of reasoning rather than merely as the confrontation of contending interests” (p.1), which appears to quite applicable in this case. With the bottom-up approach, both the stakeholders and the citizens are given the ability to discuss their interests and values, therefore coming to conclusions as a consensus over a confrontation. Though this has proved difficult for Tämnarens Vatten to discuss and reason with Uppsala municipality, there is now the beginning of this collaboration where a deliberative approach can be taken.

Both of these models bring new ideas to the work of Fishkin (2010) who argues, “we seem to face a forced choice between politically equal but relatively non-deliberative masses and politically unequal but relatively more deliberative elites.” (p. 194). Through the cases studied, there seems to be opportunities to overcome these polar scenarios, and there also appears to be many grey areas in between the divide that Fishkin has put forth.
While the top-down approach generally can be perceived as Fishkin’s former scenario, there is an element of deliberation that does occur in many of the projects, while not as fully formed as seen in the bottom-up approaches. In addition the bottom-up model integrates deliberation without succumbing to only the elites taking part in this process as Fishkin suggests. Therefore I propose using this idea of political equality and deliberation, there must be a balance, however we may be closer to this than what is perceived from the literature.

7.5 The Intersection of Democracy and Knowledge Production
To unveil the democratic tendencies within the cases, the production of knowledge can be further examined in order to understand the power structures of the cases studied. When looking at the production of knowledge, we can look at who is creating the knowledge, but it is also important to look at who is asking the questions that guide the research and the knowledge creation.

Taking a traditional citizen science approach, the projects in Ontario focused on knowledge creation from the citizens in the form of data collection and consultation. The researchers and experts analyze the data the citizens collect in order to create the knowledge used to go forward with the projects. In this sense, the citizens are a kind of stepping-stone to create knowledge. In many of the cases, after the data is collected by the citizens, they are somewhat removed from the actual process of analyzing the data and the recommendations from the results of the research. In addition to this, the Lake Associations are acting in knowledge creation quite similarly to the case of Lake Tämnaren. In the case of the projects studied in Ontario, for the most part the questions guiding the research were formulated and determined by stakeholders, this is to say, not the citizens themselves. In some cases the citizens were consulted about their interests and values, which were taken into account when the researchers designed the project. In other cases the research project was designed purely from the standpoint of the researchers and coordinators, and then they embarked on the task of finding interested citizens to become engaged with the project.

For Lake Tämnaren, there is a space for the knowledge of the citizens to both ask questions, and search to find suitable answers. With the support of researchers from SLU, the citizens involved with the Lake Tämnaren project are able to be inquisitive, and seek solutions outside the traditional paradigms of NRM. However, it was noted that it seems “easier” to use traditional research methods to employ researchers to take over the process, rather than have citizens who do not understand the techniques to find a solution. While this does appear more time efficient, there would be an element of the deliberative process that would be lost. External research and project management would come with a new stake in the project, and thus different interests may be made a priority from those of the citizens at the lake. The issue of funding and resources has risen in this case though, in a very prominent way since the project cannot move forward with any kind of critical intervention.
From a similar perspective, citizens from both cases felt their knowledge or skills would not be adequate to carry out a project without the guidance or support from researchers and experts. In the Ontario case this was generally met with a filling of this perceived gap, and researchers and experts took on leadership roles to guide projects using their knowledge. For Lake Tämnaren, researchers from SLU encouraged citizens to use their own knowledge in an attempt to ensure the citizens retained their power. Both these uses of guiding the production of knowledge have benefits and challenges. For Ontario, this model of knowledge production has become an effective means for harnessing scientifically valid data and involving interested citizens, while for Lake Tämnaren, out-of-the-box solutions were put forth and citizens were given the space for exploration. However, in Ontario in a very broad sense, and not specific to any project, there appears to be a lack of encouragement for citizens to create projects for their own interests. For Lake Tämnaren, they have this capacity but they can lack the efficacy to execute the projects, and they must negotiate with the three municipalities to take action, which has proven to be a very lengthy process.

From this standpoint there is an apparent trade-off in terms of knowledge production seen between the two cases. In Ontario, the researchers raise the questions and citizens collect data, whereas at Lake Tämnaren the citizens raise the questions but there is a lack of resources in order to collect data or make significant restoration actions. Drawing from the literature, many authors point towards the empowerment of citizens in knowledge production to emphasize democratic processes, including: McCormick (2009) arguing for Democratic Scientific Movements to legitimize lay knowledge in science, policies, and public discourse, Shiva (2005) introducing Living Democracy to return decision-making power to citizens. In contrast, Ojha et al. (2007) notes that historically actors who hold knowledge and power have embodied the governance of natural resources. Given the cases presented, there appears to be a need to combine the two situations to overcome the historical dominance of powerful stakeholders and legitimize the knowledge of the citizens without forfeiting resources to deal with the problems at hand. Therefore the citizens must be those asking the questions, with their value and interests at the forefront, but they must collaborate with government and public institutions in order to have proper guidance and resources in order to carry out the projects in an efficient and sustainable manner. Citizen science has the ability to bridge this gap of knowledge and power, but it must be done in a format that accounts for the values and interests of the citizens from a collaborative standpoint. This heavily echoes the works of Habermas (1971, 1987) in bridging the two knowledge domains of technological knowledge and communicative knowledge. Habermas notes that since the communicative domain’s function is to discover how humans are can better understand one another in order to generate more positive relationships and increase social justice; there is the possibility to draw out the communicative domain from the technical knowledge that explore how humans use nature for their own purpose, in order to bring deliberative approaches to governance. Therefore this is not to say there is not a place for scientific knowledge as such, but rather that scientific and technical knowledge is a key component and we should understand how build relationships around knowledge production in order to increase the legitimacy of participation and the democratic rights of the citizens.
7.6 Furthering the Institutionalization of Public Participation in Government and Public Institutions

The final point for discussion is to address the institutionalization of public participation in government legislation and public institutions. For both Canada and Sweden, public participation is encouraged in some way through the legislation, but there is no specific direction towards the degree and way in which citizens should be involved. In Sweden, the WFD directive leaves this decision to the CAB’s, which for the region of Uppland has not resulted in great public participation successes. For Canada, CEPA 1999 notes that citizens have the ability to influence environmental decision-making; government facilitated projects indicate that there is an attempt to involve the public in NRM, however this is not a required process and the researchers must choose to actively engage the public without a direct mandate from the legislation. Both these scenarios, public participation occurs within the legislation, but implementation is ambiguous. Arguably the situation in Sweden with the WFD has resulted in a looser idea of how participation should be implemented, therefore by luck of the draw the Uppland County where Lake Tämnaren is housed, has not received enough support from the institutionalization of participation. In Canada, for some projects such as the LPP there has been a fair amount of institutionalization of participation given the high involvement of citizens in the Ministry of Environment and Climate Change projects. However for smaller regional projects, there does not appear to be enough support, or obligation from governmental organizations to aid in the success of the projects.

Here I argue that the better institutionalization of citizen participation in NRM would be a beneficial situation. With support for citizen projects and citizen involvement, there could be many positive outcomes. However, there must be a caveat in the manner in which public participation is institutionalized in Canada and Sweden. Should the deliberative process be squandered in this situation, there is little incentive to go forward with the institutionalization. Citizens must be able to retain their power, and work in projects that serve their interests and not only those of the stakeholders. Additionally, there must be inclusivity built into the process, meaning the process of participation should not only serve the citizens and stakeholders who share similar political leaders or facilitators of the project. This notion is very much in alignment with the argument put forth by Fishkin (2010), noting that the institutionalization must meet both deliberative and political equality in the design of public participation. Optimistically, if public participation in NRM is able to be implemented in Canada and Sweden under these conditions, there will be a significant improvement for almost all the projects studied in this research, and democracy only be strengthened.
8. Conclusion
This research aimed to explore and understand the ways in which citizens from two separate nations are participating in NRM at the local level, and to examine the challenges these community-level projects face at the intersection of knowledge production and democracy.

My main research questions are:
1. How do democratic structures change with differing models of public participation in citizen science projects?
2. Can the model of public participation influence the outcomes of a natural resource management project?

Regarding the first question, the research indicates that democratic structures within differing models of public participation change with a greater focus on vertical democracy in top-down models, in contrast to a greater focus on horizontal democracy in bottom-up models. As noted, both vertical and horizontal democracy is necessary, and neither can function properly without the other. In this case as with many others, the importance should be emphasized on equating the two, in order to empower citizens while having a necessary system of support. Strategic action and reasoned argumentation in the deliberative sense must also be balanced regardless of the model used to implement a project, in doing so this will emphasize democratic practices while encouraging action on the ground to work towards solutions to the issues at hand. In this sense, combining the strengths of the different models examined in this research may result in stronger future NRM projects.

Secondly, the model of the project can influence in the outcome, negative and positive ways for each model. For the top-down models, the influence lies in the efficiency of the project, in the sense that these projects have more scientific support and execute their project aims quite effectively. However, these projects have less of a focus on citizen empowerment, and tend to involve citizens as tools for research and opportunities for education. The bottom-up approach is able to take great care in terms of deliberate communication, and empowering the citizens to take the lead on the project. With this case however, the process become quite slow and involving other stakeholders to take action can prove to be a difficult and timely endeavor. These characteristics affect the speed, efficiency, citizen involvement, and communication of the project, therefore having an effect on the overall project and its outcomes.

In conclusion, public participation in NRM is certainly addressed in both countries, but the implementation and the support projects derive is critical to their existence and success, as well as society’s ability to implement strong democratic initiatives. This research has brought to light profoundly optimistic views for the way in which citizens care for their natural environment, and I hope this optimism will continue to grow in the future.
9. Practical Recommendations For The Cases
Some of the solutions proposed in this research revolve further away from the realms of the projects at the level of the citizens, and do not offer short-term practical solutions. Therefore this section presents some recommendations for the coordinators, board members, and citizens of the projects studied in this research who are struggling in various ways.

9.1 Ontario
In Ontario, the three main challenges addressed in the results were: lack of motivation, narrow demographics, and lack of resources and funding. To target these challenges, I would propose a networking entity specific to citizen science projects. The umbrella organizations working with the Lake Associations provide a partial model of this idea, indicating that effective communication and support among the Lake Associations is extremely valuable and effective in knowledge sharing. An entity to play a similar role, not in networking with Lake Associations but with individual citizen science projects occurring across the province would share knowledge between coordinators and citizens on a regional basis. While some projects secured funding but lacked motivated participants, others had motivated individuals but were having difficulty to secure funding. An entity that could help these projects to communicate projects’ challenges and successes would increase the knowledge shared and help those involved in the projects to problem solve and hopefully overcome their difficulties. Ideally this entity would also promote more deliberative communication among citizens as well in order to increase this facet of the Ontario projects.

9.2 Lake Tämnaren
Similar to the networking proposal for Ontario, I suggest a networking entity for the case of Lake Tämnaren. Sweden, like Ontario, has an extremely large number of lakes. Though some of the issues at Lake Tämnaren will be specific to their community, similar problems either are occurring or will occur in the near future at other lakes in the same region. Being the only water board established in their CAB, the Lake Tämnaren project has a unique opportunity to share their experience with other lake and communities in the region. Similarly, other communities nearby may have experiences and solutions to share with Tämnarens Vatten. Organizations in Ontario such as the LNG and FOCA play an important role in creating networking opportunities across many Lake Associations. There appears to be a space in the Uppland County to be filled by some sort of organization, or simply for Tämnarens Vatten to gain more contacts from other communities in the region. Additionally with this kind of networking and communication on a larger scale, there may be encouraged interest from other municipalities to take interest in community level projects in relation to the management of common freshwater resources.
10. Further Research
Further research in this area could help understand some of the solutions discussed, and whether the implementation would be appropriate and feasible. For Ontario, research that resembles the process undertaken by the researchers at SLU in relation to Lake Tämnaren, Critical Utopian Action Research, could further the knowledge of the projects studied. This would also enhance the deliberative process for the case, and work to understand and address the challenges faced by the citizens.

For Lake Tämnaren, understanding how Tämnarens Vatten could work with other projects and communities in the area would enhance the idea of networking for greater citizen power and knowledge. Therefore research in the broader area of the Uppland County could spur suggestions on how the communities can collaborate and interact, while also understanding if the communities in the surrounding areas are experiencing the same issues as Lake Tämnaren.

In a broader sense, further research should be taken in other countries where public participation in NRM is facilitated in different ways. Many of the Canadian participants suggested research in comparison to citizen science projects in the United States of America would be a very interesting and relevant case, since here citizen science is funded and implemented quite differently. Comparing the research presented here with a variety of different nations could further the understanding of democracy in citizen science projects.

Acknowledgment
The completion of this research and thesis would not have been possible without the help of several people. For lending their time to share their experiences and knowledge, I would like to thank all those who participated in an interview: Anna DeSellas, Bengt-Olov Eriksson, Birgitta Ohlsson, Chuck Miller, David Lawrie, Dorthea Haangard, Jesse Vermaire, Kaitlin Brady, Karen Hunt, Kiell Tofter, Mike Yee, Paul MacInnes, Pontus Elvingsson, Robert Ekman, Taro Alps, Terry Rees, and Ulf Nygren. I would like to thank Jackie Oblack for providing guiding information about the projects studied. I would also like to thank Rob Bell, Jayne MacDonald, and Christine Kilburn for sending written responses about their Lake Associations to further the research, as helpfully facilitated by Karen Hunt. Many thanks and appreciation to Nadarajah Sriskandarajah for evaluation and valuable feedback regarding the thesis. I would like to extend my sincerest thanks to my supervisor, Hans Peter Hansen, for his continual support and assistance in the entire conception, execution, and completion of this research. Finally, I would like to thank my family for their support and interest throughout my education and this research.
References


Plait, P. (2015). *At last, the dark years are over for science in Canada*. Available at: https://www.newscientist.com/article/dn28516-at-last-the-dark-years-are-over-for-science-in-canada/ [2016-05-09]


Interview Summaries
Brady, K. (2016). Interview on Citizen Participation and the Rideau Valley Conservation Authority (People, Aquatic Plants, and Healthy Lakes project) by C. Begg, February 5.
Appendices

Appendix A: Interview Guide and Sample Questions

Interview Guide

Intentions

• Focus on the themes (use questions as starting points if needed)
• Create space for open dialogue to draw out different points of view, reveal realities, and provide information

Plan for each interview

• Ensure a comfortable atmosphere
• Beginning:
  o Introduce myself, explain my background, and intentions
  o Explain the main points of the research, objectives, and aims
  o Explain the plan for the interview: use of themes, questions, and timeframe
  o Inquire about recording the interview and degree of anonymity
• Proceed with the themes and questions below
• Thank the participant for their time and ensure I have their correct contact information in order to follow up with a transcript/summary of the interview

Themes

• Knowledge and knowledge production
  o What effect do citizens have on knowledge production given their level or involvement and model of participation?
• Democracy:
  o Are the participants fueling democratic processes through the project?
  o How does this change with the model of participation?
• Participation:
  o Understanding the level of involvement of citizens
  o How the participation influences feelings towards democratic processes at play
  o Understanding the power structure of the project
• Citizen science:
  o How this is used as a means for public participation
  o How public participation shapes outcomes of the research

Introduction to the research

• Student at Uppsala University, Sustainable Development, thesis project
• Research: comparing some different citizen science projects, in Sweden and Canada focusing on managing lakes on the community level
  o Looking to compare different projects in terms of how citizens participate in research projects concerning natural resource management
• Mostly focused on certain themes relating to how people participate, and how knowledge is produced
• Inquire about recording the interview and degree of anonymity

Questions
• Follow guide of sample questions in order of categories presented (see below)

End of interview
• Anything you would like to add?
• Do you wish to remain anonymous in write ups and presentations?
• Thanks and will send summary for both to look over (can take out, add, or change anything)

Sample Interview Questions

Sample A: Citizen involved with the project
*Facts and general questions* (Get to know the participant and understand who they are, make links to be able to identify with the person)
- Name, age
- Occupation
- Education
- Family, community ties
- History of living in the community and affiliation with the organization

*Involvement and motives* What have they done in relation to the project and why, what are their thoughts on the issue at hand
- When did you first become interested in the condition of the lake(s) in your community? What sparked the initial interest?
- When did you become involved with the organization of project in question?
  - Can you describe a bit about how you have been involved with the project? What was your role?
  - Why was the motivation behind your involvement with the project?
- Are you satisfied with your level of involvement in the project?
  - Do you wish that you could have done something differently? How so?
- What have you learned through your participation in this project?
- Are you involved in dealing with issues related to the water quality of lakes in your region outside of this project? How so?

*Theoretical level* Ask about any contradictions, do there appear to be consistencies, discuss any issues
- What are some factors you believe influence the successful participation of citizens in a natural resource management project?
- Do you believe the intended aim of the research can be achieved through the current structure of the project?
• What are your expectations from the project? How have those expectations changed throughout your involvement?
• What are you hoping will be the outcomes of the project?
• Challenges
  o Did you encounter any challenges during your participation in the project—before, during, or after? If yes, did you voice your concern and how were the issues dealt with?
  o Was there guidance from the researchers that you didn’t agree with? Or was there an aspect of the project that you did not agree with? How was this issue dealt with?
• The role of democracy
  o Did you feel that one or more people lead this project? If yes, who and why do you feel this way?
  o Who structured the project in terms of public participation?
    ▪ Do you agree with the structure and would you change anything?
• Is there any group or person you feel has been left out of this project?

Sample B: Researcher or Coordinator of the project
*Facts and general questions* Get to know the participant and understand who they are, make links to be able to identify with the person
• Name, age
• Occupation
• Education
• Family
• Where are you from/live now?
• Are you affiliated with any organizations in relation to this research?

*About the project* General questions about the project, gain a better understanding about the finer details of the project
• Where did the funding come from? Was this difficult to acquire?
• Who is involved with the project? Who are the stakeholders?
  o To what extend are all these people/organizations involved?
• Is the government on any level involved in any way?
  o Is there government support?
  o Does the larger political atmosphere have an effect on the project?
• What is the scientific basis for the management of the lake(s) you study? How are the problems dealt with and why?
• What success has this project seen? To what is this success owed?
• General participation:
  o Who was welcome to participate in this project?
  o What was the purpose of public participation in this project?
  o How were participants selected for this project?
  o In what capacity did the public participate, and how did this help with the project?
**Involvement and motives** What have they done in relation to the project and why, what are their thoughts on the issue at hand

- When and why did you become involved with this project?
  - Can you describe a bit about how you have been involved with the project? What is your role?
  - Why was the motivation behind your involvement with the project?
- Did you choose to participate/research or were you asked to do so?
  - Are you being paid to participate/research?

**Theoretical level** Ask about any contradictions, do there appear to be consistencies, discuss any issues

- What does public participation mean to you?
  - Do you feel that the citizens involved fulfilled this role during this project?
- How would you describe the level of engagement of citizens in this project?
  - Did you plan for this level of engagement, and how has it evolved over the course of the project?
- Are you satisfied with the level of involvement of the public in this project?
  - Do you wish that you could have done something differently to involve them? How so?
- What are your expectations from the project? How have those expectations changed throughout your involvement?
- What do you hope the citizens have learned from this project?
- What are some of the benefits and challenges of having citizens participate in this project?
- What are some factors you believe influence the successful participation of citizens in a natural resource management project?
- Do you believe the intended aim of the research can be achieved through the current structure of the project?
- Challenges
  - Do you believe anyone was excluded from participating in this project? Why?
    - What kind of barriers did people face to participate?
  - What are the costs and benefits to people participating in the project?
- The role of democracy
  - Did you feel that one or more people lead this project? If yes, who and why do you feel this way?
  - Who structured the project in terms of public participation?
    - Do you agree with the structure and would you change anything?
Appendix B: Interview Summaries

This Appendix contains the summaries of the interviews conducted, amended as necessary from the remarks of the participants. Personal details regarding the participants that were discussed in the interviews are not included here.

Interviews Conducted in Canada

Participant 1: Citizens Science and the Friends of the Tay Watershed (February 4, 2016)

Background information
- Friends of the Tay Watershed (People, Aquatic Plants, and Healthy Lakes)
- Retired but always interested in community, moved to Perth and naturally got involved in things

About the project
- The formation of the Friends of the Tay Watershed (FoTW):
  - Province as main motivator by adopting policies encouraging municipal strategic planning.
  - Money became available to organized community discussion on the concept of strategic planning (what do you want to community to look like 20 years from now). One of the elements in this community was the watershed and the condition of the river
  - A Tay River Watershed Plan was developed between 1998 and 2002 by a community- and stakeholder-based Round Table, under the guidance of the Rideau Valley Conservation Authority (RVCA) – and published later that year by the RVCA.
  - The FoTW was founded in mid-2001 to monitor and promote action to implement the recommendations of Tay River Watershed Management Plan and to carry out activities to ensure the ongoing care of the watershed and its related natural resources.
  - Became involved later on since had experience with river hydraulics so inevitably happened
- Friends of the Tay Watershed involvement mostly with administrative work rather than conducting research
- RVCA is one of Ontario’s 36 Conservation Authorities. It is a community based environmental protection agency that works closely with municipal, provincial and federal government partners, landowners and community groups to maintain and improve the natural resources in the Rideau watershed.
- The community at large came to recognize that the algae business was a curious one and the scientific people at RVCA outlined a proposed study. A collaborative group was formed, comprising FoTW, RVCA, Mississippi Valley Conservation Authority and Carelton University.
- FOTW made application for a grant from the Ontario Trillium Foundation, leveraging the in kind contributions of the collaborative members to fund the study. A sum of $149,500 was granted to cover the two year study. At this point the Collaborative recruited an Working Group of individuals from various backgrounds to provide input and contribute feedback. The Working Group
members share project resources through their networks to help spread awareness of science based best management practices.

- The project has published a handbook of best management practices for use by Lake Associations and waterfront property owners. Research results indicate that rising water temperature and longer growing seasons due to climate change, when added to other stressors like excessive nutrient runoff and invasive species, can add up, and change the amount and types of algae and aquatic plants living in lakes and rivers. [http://riverinstitute.ca/wordpress/wp-content/uploads/2016/03/Science-Nature-on-Tap_MAY16.pdf](http://riverinstitute.ca/wordpress/wp-content/uploads/2016/03/Science-Nature-on-Tap_MAY16.pdf)

- The contract from the Ontario Trillium Foundation has milestones and deliverables to be met, and these are being satisfactorily met in that the manual produced for interested people will provide information and practices to help manage the part of the problem that is within their control, and will educate the broader public who have concerns.

**Research**

- The research itself is a collaborative decision, Jesse Vermaire has a long standing interest in history more than algae, but in order to establish what is happening today, a database needs to be established that goes back to glacial times, so he is interested in getting some of this money to do the analysis, the come back to the project and be able to show history.

**Participation**

- FOTW was primarily involved in the financial management and has not participated in the science side, as they felt the others in the collaboration were more equipped to the scientific research.

- FOTW also helped with public education, issuing press releases, having booths at public fairs. FOTW have an annual discovery day and have a booth at an annual music festival in Perth, and participate at booths at lake association events.

- They present to the public at the venues with slides and pictures to explain what they are doing.

- This project was conceived by a community of interested people, rather than a corporate decision. Then the interested people have to look around and decide how they are going to fund this, and who is going to manage it and who is going to get benefit and so on… So it is not as if the Minister of Natural Resources saw the problem and decided to study it. Rather, what it depends on is that some people raise these questions, then it becomes a political question, "should the interested community do this with volunteer citizen scientists and government financial support, or should the disinterested government do it because it needs to be done to keep us all healthy?" Which political pressure is going to put the money where you want it.

- The research concerning the baseline (study from Carleton) has been quite successful, but one of the aims was to involve the community at large.
  - The mechanisms to do this have not evolved to a satisfactory degree. Initially they wanted to have an app, there were technical or other complications so ended up with a water watch website, the idea is enough people will send in information and there will be enough data accumulated over time (could go on for 8 or 10 years) but the difficulty is that beyond
very activist minded people involved with the lake associations and so on, they haven’t been able to engage the general public to make these observations
  
  o “It’s a negative positive, but at least you might conclude that some of these things, if they’re important, have to be done by government, because the population at large doesn’t care”

• Harris government years, one almost got the impression from their political thinking, we could get rid of half of the scientific capacity of the ministry of natural resources and replace them with people like himself

• “The notion that citizen scientists can adjust the footprint of this society on the planet without dedicated dis interested well funded civil servants, it’s just ridiculous… Leaving these matters up to private corporations with their own agendas is dangerous in the long run. The population should be involved to the point of encouraging and understanding everything, but the idea that serious study or policy decision making, any of that kind of thing can be done without a proper scientific background, it’s just not on… the best will in the world is not going to make me into a biologist”.

Anna DeSellas: Citizen Science and the Lake Partner Program (telephone, February 22, 2016)

Background information

• Lake Partner Program, Ministry of Environment and Climate Change
• Works at the ministry of environment and climate change, at Dorset Environmental Science Centre.
  o In Dorset they monitor the chemistry, hydrology, and biology of lakes
  o Many different projects and collaborations going on, one is the Lake Partner Program

• Anna coordinates the LPP which is an Ontario wide lake monitoring program
  o She has a contract person who does day to day stuff as well

About the project

• 1970’s in Ontario there were intriguing phosphorous concentrations in lakes leading to algal blooms (especially lake Erie), research showed it was total phosphorous that was the cause of the blooms. At the time there was something called the self-help program that was a type of volunteer monitoring program and they looked at cores and water clarity. There weren’t too many volunteers at the time; all the data analysis was done at the Ministry of Environment and Climate Change in Toronto. This program went on for a little while.

• 1996: LPP started (it was an offshoot of the self help program that doesn’t exist anymore), the LPP is also a ministry program and gives volunteers the tools they need to look at total phosphorous

• 2008: also started looking at calcium concentration
• 2015: officially started looking at chloride concentrations as well

• 2002: program moved to Dorset (from Toronto) and this is when they started to get really high quality data sets, the total phosphorous concentration from the Toronto lab were not as precise as the data that is now in Dorset
• The program now has about 600 volunteers, monitor about 550 inland lakes at 800 locations (some lakes have multiple locations)
• The driver behind the program is total phosphorous because the concern of algal blooms
  o The volunteers understand the connection really well
  o Many lakes around the world are having declining calcium concentrations
    ▪ This is happening in parts of Ontario
• In future hoping to expand program to look at more parameters… still looking into the details of this
• Ministry program and funded by the government, percentage of the funding goes to the partnership with the Federation of Ontario Cottagers’ Associations which then hires one desk person
• All the funding comes form ministry of environment and climate change
  o (Volunteers don’t get money)
• She knows of many small scale community water monitoring projects that partner with the LPP, they send phosphorous data to them so that they can provide them with a high quality assessment
  o one issues for the communities is that they have to pay when they are on their own
  o otherwise they may not get the high quality data they need in order to look at the trends through time
    ▪ with total phosphorous there can be contamination, the methods aren’t precise for low level (the method needs to be precise at the lower end <10 micrograms since the lakes in Ontario are so low in phosphorous), if you can’t trust the data at the low end then you aren’t going to get good data
    ▪ so combining money and data quality the associations need to go with the LPP
  o Central Algoma Freshwater Coalition and coalition of Haliburton cottagers’ associations

Participation
• Stakeholders
  o Program wouldn’t be what it is without important partnerships
  o Longest standing is the Federation of Ontario Cottagers Association, in Peterborough (membership spans the province): promotion and recruitment of volunteers, now do a lot of what the ministry can’t do in terms of stewardship (getting the message about why they need to monitor and care about the lakes), they are the linkage to the cottagers, represent 1000’s of associations, official partnership agreement through them (how the assistant was hired)
  o Lake of the woods district property association, no more official partnership agreement
  o District of Muskoka: partnered with them for quite a while
  o The volunteers can still contact the LPP through toll free hotline and email. The LPP also send email updates and information
Work also directly with cottage associations, they get in touch and then they help to monitor

- No big meeting or workshops with volunteers, have instructional handouts for participants (no training but they can get in touch with questions)
- Survey sent out in January (80% participation rate), the volunteers are happy with the level of engagement but some suggested in the future they would like to participate in some kind of webinar, half don’t want more engagement and are happy with the way things are
- The level of engagement in future may have more electronic communication in the future (email newsletters, possible webinar etc.)
- Demographics: large part of volunteers are older and many don’t want to use apps and are quite happy with the way things are
  - The younger generation coming in may want to learn more (kind of in between right now though), hoping to work with Muskoka in the future too for someone to help with that since they are not allowed to just go and do a webinar, have to work with partner to do that kind of thing
- The program has generally been really successful since they are not many barriers which people face to participate, the messaging is quite straight forward and people can get in touch if they need to, may be a small percentage of people that can’t access a boat to sample in the middle of the lake, but for the most part there aren’t many barriers
- Methods: everything send back and paid for with Canada post, goes into database and this information is publically available, the dataset that is produced is quite good, otherwise the lakes would not be monitored, it is a good model that has been successful
  - model is working well for the intended aims of the project
  - partnership with FOCA is key, “if someone was to start a monitoring program and maintain the volunteers going from year to year” FOCA is key for that
    - some other programs she has worked with in the US, the volunteers change every year or two, not sure why that is but it seems the way they are set up with the partners is really beneficial

Chuck Miller: Citizen Science and the Central Algoma Freshwater Coalition (telephone, March 12 2016)

Background information
- When he was a kid he grew up on a farm and had a creek than ran through the farm, had some trees along the creek, always liked to be outside
  - Central Algoma rural area has many characteristics to those that he grew up with as a kid
  - Was a manager with ministry of natural resources and forestry, needed some assistance on the board from him as a managerial perspective

About their projects
- Not for profit organization
Grant from the government to do water monitoring in three watersheds, also had some money from private companies (Shell, MEC) and Ontario Ministry of Natural Resources and Forestry, each of the funders have different objectives
  o Two year staffing position they had is mainly for water quality monitoring with a focus on phosphorous in all three watersheds
  o MEC: public education programs (videos and brochures)
  o Shell: water quality monitoring and restoration
  o MNR: long term strategic planning

Into a new project now looking at how people can live together harmoniously with beavers

Issues with the lakes: the CAFC really got a start because of the blooms on the lakes, but the interests are wider in terms of general quality (such as groundwater is on the list, increasing biodiversity in the riparian zone)

Structure and government involvement:
  Everyone on the board is a volunteer
  Some of the small rural community have been loosing their youth, many of the board members are on more than one board so there are a limited number of people who are able to do this work
  Regarding who brings forth the concerns about the lakes: most of the lakes have lake associations who are concerned about their lakes since they have had blooms, and most of them have applied for projects to do on their specific lakes
    o What their organization is trying to do is getting a large number of the lake associations together and regionally there is more bang for their buck so they can apply practices across the region
  Large organizations needed or can smaller lake associations do it too: there is no difference in ability to attract funding
    o There is generally lots of money available through different agencies, it’s just about having the time and effort to pull it all together
  On the ground delivery of programs from government is in retreat, it’s been replaced by a large corporate bureaucracy, at the field level it is disappearing quickly, doesn’t think there is as much money as there used to be on an inflation rate basis, so government is having to find new ways of delivering programs, and they are looking at the volunteer sector to deliver the programs that 30 years ago would have been core programming for them
    o Could be both good and bad: a volunteer organization is more connected to the community than government, but government sees itself more as a regulator than a doer
    o Government is now more of a regulator and an advisor, “I think society has changed quite a bit too actually, where a lot of things to happen with electronic media and a lot of things do happen more collaboratively at the local level too so in some respects what the government does changes”… but also with media there is more ability to work collaboratively locally

Participation
  Water quality monitoring: some is collected by the paid staff and there is also provincial lake monitoring program, on some of the larger lakes they don’t have boats and on those lakes there is usually a cottage association or an individual that
either collects the samples, or can take a staff person out with their boat to collect the samples
  o  And similar for neighboring lakes that don’t have a cottage association, they would also take their boat there and help out to do the sampling
• People come to comment on public documents that are created
• Demographics:
  o  board members: generally people who have worked and since retired, occasionally have a business person who is still working but the majority are retirees
  o  people helping with the monitoring projects: a bit more diversity, most of those people are cottage owners, some working and some retired
• they have a mailing list and Facebook page to get the news out, people are interested in having cleaner water
  o  also meet with the Mennonites and Amish communities where they are not able to get information out to them via the internet
• factors for success:
  o  people are quite interested in the water quality on their specific lakes
  o  the organization understands that the farming community needs to continue on with their farming practices, they try to encourage improvements but not beat people up about their practices

Citizen Science
• LPP: they have a large number of lakes in their region and can’t really get to them all, so try to encourage people to join the LPP program since it is low cost for them,
  o  For the other ones they are looking more at entire watersheds so for those ones they collect their own samples and send them to a lab in Sudbury, there they analyze the samples, this is more expensive for them
• 2 things going on: large number of lakes sampled through the provincial program where the volunteers collect the samples but they don’t pay for the cost of shipping or analyzing the sample, and then there are three specific watersheds that have seen cyanobacteria blooms on the lake so they wanted to do more in depth research on those lakes

Other notes:
• If the resources are there (time and effort) then funding is not a challenge for them to acquire
  o  in funding models there usually isn’t enough funding for overhead costs
  o  sometimes don’t take funding because they don’t have the capacity to pay for overhead costs
• Future projects:
  o  started in 2007 and were very focused on water quality monitoring, and really just getting to a point now where they have “preliminary data”, have written two water management plans, so they are switching focus slightly from agency that was involved in water quality monitoring to an agency that will spend half of the time on remedial programs and half of the time on monitoring on the watershed they haven’t been to yet
o also re-structured the management side of the projects, trying to get more of a handle on this: tend to burn out board members since it tends to become a full time job for them

David Lawrie: Citizen Scientists of the Rouge Valley (February 27 2016)

Background information
- Always been involved in the Rouge a bit (research, etc.), always interested in the park so in 2003 (after all the stream monitoring) found that
  o the purpose of the protocol that had been developed was for the public to use, the OSAP (Ontario Stream Assessment Protocol) had standardized protocols and was very low costs to involve the public and assess the stream habitats
  o the only ones that had picked up the monitoring were the agencies who had a lot of time and money
  o he was intrigued by this so started his own group to do the monitoring for what it was designed for (public) and started teaching people how to use the standardized protocol that could be used (data) by researchers, government, etc.

About the project
- started getting grants to send people to go for training, wanted a leadership class of experts to involve people
- felt like it was taking a really long time to involve people in the protocol so trained people instead and then broke it down into components
  o the trained people took small groups to do one certain aspect, then when they were done they could move onto something else
  o some components take longer than others, start with the longer stuff then those that finish can move onto the other components, also different groups working on different transacts and leapfrogged each other which made for a faster and more efficient project
- to keep the leadership class engaged they had to have continuous training, people would come on for a season or maybe two, if lucky three, then they move on (costs thousands per person to get trained) so it became quite expensive, eventually the money from the funding was gone but this as at the end of the 10 year program
- intended for the program to only last for 10 years, and then they would re-structure it, so they are in the lull after the project now where they are thinking about where they will take it next (go over data, see how useful the protocol was, other issues such as land issues etc.) then they will launch into new format
- didn’t do the whole watershed, but did small sets from bottom to top, picked different habitats, some sites had pre-existing data, used this as well (picked up abandoned data), some sites were close together with same general habitat, looked at low order tributaries (comparing over time)
- looked at data for 10 years so not super clear statistical trend but can look at patterns
  o captured three chemical spills on sites
- all funding coming from grants
to run the monitoring program the equipment isn’t too high end (and don’t have staff) so not to expensive to run it but when you get into the province of Ontario most lands are privately owned, municipality owned, conservation owned… someone owns the land and they all want insurance to do anything, so have to have coverage which will cost about 12,000$, no grants wants to pay for your insurance (get’s troublesome here), pretty limited what you can do on your own, harder to run independent program without dedicated funding

grants mostly coming from banks or charitable funding, not a lot of federal or provincial grants available and they tend to want high end work for low cost (academic exercise for endangered animal for example) but need staff and permits for these kinds of things, this funding isn’t really accessible

OTF needs an audited system, could cost up to 10% of funding, unless you are a big organization you can’t get that kind of funding

Once you get the grant you can afford to do stuff, but until then it’s hard since difficult to find volunteers to do lots of work on grant writing

Participation

• offered free training so at the start of the season would have 50-60 volunteers and by end of season had 8-10 (this was a consistent pattern over the seasons), 2 or 3 continue onto the next season

• not really a long term volunteer commitment but trying to get this so that the trained volunteers can train the next batch and then there will self sufficient knowledge sharing

• when it is free training people are less likely to really commit for long periods of time

• expected they would have more long term engagement, one challenge that they haven’t been able to solve

• volunteers prefer restoration and education over monitoring projects, science and research takes more effort, outside from 10-3 in the hot sun (can’t just show up for 20 minutes and plant a tree), lots of people don’t come back after this (maybe they didn’t know how involved it was, or felt they were an expert after their experience)

• the people are appreciate and say they learned a lot, but not sure why they don’t come back

• hard to find people that want to do engaging work, people are already doing their own thing, the people who have stayed on are older and have finished up their careers and no longer have kids to take care of

• hard to find just a couple of individuals to really involve

• for the next phase: now looking to change the model a bit where people take on parts that they can tackle, develop programs step by step, develop them into individual projects and people can work on them when they have the time, there is no one long term project that someone has to lead, but instead components to plug in, and when the pieces are done then can move, don’t have a lot of capacity to manage people so they can just do small bits

• trying that now and seeing how it goes before going back to a really long term model
• newer approach with different protocols, so it takes quite a bit of time to run the programs
• turns into a mini project

- key components to engage people in CS projects:
  o can do a whole bunch of things with just awareness
  o but when you want it to be meaningful then it needs to be different → a lot of the time the projects are one offs that don’t show how systems are changing and how you can work towards solutions, if this is what you want this is a big challenge since you need long term monitoring that is consistent and standardized and it’s more involved so you need a different class of volunteers (more time, commitment and knowledge) → this is what they are trying to do, get away from simple participation and to achieve and outcome
  o trying to go from “outputs to outcomes”: don’t want to count number of trees plants, but rather learn how things work from management and maintenance standpoint to understand what is needed for a specific outcome
    - a lot of tree planting situations of “citizen science”: lots of the trees die (only certain species will last), no detailed analysis to know what works and what the analysis is
    - seeing constant decline despite enormous outputs: to change this need to put in the time and have knowledge develop from the work to understand what is working or not working → not a lot of money for this though (people like the photo opportunities of trees planted), 90% of funding for tree planting and habitat restoration
  o hard to find money for maintenance, tracking, and monitoring aspects: that’s where the downfalls are because it is hard to learn from the long term outcomes, without this there is no critical evaluation of the work that was done
  o easy to get people to come out for a little bit of time and plant a tree (also lots of funders to support this), but there is not a lot of people who would want to track the tree growth over the next ten years

• can’t find a lot of long term volunteers to do the work so trying to partner with academia, students that are almost obligated to do it for their degree, they are locked into a program for a certain number of years so can get them to collect the data for several years in a row

• not really wanting to expend effort to pull people in and to chase them, they want people to participate who want to be doing the work, coming to them because they are interested
  o easier to have people who have a pure interest in the project

**Citizen Science**

• in North America, CS started mostly in the US and geared towards “not necessarily exploiting, but utilizing the professional retiree, because there are a lot of expert scientists that were highly trained but still wanted to dabble [after retirement]”, “the government agencies had a lack of capacity or gaps they wanted to get filled, they could call in these experts that were highly qualified and
reliable but for free labour”, so gov agencies could get them to collect the data for them → they had hoped this would translate into the same kind of thing for their project
  o they tried to get teachers and retired biologists to come out, but ended up mostly with university students who wanted to gain skills “it’s not necessarily a commitment to the environment, it’s more about building your skills up, enhancing your resume, to get jobs”, primary focus was to get into work force, the minute they get a job they are gone
  o had a couple of older people help out for a while, now retired
  o hard to find people to take on leadership role and take on responsibilities for year after year
• the benefits from ecosystem services are sometimes hard to recognize, it’s hard to get money to do the work
  o when the economy was good pre-2008 it was easier to get funding, but now with more economic challenges the money is fairly tight (and so is volunteer time → people looking to work as much as they can for money and then there isn’t a lot of extra time for volunteering for “non-important” work)
• “if you loose nature here, how much does it matter to a person if you can just drive and find nature somewhere else”
  o in parts of Europe (e.g. UK bat monitoring), they are hard core on this because that is all they have left in terms of nature
  o this is what we don’t want to get to, they find there is more engagement when the forest is not run by a neighborhood
  o when there is a rural neighborhood, there is a low population density and not many people to draw on, low numbers of people
    ▪ once they are all gone, there are 1000’s of people who are interested in participating, but by then the people have exerted the land too much and it is already degraded
    ▪ so not a lot of people in close proximity = disinterest in NRM BUT lots of people around = degradation + environmental interest and possible engagement
• hard to get people out to the Rouge at the beginning, but now the neighborhoods are closer and more people are interested, but the ecosystems are starting to decline
  o “how do you attract enough people without damaging the ecosystems you want to protect over time”

Dorthea Hangaard: Citizen Scientists of Couchiching Conservancy (telephone, April 12 2016)
Background information
• Project manager for the conservancy
• Works on projects to fill gaps in the organization, such as the water quality monitoring project (water on properties was overlooked but lots of eager volunteers to take on citizen science role)
About their project

• Started last year
• Reception from the community:
  o Excellent from the volunteers
  o “my experience is that people really want to get involved in science projects, people that are interested in the environment. They also want to get involved in projects where they can feel a sense of ownership about a particular place. And so we set up this project with that in mind where the volunteers are assigned a site, and that will be their site for as long as they wanted it. And what we find when we do that is a huge amount of buy in”
  o they were extremely self motivated to go to their sites: never called the volunteers, they all called in to say they are going out
  o waiting list of people to do training because there was so much interest
• they are trying to get to the point where they have an understanding about all of the water that is flowing through the properties that they manage, goal is to have a monitoring station at the beginning and end of the properties they manage to see what is happening with the water, want it to just become a part of what they monitor on the property
• they also are appreciating that they are engaging their volunteers in this way
  o it’s turning into something bigger and thinking about how they can build citizen science programs in their organization (also want to branch into climate change and species adaptation on their properties)

Participation

• had a high school team participate: Capstone
  o for students that are in grade 12 or recent graduate who are sure what they want to do yet
  o a teacher is the head of the program and put them in projects they are interested in
  o 3 came to be part of the water team + teacher
  o 2 decided to go on with environmental studies and one stayed on as part of water team
• demographics
  o range in ages
  o some long standing volunteers with the conservancy who felt they wanted a bigger role (re-recruited people in the organization), and then also some that were not previously involved
  o social media work is quite well developed (Facebook, Instagram, Twitter) and website is pretty alive (constantly changing information)
  o they have been attracting young people to the organization but there hasn’t really been a way for them to fit in
  o by and large the majority of the members of the organization are retired, most of them are on a property team, most are not all that active (they are on a the list but not committing time)
  o have a core group of older volunteers but a bit surprised by the number of young people
  o regarding the young volunteers
- “I think what is going on is unemployment, we ended up with three biology students who has graduated and couldn’t find work and had to move back home”
- 2 ended up interning full time for free, unpaid position isn’t ideal but it has been keeping them involved
  - also have attracted some women who are working part time and would like more to do with their time

Citizen Science
- “I feel like the kind of grassroots initiative where you are truly engaging the community in the environment, I think is exactly what society needs right now.”
- “Citizen science happens in Canada, it’s not very organized, it’s not that well spread… but I don’t think it’s being taken seriously enough, and we frankly want to take it seriously, and we want to build a full program in our organization of citizen science”
- the advantage of it is that they have an expert for the research, we need experts to oversee the work and to make key observations, but they can’t be everywhere and with citizen science you can have people more widespread
  - the data you get might be more dispersed
  - you get more environmental observations on the ground
- people get really invested in their sites so they make very good observations about their surroundings
- challenge: “citizen science isn’t very well respected”
  - it is respected in certain circles
  - even among friends who are biologists or esteemed naturalists, they don’t always expect these projects to get reliable results
  - it’s more of a long distance race, over the long term they do expect to be able to show trends
  - they did have one team that never really quite understood the testing, it was apparent the data was a bit all over the place so they set it aside and noted it (while working with them)
  - they do put protocols in place
  - they are getting credible information to use

Funding
- very challenging
- since they are a regional project the fundraising is really challenging, most funders don’t see regional environmental organizations as organizations to pilot things (given to larger, national organizations)
- the kind of money regional organizations get is from community funds, about 5000 here and there
- the challenge is that they put the project together on 3 5000 dollar grants
  - this year they have gone back for more funding and this year have been turned down by 2/3 (still waiting to hear back from third)
- not sure if it’s just there is a lot of competition out there or what
- “I have noticed coming from working for an organization working provincially and nationally that it’s much harder to get taken seriously”
• spending a lot of time fundraising and recording, “the amount of work you are expected to do just to get that little bit of money is still really huge… it’s the same amount of work as if you were getting $150,000 grant”
• it’s a very labor intensive process, they are able to maintain what they have been doing with initial funding, but to expand with more CS projects- not sure if they can pull it off (might have to wait for later in the future)
• you end up just going to the funders who are looking for a photo opportunity
• most of the funders aren’t interested in funding salaries or for coordination, but this is what is needed

Government relations
• Not involved in advocacy
• Mandate is to buy up habitat and protect it for future generations
• Involved in aggregate project and creating standards (cooperative with aggregate industry)
• Worked with governments a fair bit
  o Not really in terms of policy change
• With the citizen science project they work with the Lake Simcoe Conservation Authority

Jesse Vermaire: Citizens Participation and the People, Aquatic Plants, and Healthy Lakes Project (February 12 2016)

Background information
• Assistant professor at Carleton University, environmental studies and geography
• Main research area is impact of environmental change on lakes and aquatic systems, river: mainly look at climate change and land use change
  o Look over longer time scales, take sediment cores from the lakes and look at changes in algae community to see how the water quality has changed
• How became involved in project: RVCA had ball rolling when he got there, Kaitlin working on the project for a year already, they sent the survey around to the lake associations and lake users about the green algae blooms and aquatic plants, then he got hired at Carleton and gave a presentation to them about his research interests (algae and aquatic plants), then they put the grant together for the Ontario Trillium Foundation

About the project
• Lake users had concerns about changes in the water quality, but the monitoring records only go back to the mid 90’s, so no one got an idea of if the water quality was actually changing or people were just noticing it more now, so the basis for his part of the project was to find if the water quality had changed in the last 150 years in the lakes, and mainly the algae changes in the lakes
  o The other part is looking at the impact of zebra mussels (half the study lakes had them), tend to make the water more clear, so these lakes have more or less plant growth
• Outcomes of the project are going they way that was hoped, it is showing interesting results that the people seem to be interested in
The website and app were a minor part where they ran into problems (this was less than 2% of the budget), hoping that teaming up with water rangers there will be more resources.

- Not sure exactly where it is going in the future, but would like to keep the community engagement with the plant mapping (really useful from an academic standpoint), good to get information that the lake associations have
  - Also from community engagement standpoint would like to see the water rangers site take off, he would like to support that and is looking to find grant money to support that
  - Scientific side: still analyzing some more of the core samples to answer some scientific questions

- “their interest in me is basically the results and the research”
- the idea at the start with the citizen water watch was to get people out and looking at their lakes and taking pictures, getting people to care about it
  - if it ended up working well it would be really interesting as a monitoring tool for algae blooms (the data could be useful in theory)
  - could also be a neat tool to pass information back to people: can tell people to anticipate algae in the lakes depending on the conditions (could be a two way street)

Participation

- Believes it is important for the public in the communities to be engaged in these issues, and will become more as the project grows
- Two different aspects of the citizen engagement:
  - Top down engagement: us telling them about the issues, creating the educational manual for the public about the algae issues, some citizens on the volunteer board
  - Citizen driven: they have helped map the plant beds, he learned a lot from that which can be standardized in the future
- Kaitlin is his access point to the lake associations, for the plant mapping she really organized all of that, he got the data from that and crunched the numbers then sent it back to Kaitlin
- He is a bit removed from the public participating in the project
  - Does attend training days, gives presentations (such as Lake Links, at lake association meetings)
  - Interacts a couple of times a year
- Citizen water watch: could have benefited from some more resources, mainly done to reach out to younger people (lake association members are more likely to be retired people), didn’t budget enough, did have a website but didn’t have a dedicated person in charge of it, now partnered with the water rangers for the future
- Had a high expectation of how many people would sign on to participate in this project, now has a better idea, usually one person from each lake who does participate and represents most of the community
- “you get a lot of people who are really engaged, and it’s sort of the same people I think over and over again, but I’m not sure that you can do much about that, at least you have the people who are really engaged….”
The website suffers from lack of resources, could engage more people if it had more resources
- Plant mapping: surprised how many people signed up for this, dedicated several days to map plants, at least one person per lake, not really going to get more than that in Ontario
- Engaging a certain demographic, usually retired professionals, living full time on the lake

Funding
- For something of this size, it’s necessary for them to come together to have the critical mass of people interested in doing something
  - There is a core group of 5-10 people with each lake association, but it would be too much work for them to do it on their own
  - So kind of key for them to come together
- OTF: not really meant for research, most of the budget went into Kaitlin’s communication/outreach/education with the lake associations

Kaitlin Brady and Mike Yee: Citizen Participation and the Rideau Valley Conservation Authority (People, Aquatic Plants, and Healthy Lakes project) (February 5 2016)

Background information
- Kaitlin Brady
  - Project Coordinator: People, Aquatic Plants and Healthy Lakes Project
  - The grant from Ontario Trillium Foundation gave her a position at the RVCA to work on the project
- Michael (Mike) Yee
  - Manager of Biology Water Quality

About the project
- M: MVCA: When they do surface water quality monitoring under the umbrella of watershed watch (sample 39 lakes) mainly looking at nutrients and E. Coli ➔ the biggest threat to the recreational lakes is eutrophication (from nutrient runoff)
  - monitoring the nutrient levels through phosphorous and nitrogen ➔ if those can be controlled then plant growth on the lakes shouldn’t expand, but they found something is changing so that is why they went into this project
- M: “[We] tried to look at some things to try and engage people and to help us with monitoring and finding out what some of those other drivers might be for the algae and excess plant growth”
- K: Algae watch: title on website (program started before the funding came in), they surveyed around 300 people in lake country to get take to quantify if they are concerned about algae and excessive plant growth, out of that they got the funding and then created the People, Aquatic Plants and Healthy Lakes Project
  - Out of this came the citizen water watch app: citizen science aspect

Knowledge and knowledge production
- M: Research component:
  - With Dr. Vermaire at Carleton: core sampling to get sense of what algae population was for the past 200 years, looking at diatoms to see if
nutrients have change, change with zebra mussels, and climate change →
three things to influence the algae changes
- Fish finder: finding biomass of aquatic plants, 5 year span to track changes
- Fish finder being tested as a citizen science project

Engagement
- K: Stakeholders are equal partners, most working happens at RVCA but many meetings to discuss
  - M: It is a collaborative approach
- M: Tried many ways to engage people
  - With the collaborative group engaged with a variety of people (participants from MNR, fish and game club, lake association, Ottawa river keeper), got a broad cross section of people to represent other groups and other interests with other perspectives
- K: people were able to have their concerns heard, email address and phone number was distributed widely and people responded
- M: both went to lake association meeting (Kaitlin to lots), met with as many groups as possible who were interested in what they were doing and to build relationships to help with what they are doing
- K: before the trillium grant very open to hearing what people wanted to see, wanted to make the project beneficial for people, there has been an open collaboration piece, Karen would share notes with presidents of lake associations from meetings, so they knew what was going on
- M: provided workshops, made an educational manual about aquatic plants and algae and ways to deal with them, the app was trying to engage the community more, and collaborative group was bringing people together through the project and work towards other projects and other research

Participation
- K: Moderate participation with the citizen science aspect
- K: “I think it’s tough because people don’t want to report an algae bloom in front of their property… let’s say it’s tracked or publicized somewhere then say so and so is going to come by and say ‘oh well there an algae bloom in from of their cottage so I don’t want to buy this cottage’ or ‘I don’t want to report this because my property values are going to go down’”
- K: “People are saying why would I want to report this if it’s going to affect my property value”
- K: “it’s only the really engaged people that will [participate], it tends to be the retired community, and we were hoping the app would engage a younger group but yeah…”
  - First there was the website, so you had to take a picture then go to the website so there were more steps
- K: Another group called water rangers who is creating another website to engage citizens science people so they asked if the MVCA could collaborate and they are web designers so it’s a mutual benefit, they are also hoping to use their monitoring data
• K: Advertised the project at lake association meetings, community events for outreach, RVCA has newsletter to put the word out, had some radio and TV time to advertise, don’t know what else could have been done
  o Radio interview was quite successful
  o K “no matter what you do there will always be people who just want to go to the cottage, you know, they don’t care, they just don’t”
    ▪ “And then there is your other groups who is going to do the bird watching and whatever and they’re more into the [project]”
• K: A lot more of the retirees who like at their cottages year round pay more attention to the environmental aspects
  o There always needs to be an attempt to engage people but its really only the engaged people who are part of the lake associations in any case engaged people are mostly those who are living on the lakes

Citizen Science
• K: Algae watch app for tracking blooms
  o In the long term this is useful for the researcher (if noticing trends in the long term)
  o Before they were just getting random phone calls, it was all anecdotal and there wasn’t a tracking system for it (thus the app was created)

Additional notes:
• M: This is a rather new project, it is a work in progress, they are still morphing and changing
• M: LPP: record on the same lake going for 20 years
  o Sending to MNR out of Dorset
  o It’s a successful project
• K: Moving forward would like to keep communities engaged with the researchers, so the university knows what the community is concerned about
• M: This was an opportunity to engage lake associations and users around lakes and make them aware about the issues and put some research around it, and then idea was to bring these people together and have a collaboration that will keep going
  o The idea is that as a project it would have a finite window, but once the project ended there would be a legacy of learning
  o There is a group established and have a university involved with talk with other universities
  o So the idea is that they can keep building on that, once the project is over hoping to look to see how they can deal with storm water runoff and more nutrients going in to the lakes, so is there a way for the people who like around the lake in those catchments to deal with their storm water in a way that doesn’t just put it in the lake with all the nutrients but puts clean water back in the ground where it is supposed to go
• K: there is now more information on the conditions of the lakes through the research, there hasn’t been a drastic change (from the cores), changes will be occurring but nothing to severe
  o M: climate change as trigger in the Mississippi, and nutrients in the Rideau (but they are small signals) before it becomes an issues maybe
things should be done to deal with it (now rather than fix it when it is too late)

- K: should be extra careful now with climate change since lakes are a little more sensitive

Karen Hunt: Public Participation and the Lake Networking Group (People, Aquatic Plants, and Healthy Lakes) (telephone, February 8 2016)

Background information

- She coordinates the Lake Networking Group through which the lake associations are able to work together and share information back and forth.
- On her own lake association: one of the major undertakings they did was realizing that the lake community needs to take responsibility for what happens to the lake in the future and a long-term community plan for the lake is needed (in other terms, a lake management plan).
  - Starting in 2003-4, work was started on the Lake Management Plan, partnered with local organizations (Friends of the Tay Watershed, RVCA, etc.) grew and became the larger project with Trillium Funding which provided a lot of basic support and understanding for all of the local lake associations (not just her own).
  - The local Lake Management Plan was released in 2008, they are working towards implementing the plan.
  - The Lake Management Plan was developed by working with the community, talking with community, going door to door, doing a survey, reaching out in many ways to get input.

About the lake associations

- Starting: it comes from the community where people are worried about issues with their lake then they band together to see what they can do to help with lake
- Her lake association: coming up to 40 years (and many of the other lake associations as well)
- “It’s an association that comes from the community”
- Demographics: made up of many different people in the community, some people in the lake associations like to have a lot of active participation, while other would just like to stay informed, they are all volunteers, people have different amounts of time to put into the different activities, the lake associations try to have many different types of activities to appeal to the different interests of the people.

About the People, Aquatic Plants, and Healthy Lakes Project

- In 2013 many of the local lake communities were really concerned about the increased amount of algae and other aquatic vegetation in their lakes, RVCA works with a number of these lake associations (not all since many lakes are outside their watershed but all are part of LNG)
  - RVCA sent out survey to understand concerns of the communities, everyone said that they needed to understand more about why changes were happening in the lakes. RVCA decided that they would try to organize a project and sought partners (universities, other agencies, other conservation authorities) and applied for funding to do this, they set up a steering committee and a working group. For the working group they
really wanted involvement from the lake communities since it was the lake communities that were concerned about this issue… through this process they approached Karen since she represents the LNG they reached out to her (Karen takes back information from meetings and distributes to the local lake communities and provides lake community input to the working group)

Outcomes

- Lake Associations understand that the project will not change what is happening on their lake, but from the project they are looking for a greater understanding about what is happening and why.
- The Ontario Trillium Foundation wants to get the greatest amount of result for the dollars that they have to put in, “if every lake association was undertaking a project on its own, trying to come up with an answer to the same project as the lake next to it and expecting all to get individual funding for that, they wouldn’t get it”… so much money is tied up in the bureaucracy, so that’s not going to happen
  - It doesn’t make sense for them to fund the same project again and again if everybody can benefit from working together

Participation

- Until it (the issues with the lakes) touches somebody personally, they don’t get too involved
- RVCA tried a multitude of ways to reach out to the public, same with the lake associations trying to reach people in the communities
- Many different approaches must be used: general media, radio, local newspaper, going to the annual meeting
- Lake associations reaching out to public: email contacts, newsletters, websites
- “you’re never going to reach everybody because not everyone is interested, that’s the bottom line, but you do your best”
- “public participation is important. People have to take that ownership, that responsibility for what’s happening for wherever they are in this world of ours and how you get the most of the communities to participate in the best way”

Paul MacInnes: Citizen Science and the Haliburton Cottager’s Association (telephone, March 1 2016)

About their projects

- CHA is a an organization made up of several lake associations
- They have lake stewards who are lake association members who have volunteered to be most involved in their area with water quality, when they got them together they spent time talking about what they are doing, the main activity they were involved in was collecting water quality data, so sampling their lake and sending their samples off to the Ministry of the Environment for testing and then publishing after that. So it’s very much a citizen science project but what they discovered is that there were great differences between the skill/knowledge levels of the various lake stewards and also what they were testing for. Some lake associations had comprehension testing (e. coli, dissolved O2, invasive species in addition to phosphorous). Over the last few years they have brought the lake
stewards together for training sessions whereby they provide them with expert training on how to do the testing properly, try to standardize the methodology and equipment used without giving up the benefits of citizen science (including low cost)

- 48 lake associations that belong to the coalition
- Lake Partner Program is a program that is involved with the water quality testing, so their involvement (CHA) is that they recognized that they were providing the services to about half of their members, and they wanted to ensure that all the associations enrolled
  - Don’t have a formal relationship with them
  - Relies on them for advice, but they rely on her for getting the message out to the associations
- Focus is Halliburton county, has about 600 lakes, 120 belong to CHA and the other 480 are really small or are lakes without lake associations, CHA covers about 80-90% of the volume of lakes in the county though
  - They have been fortunate to not have a lot of water quality problems yet
  - Have a panel of 9 science advisors, very knowledgeable people in terms of lake health, they have advised and seen that as the climate changes and the lakes warm they are at greater risk for blue green algae blooms → this is the number 1 threat to their lakes (and other issues include calcium loss, invasive species, dropping oxygen levels)
  - Have had blue green algae on 1 or 2 lakes for each year in the last 5 years
  - Concern is that with effects of climate change the issues will get worse
  - What they are focusing on is prevention since if they wait until it is happening it will be too late
  - To combat these issues they are looking at septic health and natural shorelines, two outcomes:
    - Re-naturalize as a many of the shorelines as they possibly can over the next few years (90 properties that have applied to be demonstration properties)
    - Properly operating septic systems, more systems inspected, education people about septic health
      - Working with municipal governments, lake associations, media, and with whole community

Volunteer involvement
- differences in involvement between the lake associations
- in many cases the lake stewards are those that have stood up at meetings and volunteered themselves for the monitoring programs, and in other cases other people have gone out to recruitment (guesses about 80-90% of the people just volunteered at the meetings)
- large dissemination of information → very available to everybody to access (free, libraries, etc.)
- they work at multiple levels, training municipal council: when they started talking to them a number of years ago there probably wasn’t a single councilor who was environmentally oriented, and at least now they are all talking the talk
also worked with local real estate agents since they are the first people new owner contact, working with contractors, working with septic haulers

they are looking at multiple platform to get the message across

Participation
- lake stewards and volunteers/members of the lake associations are overwhelmingly individuals that are 50+
  - certain lake associations have been successful in getting young people with young families to get involved, and have people in 30’s and 40’s and even 20’s, but that is in the minority
  - this is a problem they face, more people are retirees. They bring incredible skills because in many cases they are previous senior managers or entrepreneurs, but they have a shelf life
- use specially trained university students for shoreline classification
- success in public participation in their projects: marketing the message
  - scientists are great at what they do but “I find scientists terrible, absolutely terrible, at marketing, and when I look at so much of the material that has been created by other organizations to talk to lake front property owners, it’s too technical, it’s too long, it doesn’t keep in mind the basic principles of marketing that you know who your target audience is to appeal to what motivates them….”
  - 10 people in the board of directors and many of them have marketing backgrounds
  - this is what he thinks sets them apart
- have been surprised at the number of volunteers that come forward each summer to help, even the lake associations have been surprised at the number of volunteers
  - bottom line is you have to make it exciting for people to want to participate, “have to create that sense that people are part of something that is bigger, that it’s inspiring, that it’s doing something, and it’s making a difference, and I think if you do that you can get people”
  - know there is a number of people around the lakes that will never care about the projects they are working on, but not trying to reach those people, the target is not the hardcore environmentalists that are already doing most of the right things, their target is the 70% of the population that is in the middle, these are mainly not environmentalists but if motivated properly and given the right information and given simple tips for things to do to protect their lake, they will act. They don’t try to go after 10-20% that are never going to be interested, rather focus on 70% in the middle
- no project is going to be a silver bullet, need to continue to hammer the message home

Citizen Science
- Downside: “it’s not like a university researcher going out and collecting all the data, and you know that the methodology is up to snuff… with citizen science you don’t know that, but you have a low cost system with passionate people. So what
we’re trying to do is to bridge the best of both worlds, it’s not easy to do but that’s been our major focus”

- They started with a lake stewards guide which was published for them a number of years ago, hired an expert to have a guide for lake stewards, they have a binder to refer to, also available over the web, supplemented with ongoing training sessions every May for the lake stewards

**Funding**

- Ongoing operations of the CHA don’t need many funds since they have no staff, no office space, just volunteers working out of own offices and paying for won supplies → this is taken care of by memberships from lake associations
- They had talked about increasing membership fees, but smaller lake associations said they couldn’t afford that, changed membership approach: basic fee of 50 dollars then voluntary contribution for value (1 extra dollar for every member a lake association has if they feel they got good value from the CHA), this has been pretty successful to raise additional funding
- For specific projects: funding is sought from a variety of funders: OTF (government), local development corporation (arm of federal government), Canadian wildlife federation, Canada summer jobs funding for paying for the four summer students
  - Big project this summer is shoreline project: budget just over $100,000
  - “we look for funding wherever we can, and it’s a challenge… it’s a whole lot of work… but it’s necessary”
- smaller community vs. larger projects: when they founded the CHA they realized that one of the benefits of having a coalition is that there are some projects that are too big for one single lake association, or small group, to undertake on their own and it is better done through a coalition
  - the individual lake associations do smaller projects, typically they can raise the money they need from their members and from small local businesses
  - “if [the lake associations] really want to get something done, they find a way to do it”

**Additional notes:**

- use the principles of marketing to deal with environmental issues and not just talk in science talk, “your science has to be sound, but your communication- you need to keep in mind your target audience and the principles of marketing”

**Taro Alps: Public Participation and the Friends of the Tay Watershed (People, Aquatic Plants, and Healthy Lakes) (telephone, March 4 2016)**

**Background information**

- Interested in environment after living on the lake for a couple of years, started becoming concerned about water quality
- “living in the city, you don’t think about the environment that much, but moving out here and being on the lake and everything, I got interested in that”
Involvement
• on the board of the Friends of the Tay, active with monitoring water quality, especially around the Perth area since there is industry affecting the quality of the water there
• they were approached by the RVCA about the people aquatic plants and healthy lakes project
• volunteered to be on the working group, knew a few of people who started it up (knew them from before since was President of Lake Association for 5 years and had worked with those people)

About the project
• thinks the program is going well, the objective of studying plants and climate change and humans
• “the biggest challenge has been lack of funding, it’s always a real struggle for that”
• the scientists from funding did some interesting stuff, learned a lot from these researchers about the issues
• got the Ontario Trillium Foundation funding: have pretty particular objectives but they met all of those
• will try to carry on past the near end of project, keep going past the 2 year project mark to learn more, willing to continue with the format

Working with Stakeholders
• “I felt, there’s scientists in the working group who know a lot of stuff, and a lot of stuff I don’t really understand, but they’ve always been open to questions and ideas…”
• where people are disinterested in natural resource management and lack of public activity: “you need government intervention or interest, the lake association or even conservation authorities, they have a voice, but it’s not binding, they just bring up opinions, try to convince different councilors and townships they should be doing this or that, and if those people are not on board, nothing happens”
  o he has talked to townships before about things that should be different, they say that if things are already done then it is almost impossible to reverse it (for example building a boat house or putting cement in the lake to build a boat ramp), if not caught in advance then the councilors say there is almost nothing they can do
  o people that own cottages or land on the lake, they contact the contractor and the contractor doesn’t really care since it’s money in their pocket, so they do what the person wants done, do a lot of stuff without permits especially in the rural areas
  o it’s tough to get anything in place to stop things from going on unless you have the politicians involved
  o even then “politicians are more concerned about the income, and tax based”
• the reception from conservation authorities or governments from concerned citizens: the listen if they are interested, he was involved in spawning rehabilitation, they got a lot of support and volunteers to help out, but at the same time, there are always the same few people coming out
mostly the same people at the annual general meetings
one of the biggest issues is getting more young people involved

Participation

- “I think that’s important when you’re in that type of project, to have a mix of people, you know you need the scientists to do the science work, but you also need your citizen people, volunteers… I think it’s important to have that mix because it gives you a better balance of the whole outlook of what is going on”
- “I think because people who are not involved in the lake association, they don’t think about water quality, they don’t even think about the environment itself, to them it’s you know ‘I want to have a good job, I want to be able to pay my bills, I want to raise my kids’, they don’t even think about water. You know I was one of those people, living in the city who never thought about water… unless you are told by the health that it’s not safe to drink… so you don’t think about where it comes from, you don’t think about the vulnerabilities of the water. So that’s where I think the challenge comes in because they don’t even think about it, they’re not concerned about it, for them that’s the last thing they think about. I think less people are raised in an environment where they’re on a lake or near a lake… I think a lot of people even oddly don’t think about the longer term, you know they’re interested in going to the cottage, boating and swimming, they don’t think about the impact that they are having”
- some people like the way things were 100 years ago, they don’t want to change their ways and practices involving water treatment and usage
- the motivation to participation had to come from the person themselves, “it has to come from their own beliefs and their own understanding”
  - conservation authorities support people like himself, they support citizens that are concerned and they do try to reach out to others but it’s sometimes a really hard sell
- demographics: older, retired people involved in projects
  - there are people that rely on the lake for their living (whether retired or not), but if they rely on the lake for their livelihood, then they are more interested and they get involved
  - the demographic of the people who are living on the lakes full time are changing, they are selling and being bought as summer cottages, so the amount of people full time on the lake will decline, and this might change over the years, when people get a bit too old it becomes too much for them and they need to switch to a condo or an old age home

Funding

- mostly found not from government directly, more companies
- some of the grants are a fairly lengthy process to go through, many of the grants are for a very specific project
- “there are so many organizations and lake associations that are asking for grants that it is getting pretty competitive”
- it’s possible for one lake association to get funding and do a project, but when you get a few lake associations together, you have a bigger voice, but have to get all lake associations to do the same project which can be a bit difficult (even though there are a lot of similarities there are a lot of different mindsets)
Public interest

- the big question is how do we get more of the general populous to understand the issues and the fragility of the lakes, which is the water they reply on, “I see that as the biggest challenge”
- CTV poll (March 3rd 2016) poll for what is most important to Canadians, job security is highest while only ~1% of Canadians care about the environment
  - “without the environment with have nothing”
- there’s too few people that have the interest and willingness to do something about water quality

Terry Rees: Citizen Science and the Ontario Federation of Cottagers Association (FOCA) (March 14 2016)

Background information

- Executive director of the Ontario Federation of Cottagers Association (FOCA)
- Started as a volunteer at FOCA about 20 years ago, then 12 years ago took an a job as a staff person but started as a citizen scientist
- Practical experience with applied science, day to day stuff with the association

About their projects

- Not for profit organization, civil society organization, association of associations
- In Ontario there are a lot of citizen groups that organize themselves as volunteers to do a lot of a variety of things in the community, related to the quality of life and protection of the environment, but also surrounding social aspects as well (community events, fundraising, etc.). Groups are all organized around the lakes
- In Ontario there is an abundance of freshwater lakes (250,000 or so) and on about 500 of the lakes are associations that belong to their organization
  - The lake associations are the eyes on the ground where people are able to express interest and concerns to their organization and the Federation provides topical information about the environment, what’s happening with water resources (freshwater)
  - The Federation also does some government relations and advocacy work so in other words they talk to various government agencies largely at the provincial level to talk about concerns around the management of resources (almost all related to the quality of water bodies)
- They have a citizen science connection between other non-profit partners and Ministry of Environment
- There is a small paid staff and a board who is elected every year (about 15 people with various backgrounds)
  - There is a nominations committee among the membership
  - Try to get people who have some qualifications (communications, science background, legal background, etc.) need people who can do a variety of things related to governance
  - Employees: scientist who works out of Dorset (direst science connection to support the citizen science), office manager is an environmental science grad, communications person (they are all paid to do the heavy lifting while the board is volunteer and they take care of more the governance)
Participation

• On encouraging participation: “we usually are trying to make connections between bigger or longer term issues, or we have to make the case for why something is important or why it matters, because most of our volunteers don’t really care about what form of phosphorous or how much of it there is just generally, but they are certainly worried about the fact that it is an element that is going to have some sort of impact on their use, enjoyment, and health of their neighborhood, so based on that we have these 600 people every year who are willing to spend some times, effort, and a little bit of money to sample for the greater good. There’s a selfish element to it, so there’s always the marketing as part of the deal where we have to explain that you do have selfish interests here, because if you don’t pay attention things might go badly it might be too late, although we do use positive and proactive messaging and try to avoid the not too alarmist”
  o try to share with people the relevant information on the impact of climate change, what is happening with contaminants in water, invasive species, how land use impacts the biodiversity and water quality → there is constant communication mode to peak people’s interest “what we are trying to do is without being alarmist and generally kind of scaring people, we do try to encourage them to pay attention in their own right because it will not only support better decision making and better decisions in their own neighborhood, but also because it supports the broader scientific knowledge and hopefully policy at some point, and practice in a sort of broader sense”
  o LPP is a long term partnership and long term core programming, through this they are looking at things that the science partners have indicated for years that they want them to track

• “we find though that the motivations to be optimistic for the greater good is significantly less motivating… people are very local in nature and they have very personal, proximate interests and concerns, so I mean that seems to be the highest motivator… which is only kind of human nature right”

• challenges
  o “I think that there’s a real challenge with the lack of causality in things environmental, we have very short attention spans I think, as a species we really think things have direct and immediate correlations and it’s very much not the case… the issues that we’re concerned about or that we’re looking at or that we even notice that are quite complex and often are cyclical and often are long term, so having people continue to be engaged and involved involves an ongoing discussion about the fact that this years data might not be all that exciting compared to this years data or even the years before but you have to convince them that they have to buy into the fact that this is a long term proposition and this is really valuable work and that it is really useful and so trying to come up with compelling stories about what the information is telling you, which is typical with having scientific partners and sort of non-scientific but interested citizens, because scientists are usually very reluctant to draw straight lines between
things for very good reasons because it’s usually not that simple, but trying to tell a story with data is something that we encourage all of our science friends to do, and whether that’s in academia or in government or whoever is doing the work”

- Example of the above: had people doing sample work with blue green algae, didn’t have data before and now that they have it they see there is toxic algae, so need some kind of management to understand what this means, takes a while before you are able to tell and interesting story about that to see what is really happening and what is means
- People are interested and motivated, but need to understand what is happening and what they should do about it

- Demographics:
  - Generally retired and living at the lakes
  - Sense of place:
    - Sometimes they get comments from people who are concerned about changes but they haven’t been at the lake for a very long time
  - Older volunteers have more time to spare (retired and kids grown up)
  - Many of the older volunteers have years or decades of connections to the water bodies, sense of community and sense of commitment to the region
    - they are a great potential source of long term data since they have been living for long periods of time for decades in the same place → this is also a motivator since you have a connection to the sense of place and to the change of the lakes
    - these people understand more about what the lakes are supposed to look like since they have been on the lakes for 30 years and know what it used to look like
  - “In Canada the development of inland lakes, and in Ontario where most of these organized groups are, most of them happened post second world war, so most of the opening up of these areas sort of communities, the social construct happened in the 40’s, 50’s, and 60’s a lot of it, and … I would stay that today as a society we’re more urban as a society so some of the connections we might have had 40 or 50 years ago, which might have been, this is notional, but I think the data bears it out, that people would have had a more outdoorsy ethic… more fishers and hunters and people who swam and canoed, I think there’s probably a higher number of people that are less connected to the outer doors generally, it used to be a free place where you could go and recreate, vs. a second home. And that’s not everybody, that’s a generalization” but the people who used to go had to deal with worse living conditions and bad weather so they were really inclined to be in the outdoors, they might have been observing things in a different way from the people who are now more urbanized by nature. 80% of people living in Ontario are living most of the time in a big city, so might have a different idea of what nature is supposed to look like → the citizen context is different and they have a different experience


- “the people that care the most are the people that are going to live the shortest amount of time, so the people that care about the future really don’t have much of one”

- “I’m not sure that volunteerism in 20 years will look the same… I’m not sure subsequent generations really have the inclination to show up to a lot of meeting and have a lot of community organizing, I think they are more action oriented” they seem more task oriented so it might be ok for citizen science in terms of getting people involved, but wonder about service clubs etc. (kinsmen, lions club), tend to see the same 10 people doing most of the activities in the mid size towns like Peterborough

Citizen Science

- Two primary ministries in Ontario:
  - Ministry of the environment: primarily concerned with toxicity and environmental protection in general
  - MNR: interested in resource extraction, biota (fish, trees, and rocks)

- They also have citizen science related to aquatic invasive (fish and macrophytes)
- Not their programming but they support and encourage: migratory birds, ice watch, metro Toronto zoo and Ontario nature for tracking amphibians, loons

Funding

- For education and advocacy work they are member funded so they can maintain a regular staff for education related to citizen science
- For data collection, analysis, etc. this is pretty expensive so they are funded through grants
  - Have a primary one for the LPP, it’s a bit unknown but it is now a long term commitment from the province of Ontario to support their network so that’s been essential, wouldn’t happen without that grant
  - So it is subject to the vaguery of government in some respects, every year there is a little bit of doubt whether they will get funded again, and the program would cease to exist without it

- If funding is cut, in the world of long term monitoring this is a problem
- They (FOCA) have an annual amount of funding that allows for the proper amount of data collection (water quality)
- For the invasive species: more of an annual thing that can come and go (presence or absence)
  - Difficult from a communications and community building aspect
  - “I have an opinion that if it’s important then you need to say it’s important and commit to something and continue to do it in a way that shows the people you are trying to get to volunteer, get these citizens involved, I think that if you start and stop a program then that sends a message too”

- there has been a big movement in Canada and elsewhere to applied sciences, to things that have an engineering application or tied to jobs, so collection of science data just feeds the body of evidence → like to think there is a role for government who does a lot of the funding for things like water quality, and academia that’s going to continue to happen… but this is not a foregone conclusion

- “We’ve had recent governments in Canada that had less of an inclination to support long term science, and not only that but some of that science ceased to
happen. So citizens weren’t supported and weren’t encouraged to do anything, the people that they work that might have been managing you know who were asking the questions were discouraged or no longer funded to do so, and maybe even more tragically there is long term data that just wasn’t retained, and wasn’t managed which is a status that you can’t reproduce”… need to remember to keep monitoring so that the data can be kept and will help with management in the long term

• “both the citizens that are collecting the data and the ones that aren’t paying attention, when push comes to shove they expect there to be good decisions making based on sound information, and when it comes to resource management it means that someone has been collecting data that whether you knew if or not it was going to be really important for decisions down the road”

• “politics and science don’t mesh really well, because at least in Canada the political terms are 3 or 4 or 5 years, and often the environmentalists require a longer term outlook, so that’s when having continuity delivered through to volunteers particularly who are unpaid and committed in their own right is very important”

Government involvement

• not all the projects would happen without government support

• there are only certain bodies that have both the resources and the long term broad social relations to conduct and support things like citizen science (and things around like decision making, design, admin), so governments are kind of in a unique position in that way

• there certainly is a role for interest groups: which is a community or citizen based organization,
  o some of the most successful citizen science projects are from these kinds of groups (e.g. birding) with some help from government in some cases, but doing a lot on their own

• it’s not that it’s impossible to do it without government intervention, but there is a risk there that you can’t maintain it in a cohesive and long term way if you don’t have the resources to do it
  o also might not be able to do the projects in a scientifically defensible way which is important

• when citizen science just happens in and of itself, sometimes the work that needs to be done isn’t always about charismatic macro fauna (can always find people to do this)
  o sometimes there are other important things to monitor that are less obvious that might not otherwise happen
  o if people are not collecting and analyzing data in a meaningful way, then could give improper results or just be a waste of time so having a long term view and objective, certainly long term citizen science is great, but it is important to have an overarching strategic direction or objective which is often reliant on someone who has a long term view and in Canada that is the government

• US: a lot more citizen funded (can be tax- Minnesota example)
• Where science should take place isn’t always related to where the people are, it often happens that projects are well funded in areas where there are a lot of people, but in areas (e.g. Arctic) where there aren’t a lot of people sometimes the projects don’t happen, so if there is government funding that can broaden the scope of the research and what is being looked at, maybe you can get the data that you need to make some bigger conclusions
  o Can have lots of science around important places, but also in other places where there aren’t many people doesn’t get as much attention and could be more important
• On citizen science projects“it’s very cultural for sure… in Canada we think governments should be looking after things, we have an idea of what the role of government in Canada in terms of taking care of our natural resources and our well being and our social infrastructure and everything else and that’s… whether that’s citizen science or day car programs we kind of have an idea in our heads as what our role as citizens is, but we certainly the government plays a strong role, it’s a cultural things”… in the US they say that if there is a problem they go out and fundraise

*Interviews Conducted in Sweden*

**Bent-Olov Eriksson: Lake Tämnaren and the Municipality of Tierp (April 13 2016)**

**Background information**
• Mayor of Tierp: head politician of the municipality of Tierp
• He was very involved with the meetings at the beginning but not as involved today

**Background on Lake Tämnaren**
• In the middle of last century thy lowered the level of the water for more agricultural land
• Around 1975 they raised the level again because the municipality of Uppsala is using it for their drinking water
  o If they did not raise the level then the lake might not still be there since they have to take a lot of the water from it
  o More needs to be done though to save the lake

**Tämnaren Vatten**
• The organization is a good start
  o There are a lot of people who want more ground (so a lower lake level) but the problem is the level of the land is lower too due to erosion
• In convincing Uppsala municipality that the issues are important and they should take concern:
  • Tämnarens Vatten is important, as is the municipality of Tierp and Heby
  • He wants the level higher today but you might need to dredge the bottom of the lake, that is only possible if you can get economic revenue (could also use this to make biogas or something and then there is much more interest since there is financial gain)
Government involvement

- The involvement of municipalities and the lake
  - Most of the lake is in Heby and Tierp, a smaller portion is in Uppsala, but Uppsala is a much bigger municipality, they have economic resources that Tierp doesn’t have, they also have another interest and that is drinking water
  - It is absolutely necessarily to have Uppsala on board with the issues
  - The problem is that Heby and Tierp are very interested in the issues with the lake, and to restore the lake. But the interest for Uppsala is completely different. Uppsala hasn’t been interested enough to save the lake

- They discuss these issues with Uppsala municipality and Heby

- The changeover of representatives in the Uppsala municipality
  - Had to make new contacts
  - Because they are new, they had so much to do in the beginning, and this project isn’t so big for them
  - It’s not because of their party views, just because they are new and have a lot to do

- To make changes long term on the lake
  - Need to convince the highest leading person in the Uppsala municipality that this is important, they are not the people who will actually do something but they need to give their support
  - Tämanren Vatten is a good way to gain their support
  - It is necessary for this to be done if they are going to save the lake
  - It’s never going to be a good area long term for agriculture since it is too wet

- Questions of the environment are now a high priority so he is hopeful that it will change in the future

The river of Tämnaren passes by Tierp to the coast

- There are regulations to open the locks from the lake to the river at certain times

- One of the problems is that one of the court orders that determines the level of the lake is very old and if you follow it perfectly then the lake will be very low
  - They want to change this so that they can keep more water in the lake
  - To change the court order it is quite difficult and it must be the municipality of Uppsala who does that because they own the court order
  - Must work with them if they want to change the order

Funding

- Can the municipalities fund the projects?
  - Can help with it, but Tämanren Vatten has a much better possibility to find an entrepreneur to help
  - They have a lot of rules in the municipality and can’t help with everything

Additional notes:

- If you take the long term, then shallow lakes are naturally doomed (they will eventually be gone), the only way to stop that is to find economic means in order to dredge the bottom and to do that you need to find an economic revenue to do that. If you find that then the lake will survive a very long time
The organization could perhaps find a company to get the funding

- Ex. Tierp had funding from a company that had a factory near the coast, they needed water from the river but now they are gone
  - Some people may be upset about lower river levels if they let less water run there, but this is not the biggest problem in comparison to the lake

- You don’t need to have the maximum level of the lake, just the summer or fall level needs to be updated in order to reflect the conditions for today
  - The court order was made in the 70’s when the environment wasn’t as important, so a court order today would probably reflect more about environmental concerns

- The environment is a high priority for both politicians and citizens today

- The lake is very important for recreation: bird watching, fishing, boating
  - It is hard when the lake is low to go out in the boat since the propeller gets stuck in the plants

Birgitta Ohlsson: Citizen Participation and Lake Tämnaren (April 7 2016)

Background information

- Former Secretary of TWB
- Working for 10 years as secretary on the board but been away for 1 year now, still follows the Facebook group
- Her friend was the chairman of Tämnaren Water Board and he asked her to come and help with the project

About their project

- Working for ten years on the project but not much happened, what did happen though is that the minds of people changed
- The most active people in the group in the first years was herself and Kiell Tofters
  - They had to do a lot of lobbying and talking to people: politicians, university people, newspaper journalists, and arranged meeting for the people living around the lake

Challenges

- Trying to make people see what’s in it for them (for example farmers don’t really have the time for that, and if they explained they should maybe change their production, they were more interested in making the most money, they were more interested in the profit)
- To make people realize the important of the long term work, because it takes time and you can see the effects
  - It’s not day to day changes but it changes over the long term

Government

- The people eventually started to realize the problems because they talked amongst themselves
  - Nowadays it is popular for the people from the city to buy some land and move to the lake, finally after some years it was easier for them to realize
  - But it was much slower to convince the politicians, the EU framework was not very direct and the politicians didn’t have a fixed deadline to do
something immediately, there were not aware of what they had to do and they were not aware that the lake was so quickly changing, they didn’t have this as a priority

• But they do have to write down in their summaries for the environmental codes what they have done in the year so it became popular to work with these questions so in Uppsala they started to have to compete with other counties to show what they have done for their watershed, and before there was no such things as a watershed before and now they have to show that they are taking it seriously

• Uppsala Kommun now has very good people, they know how to answer → this is really environmental communication
  o Not to tell them they have to do this and that, but to give them answers

• Talked about making concrete changes to dig up the bottom or spreading something to change the ph level of the lake, but nothing is done yet
  o Nothing has been done yet mostly due to economic restraints
  o Also due to the fear of doing the wrong thing because of biology, there are so many things that need to be examined before you do anything, that knowledge is not there → to buy that knowledge and to have someone go out and examine things it takes a lot of money
  o An alternative is to not do something about the depth of the lake, but to stop things that make plants grow (which affects the farmers)

Participation

• To make changes around the lake you need to start with the people (as opposed to government), the people understand and when they need help from the community, the community needs to be prepared to answer questions and listen to their different needs

• The people living around the lake are helping financially, but they are also networking a lot and they know each other, they talk to each other about issues like how to get rid of grass, they exchange knowledge

• When the community needs to know what people think, it is easy to talk to the organization to understand different perspectives

• Demographics
  o Gender is 50/50
  o Older people have more time to put into these kinds of things → but they are also very clear about what they think
  o The new owners of land are also interested because they have just invested in a farm or something, they will live there for a while and also building up their families there
  o So it is fairly diverse in terms of people but they have many different interest
  o The older people are a bit stuck in their ways

Engaging the public

• It was very important for the stakeholders to see different parts of the lake, sometimes it is low in one are and in another it’s very high

• Important to take people out of their office and talk to people
• It has been inspiring to meet with people from the University, saw linkages to other global problems and there are so many people involved to make changes, this made the project feel very important and you felt a part of it (29:00)
• The organization creates a space for the people to discuss their opinions
  o But it took times because in the beginning people said it’s no use to organize in that ways, you are just talking and you really need to do something
  o After they expressed this there was more understanding and it was more like a compact, the communication was then much better
  o The lake is still experiencing plant growth, so nothing is really done, but the people are aware of the danger, but maybe now they will change their practices a bit

Knowledge Production
• The communities said they collected knowledge that they could never have had unless the organization collected it for them
• Some of the people like the farmers are not writing people but they are thinking people, they can also tell about their fathers or grandfathers experience, most of the farmers are buying services from companies and they can give examples of how to do technical things so they are able to offer some solutions that they have already tried
  o They also have a lot of ideas of what they could do with the mud if they dig it up
  o They have examined these things by themselves and read about technical innovations and so they talk about this
• They don’t produce reports, sometimes they have bought from consultants examinations from different parts of the lake in the form of a report
  o What they still need is a project leader to take care of all knowledge and report, should be someone with a salary and employed in the community or something similar
• They were fortunate to have people coming from the University to come and say something is important, and then they realize it is
  o When someone tells you about what you already know, you can make a kind of report
  o Then it becomes more understandable, this is environmental communication
• “we know what we want, and we are just dying to get some engagement from the community, that costs money…”
• when people hear from others that they respect they listen

Funding
• some from the University
• some from water council possible but needed to do things at certain times and they didn’t have a project leader or anything to help so it was a bit of a more amateur attempt
• if they had the communities behind them or some coworker to help with this
• someone from the water group should talk to the people and gather information and then applying for money would be easier

Additional notes:
• “I don’t think you should work forever with these questions, now you know what the group of people, you know them, you know their needs, you know what they can do and what they want. So what they can do to help save the lake. And now all this knowledge should be put in the lap of the counties and then this group should stay of course and maybe collect…. Maybe to be some middle part but not always this hard working, trying to find what to do. So then the knowledge and the plans for the lake should be in the communities, and if anything changes, the community can go to the Tämnaren Water and say this is what we are thinking, and the council should go around and say what this planned...” a middleman trying to work with everyone

Kiell Tofters: Citizen Participation and Lake Tämnaren (April 5 2016)

Background information
• Former Chair of TWB
• “I remember when I was a little child in the summer my father and mother took us three children out in a little boat and then we were staying some weeks on a little island in the lake… still I have some images of that”
• involved in sporting on the lake, and bird watching since about 20 years old
• became engaged in a lot of projects and politics in this municipality and in this local area, especially to develop the countryside and the businesses of the area
• has been interested his whole life to develop the area and in the history of the area

About their project
• Collaborations with SLU and UU

Background on Lake Tämnaren
• Lake Tämnaren is placed in 3 municipalities, Heby, Tierp, and Uppsala
• Tänaren has been a big part of the early history of Östervala (it was it’s own municipality until 1971)
• Lake Tämnaren was bigger earlier on than it is now, then twice the water level has lowered (1871 and 1951)
• The lake is on really flat land so sometimes in the spring when the snow is melting a lot of water comes into the lake, then it expands over a lot of areas where the farmers wanted to do agriculture, so therefore especially the farmers wanted to diminish the lake and other people were interested for fish and swimming
  o Nowadays recreation was an important thing, but if you go back 50-100 years farming was more important
  o Years ago farmers didn’t like to have water on their fields, so they made two locks
• In the 1970’s the municipality of Uppsala was interested to get reserve water so they got a new water law or water council (regulation of the water), Uppsala has big muscles so they could have the power to build some walls and install some
pumps → when the water went over the walls then the farmers could start the pumps and bring the water from the fields back to the lake

- **Map**
  - South lake is the other lake
  - River to Tierp and to the Baltic sea
- In the Uppsala part of the lake it is marshland so it is not productive land for farmers
  - So the Uppsala municipality paid the owners of the land cash forty years ago
  - They built the walls in the other areas with the farmers and they got some financial help
  - But in the spring in this area there is a lot of flooding, there are some new land owners that are not the same as forty years ago, so the new ones aren’t interested in what the former owners got as financial compensation, so there is still a bit of a war in this area
  - In Tierp and Heby the flooding issues aren’t as bad
    - Most of the people living here don’t like it when the water is too low
    - You can now see stones in these areas that you couldn’t see earlier
  - The only ways to resolve with issue is for the people to have an agreement
    - Together with Hans Peter and Sri there have been meetings with local people in Tierp, Heby, Harbo, Östervala, and also (other name on map)

- **Water council = Tämnarens Vattenråd (TWB)**
  - He started this 9 years ago
  - The first meeting was arranged by the county of Uppsala in Östervala, they said that there was a new water rule system from the EU, therefore they wanted some people to freely organize the water council to work with the lake and could be a co-partner
  - He took the initiative that night to say that he could to it
  - Meeting was in January 2007 and in June they settled with new organization
  - He was leading this until one year ago, then a new organization was made called Tämnarens Vatten which is headed by Ulf

- One big problem is the bottom in the lake is raised about 5mm per year, this is coming from the farm fields as mud runoff (this is a natural process since the soil is clay), if you take out the mud (muddra = dredge)

- In the last 10 years they have made a lot of marketing and promotion about the lake
- Most of the inhabitants want to save the lake, but the farmers are interested in maybe regulating with walls so there is no water on the fields, but then there is also some fighter against in the area of the marshland (Uppsala portion) since the water can come up to their houses
  - To solve this is needs some power or administration who could solve this, and I think the best thing should be that the Uppsala municipality will decide ‘now we do this, now we have to make a new regulation’
Easier to have government helping with the regulation in these kind of situations where there are different interests

- Nowadays both the government and people and politicians make priorities in the environment, and people’s possibility to be in the nature, at the lake like this or the forest of the field… and I can see that this interest is now more important than the interest of the farmers”

Isn’t easy to make money these days to be a farmer

- Some farmers around the lake no longer exist because they were loosing too much money
- Now around only five milk farms remain
- So the farmers are looking for another kind of job where they can get another salary to get more income

The main challenges:

- Getting everyone on the same side to restore the lake
- Some people are still blocking the restoration
- If Uppsala municipality would make a new water board… the politician of Uppsala is hesitating since they know that some people around the lake (in the lower portions) will try to stop it and also ask for money as compensation and they don’t know how expensive the whole process will be
  - Uppsala succeeded when they made the regulation of 20cm and with the walls and pumps
  - Back in 1951 when they lowered the water level the farmers were happy since they got more land but now they have lost this land (due to the composition of the land and the runoff into the lake)
- If Uppsala needs more drinking water in the future it might be that the city needs to a new water council because water will be more and more needed, then perhaps they will have a solution on how they can help the people in the low land area

Funding

- Not received funding
- It is a little too much to plan and prepare to apply for the funding
- Perhaps and opportunity by collaborating with other in Estonia and Finland
- Working on a low budget
- Some money from SLU when students come to visit

Participation

- The meetings with the different villages to understand concerns
- When they started with TWB they wanted people from all three municipalities
- They had several meetings with local people but over the years they also had several meetings with politicians of Uppsala, Heby and Tierp, “still it takes time to persuade the top level politicians in Uppsala”
- “it takes time when you work with the local people, we cannot say as perhaps politicians could do earlier- just plan this and now we do this and now we decide this- because we have about 500 people living and staying around the lake, but
Uppsala should be more interested in this because Uppsala is growing and in the future Uppsala needs more water, so they take some drinking water from the lake”, also looking to take it from another big lake south of Uppsala
  - if they get more water from Lake Tämnaren they should be interested that there is enough water
  - how citizens are participating in the project
    - the participation has been up and down
    - 500 people are living and staying around the lake in a bout 2km from the lake, around 100 of these have been in the meetings
    - when they have the meetings there are about 25-50 people who participate
    - it takes time to work like this but this is the only option they have, they have tried to work with several tools: (combined together to convince everyone to go in the same direction to restore the lake)
      - local meetings
      - meet politicians
      - work with media: especially in UNT, radio station in Uppsala, local television
      - science: they have been happy to have the opportunity to work with UU and SLU because the more science they have the easier it is to convince people to change their mind. But to work with science it takes times to change opinions. The science is really important to know what to do. Mostly science from outside researchers then using that to know what to do
  - the aims of the methods they use to have people participating is to restore the lake, or else in a few generations it will be marshland and maybe just a river
  - the hope of the project is that all the people involved (citizens, politicians, media) should join together and go as an army to restore the lake, the methods used are to recruit people to join in and restore the lake
  - demographics
    - one problem in Sweden is that people who want to engage in any kind of organization, mostly older people come than younger people
    - but when he meets people that both young, middle age, and older are interested in restoring the lake
    - but to actually engage, it is more older people involved
    - the good thing is that looking at the board, they are in middle age (40-60)

Knowledge Production
  - they give the opportunity to people around the lake to talk about their knowledge and experience of living on the lake to help with the process

Pontus Elvingsson: Citizen Participation and Lake Tämnaren (telephone, April 11 2016)

Background information
  - Owns a farm
    - It is the old farmland that was created back in 1860 when they had a project in the area where they decreased the level of the lake, at that stage 150 years ago there was an overpopulation of Swedes and 1/3 went to the US, many hectares of land opened up
Decreased the surface area size of the lake

About the lake

- The humus on the land has been eroded so some of it is becoming a swampy area and it is going until the clay
  - The humus layer is decreasing about 1cm every ten years
- Over the last 30 years there have been more cabin built for recreation and their areas can get swampy
- Have had an increase of red reeds around the lake, increases all the time since it is a shallow lake and lots of nutrients from the runoff from the farms and the woods (phosphorous and nitrogen) so there is a good production of algae and problems with loss of oxygen in the winter so they had some periods where fish died from this lack of oxygen (also sulfur dioxide)
- Something has to be done
  - Have talked about taking out mud from bottom of the lake, but the most realistic plan is probably to raise the level of the water
  - The properties that would be flooded need to accept it and maybe get some compensation
- The water is also used for drinking water in Uppsala
- The lake is good for water birds but the development of red reeds is bad for them
- Used to have lots of animals in general (like milking cows and grazing animals)
  - Had 2 million cows in Sweden, this was one way to harvest solid energy in winter (butter and cheese)
  - Today some of the areas can’t have the cows anymore since they are too wet, the farmers leave the areas where they have the most problems
  - In order to restore the areas they need some support to do so
  - He has water buffalos which actually like that environment and they have certain features that make them suitable for the land that is a bit more wet
- In the abandoned areas in the south there are a lot of problems with mosquitos since they are very wet lands with the leftover hay
  - When they actually harvested the fields and had grasses then the problems weren’t as bad
  - This could eventually be quite a big problem for lake Tämnaren if there can’t be harvests, or with reduction of water and mosquitos breeding on wet lands
- Something has to be done, if there are too many plants then there will be no waves on the lake, and if this happens then the oxygen will not circulate down to the bottom

About the project

- The intent is to make the lake survive for a longer amount of time
- The way to restore the lake is to increase the level of the water by 20 cm
  - This would be ok for the other farmers, a lot of the land downstream is not used today, most land is abandoned and will not be used (due to the damage of the land it is lost)
- Overall need to increase the level of the lake, but also be able to avoid big flooding every now and then. In order to do this
Need some consultants to look into the problems that we can see today and the development of the lake in the last 30 or 40 years (what is tendency and what will happen if nothing is done, what will happen to the environments around the lake)

Need some county support and support from the community

There is some money in the areas to keep up the biodiversity and the wetlands, the lake can host a lot of migrating birds so maybe this can be done, but in order to do that need to do the same as some of the other big lakes where they started restoration over 40 years, they get a lot of tourists → lake Tämnaren has the potential to do this

Government involvement

• People are able to discuss about the water level through the organization, people are worried about it during the dry times
  o If the level is too low then it is bad for the reeds and more plants in the lake, hard to fish (plants)

• Need to now engage the kommuns that benefit the most from the lake, which is Uppsala Kommun
  o “I think they need to put some money into a study, so that gives some key indications on what we should do in the future, and the economical consequences of those plants… the only alternative is the raise the water level”
  o and also make new conditions for those who want to build a house, perhaps they should do it on a platform or something similar so if there is an increase of the lake there will not be any flooding in the houses, shouldn’t have houses where there could be flooding

• the Kommun’s have the economic resources, they need to think of the long term consequences
  o there is a lot of money in the expectations, need to make steps on the way that they can bear the consequences

Participation

• Involvement with Tämnaren Vatten: not too involved but did have some ideas about what to do

Robert Ekman: Citizen Participation and Lake Tämnaren (March 31 2016)

Background information

• Enjoys being outside in free time
• Has a kayak and was outside paddling on the river, noticed a lot of plant growth in the opening, also been fishing on Lake Tämnaren
• Out as of roughly the year 2000
• There has been growth in the opening and edges it’s hard to fish, plants get caught in the propeller

Involvement

• Quite a new member of the group, planning to get more involved in the future
• Follows the Facebook group to see what is happening
• Would like to help with the future of the organization since if on the water then it would be good to help
• Doesn’t know anyone else out on the lake so it would be good to collaborate with the other living on the lake
  o Would like to propose some ideas concerning boating on the lake
• Demographics:
  o On younger people interested in these issues: environmental thinking isn’t almost important when you are young but if you don’t do it now then you will have trouble later if you don’t do something now
  o “I would like to have some fishing time with my son maybe in the future on the lake so I think it will be good to join [the organization]”
• if he had heard of the organization then maybe he would have joined earlier, but it’s hard to get the word out sometimes
  o they wrote a bit in the paper
  o But people sometimes don’t look at the problems in the lake as a big deal compared to larger issues
• When he got Facebook he found the group, found the group after 2 months
Knowledge
• would like to learn more about the issues of the lake
• has heard from a marine biologist that is you take all the dirt away from the lakes then all the bacteria go and it will take a long time for it to grow back, so you can’t just take it away
Changes he would like to see on the lake
• would like to see more clear water in the future
Government
• there is a law: you have to let the locks open and let the water pour out
• there is a river controlling station
Ulf Nygren: Citizen Participation and Lake Tämnaren (March 21 2016)
Background information
• Chair of Tämnarens Vatten
• Background working in politics, now works in business
• Has summerhouse at Lake Tämnaren,
• By staying close to the lake they noticed what has been happening with it, it is a shallow lake and can notice the low water levels
• Noticed in the local paper that there was a meeting for Tämnarens Vatten, and decided to go and learn more (in 2012 went to first meeting)
About their project
• The lake is pretty big so needed some sort of organizations to bring the local villages together
• There are small villages around the lake, there were a number of meetings around the lake in the small village in order to get interest
• At the beginning it was called Tämanrens vattenråd: it was a group to help and work around the lake but there was no standard for running a club, there was no one elected as the chairman
Eventually there were a few people picked out to help run the organization, the election of the board and getting members to make an organization

2014 had the first official meeting to elect the board and Ulf was elected as chairman of the board at that time

all organizations in Sweden must have a social security number to get a bank account

“our intention is to of course make opinions around people living around the lake and the three communities”

the lake is in three counties: Uppsala, Heby, and Tierp
- the lake is divided in three parts
- need to have all three communities working together since the lake effects all three
- it has been very hard to get the politicians to work together

people further north along the river are also concerned since if there is no water in the lake then there will be no water in the river so they are also joining the organization

the area of Upplands is raising from the sea (a very small amount every year), Uppsala can’t take water if the lake is lower than 37m from the Baltic Sea, but with the land rising this isn’t good for the depth of the lake

ideally hope to have the understanding from Uppsala to be careful to not drain too much water from the lake
- the locks are still manual (not sensing the level of the water)
- want communities to understand that they need water in the river at the north but not that much water
- need the support from the owner of the court orders and the government to do this
- the court orders were there to make more land for the farmers, and at this time there was an obligation to let water into the rivers

the organization is there to educate people are the lake, they don’t have the power or the money to do it themselves (digging the dirt from the bottom is very expensive)
- the water authority had recommendations from the EU that said the farmers had to spread something to keep the phosphorous from going down to the lake, but that would be 20 million per year

are the citizens bringing forward ideas and how are they received?
- The idea of the organization is to make an opinion of the lake
- People are bringing their own ideas and initiatives (for example: water buffalo farmer that is using the water buffalo to clear the water)

The water council
- they were the ones who started up the whole project, they were running meetings
- they were kind of a council for Östervala
- they have now taken over the responsibility that the water council had, and now they also have their own bank account

Funding
- get a bit from SLU when students come to visit: 5000 kr per busload (3 last year)
• don’t have capital for activities
• European Union has projects and hoped for this kind of funding, but best if the three communities were to get together and be big enough to get this
• 2014: got some money from the water authority to start out
• membership fee from the members to cover the administrative fees
  o family membership is 200kr (70 families)
  o country of Tierp and Heby paid 1500kr as a member
  o local clubs along the river that became members paid 500kr
• money is power and power is money, if they had a lot of money they could have people employed to work on this but don’t seem to have a chance to get this

Government
• Uppsala county
  o The water council tried to get contact early with Uppsala county and they got the contact in the end of 2013, but then there was an election in Sweden in the fall of 2014 and they changed the leadership in Uppsala, so they lost their contact
  o So it is taking a lot of time to get contact with them
  o For the people living near the lake in this county they are very far away from the city of Uppsala
  o 40% of the drinking water from Uppsala comes from the lake
  o no formal membership with the organization
  o just last summer they really got in contact with the new leadership in Uppsala
  o have met the person now in charge, it is progressing now since the article
• Tierp
  o Easy to make contact
  o They contacted through mail to talk about the lake and TV went to them and presented to the chairman of the city board
  o After meeting the community of Tierp became members of the club
• Heby
  o They understand the importance and are members
• “To do anything around the lake we have to have the three communities cooperating”
• invited in May for the local politicians to come and learn more about the lake

Media
• Article in UNT in June, then SVT (Swedish television) saw this and the reporter came to the lake
• UNT article: main photo on front page with a double spread article about the lake on a Saturday
  o Said that the top politician in Uppsala
  o The article really started something, received an email immediately to get in contact
• The journalist always have the last word (the politician was not too happy about what they wrote but the journalist will continue)
History
- The lake has been bigger before but they lowered the level of the water in it starting in the 1800’s and that was in order to get more area for farming
- The judges and the court orders decided what the level should be, there are also orders on the amount of water that goes into the river in the north
  - So even if the lake is low on water there still must be water in the river going north because there used to be old power station up there that needed the water

Concern with the lake
- Level of the water, when it is lowered the sun reaches the bottom more easily and stuff will start growing more so more weeds water lilies growing
- People can’t go in their boats since the water lilies get stuff in their motors
- The mud can get very deep, comes down from the farmers

Farming
- Less important than in the 19th century
- Starting to get more into these kinds of projects and with the organization, the former chairman of LRF is involved

Challenges:
- Slowly getting to the political parties to understand the problems of the lake
- The county of Uppsala: better contact with them, money and understanding from the national government to help the lake
- Water authority on the national level (probably the water framework/directive), they have 6 areas …

Participation
- people from all around the lake are involved and working together
  - farmers viewpoint
  - living up by the river
  - people who like fishing
  - land owners (not farms but woods)
- public participation in the organization
  - try to get people interested through the website, facebook site, some poster for local grocery stores, meetings, adverts and paper/magazines
- citizen science
  - help from SLU
    - one researcher in summer of 2014 to see what was in the bottom (it was her interest), to have a company do it then it is expensive, had one of their members take her out by boat
  - otherwise not many other parts like this
- is there a lot of interest in the project?
  - Most people understand there are problems with the lake but it is a little harder to get people involved
  - People are not scared of it
  - In the marshland area they are a little scared that is the water raises then there could be flooding there, but the plan is not to raise the water it is to
keep the water at the same level and to perhaps get rid of some of the dirt or mud

- Is there a certain demographic
  - Not really, it is getting wider and wider
  - Naturally happens that there is a variety of people
  - In some clubs the members are getting older

Appendix C: Field Notes
This section contains field notes and observations taken from around Lake Tämnaren on April 18th 2016 from approximately 10:00-15:00. The main regions visited were Aspnäs and Ostervåla. The trip was done in conjunction with students in the Masters of Sustainable Development program through their course at SLU. Below of the notes taken from discussions with those involved with the excursion.

Kiell Tofters
- The lake was lowered by 1.1 meters the first time in order to increase the farmland
- The lake was lowered by 50cm the second time in 1951
- 1970: they built the farmers walls and increased the lake by 20cm for Uppsala drinking water
- when they lowered the level of the lake the first time they talked/argued about it for 70-80 years
- # of residents in the surrounding communities
  - increase in inhabitants since it is expensive now to build in Uppsala so it is cheaper up further north near the lake

Per Möller
- phosphorous is a big problem with the lake and this is
- he became engaged with the organization because of the phosphorous issue
- there is so much in the lake that is they could extract it then they could use it at the farms
- there is also more nutrients at the bottom of the lake
- it is very expensive to take the sediment up
- 20 years ago there were a lot of farmers around the lake but not there are not so many
- there is funding from the EU when animals are grazing for restoration purposes
- with the landscape that is at the lake there is a need for grazing animals
- the farmers got together to talk about the issues starting about 10 years ago
- the heavy metals in the lake are coming from the larger towns around the area and from the fertilizers
- they don’t have money to do anything, but they do talk about what to do
Ulf Nygren

- TV is there to form opinions and to develop LT
- Goal: live as a healthy and attractive lake
- Don’t have the money to DO anything, they just make opinions
- On year ago they made contact and have Tierp come on as a member, then shortly followed by Heby, it was difficult to make contact with Uppsala
- The municipality representatives on their board are politicians
- The media was how they got in contact with Uppsala
  - They talked after the UNT article and had their first meeting in August, slowly things are moving forward
- They need to have all three communities working together in order to:
  - Change the court order
  - Dredge the bottom
- They have about 70 member families, 4000 people are living fairly close to the lake

Hans Peter

- Decades ago people used to think that they could control things with technology, but now they realize this is not possible and with climate change it is getting worse
- It is very difficult to control the hydrological cycles
- All lakes in Sweden are ordered to be at a certain level and they are decided by the court
  - The water verdict goes back a very long time and it is very difficult to change it
  - Lots of work has gone into trying to change the verdict
- The wish now is that they can increase the level of the lake by 20-30cm
- The court order is not actually followed as it should be and if it was then maybe they wouldn’t have so many problems
- There are two levels:
  - the local people who want to do something but are unsure what
  - the WFD
    - chemical requirements
    - ecological requirements
    - and the also the public participation part that is left up to the water authorities to decide
- there is the water authorizes, there are 5
- then there is the water councils: no direct guidelines about this in the WFD or in Sweden therefore the implementation is diverse
- it is an emancipatory process for the people living near the lake: they can take initiatives and be heard through the project
  - lay people are asked to read and report to the chemical people
  - Hans Peter is supporting and helping and facilitating but not doing it for them
Appendix D: Lake Association Questionnaires

Robert (Bob) Garrett
- Education: PhD
- Name of Lake Association: Canonto Lake Property Owner’s Association (CLPOA)
- Position with Lake Association: Lake Steward

1. When did you first become interested in the condition of the lake(s) in your region? What sparked the initial interest?

   When we purchased land at Canonto Lake (1988) and became beneficiaries of the high quality of its water and environment. We have had a far greater involvement since the formation of the CLPOA in 200[20], at which time I offered my services as Lake Steward.

2. Why did you become involved with the Lake Association in your area?

   To be active in the community.

3. How was the Lake Association in your area started?

   The impetus came from recognizing the need for a Lake Plan so we could influence local government decisions, and speak with one voice for the lake community.

4. Are the board members or the Lake Association elected or do they volunteer for the position? Is anyone at your Lake Association paid for the work they do?

   Board members (Directors) are elected volunteers for up to four years (two 2 year terms). The Lake Steward is a volunteer position, as it is not subject to term lengths this provides continuity. The Lake Steward is a non-voting member of the Board whose role is to provide information and links to Ontario Ministry activities, the Conservation Authority, and forestry management on Crown Lands in our watershed by Mazinaw-Lanark Forest Industries Inc. No one receives remuneration for their lake stewardship activities on the lake or in meeting/workshop attendance, it is truly volunteer. On occasion Board members have received financial assistance for meeting attendance.

5. What are the primary concerns regarding the health of the lake(s) in your region? (E.g. phosphorous levels, algal blooms, invasive species, etc.)

   Canonto is a high pH Shield oligotrophic lake, P levels are low (∼6 µg/L) and stable. Major current concerns are invasive species, i.e. zebra mussels and rusty crayfish, and wild parsnip around the public dock and elsewhere.

6. In what ways has your Lake Association engaged with the public to raise awareness concerning the health of the lakes in your region?
We have posted an invasive species awareness sign at the public boat launch. We participate in Conservation Authority activities and an annual Lake Links Workshop (Perth, ON). We have made presentations to the North Frontenac municipal Council. Members are kept informed by supplying relevant fact-sheets. The Association is a member of FOCA, and the Lake Steward forwards their monthly Elerts to the membership.

7. Is your Lake Association involved with any citizen science projects in relation to water quality? If so, can you explain a bit about these initiatives (number of volunteers, how long it has been going on, the aim of the project, etc.)?

We have participated in the Ministry of the Environments Lake Partners Program since 2010, this involves water quality sampling for P and Ca in late May, and fortnightly measurements of Secchi depth and water temperature. This involves myself and one other volunteer, sometimes accompanied by another member. We have annually participated in the OMNRF/OFAH invasive species monitoring program through the Mississippi Valley Conservation Authority (MVCA) since 2012. We contribute data annually to the ‘Secchi Dip-In’ of the North American Lake Management Society; and we keep a record of ice-on and ice-off dates for the lake that used to be supplied to the Federal Ministry of the Environment (the program seems to have fallen by the wayside due to past budget cuts).

Canonto Lake is in the Clyde watershed of Mississippi River, we actively participate in the MVCA’s 5-year cycle of detailed lake hydrological and biological studies. The Clyde watershed is up for study in 2016.

8. Is there a trend in the demographics of the people who participate in projects associated with the Lake Association? (E.g. age range, occupation, etc.)

No, major participants are retirees, one a geochemist, the other a school teacher.

9. What kinds of challenges do you encounter when working with the public on water quality projects (e.g. difficulties finding volunteers, difficulties getting funding, not enough board members, etc.)

To date volunteers have been forthcoming, notably for a fisheries enhancement project with Watershed Canada planned for 2018. We are a small Association, some 42 members of the 63 waterfront property owners, a little ‘arm-twisting’ is sometimes necessary to get members to stand for office. We run a tight ship minimizing our costs, we can self sustain on our $20 annual dues. We did receive a significant grant from the County of Frontenac to cover the printing costs of our Lake Stewardship Plan in 2011.

10. Where does the funding come from for your projects? Is it difficult to acquire?
Apart from the previously mentioned County grant, we are largely self-financed by our dues and the generosity of our volunteers. We acknowledge the significant in-kind support, notably cartographic, that we received from the MVCA during the preparation of our Lake Stewardship Plan (2011).

11. Is the government on any level involved with your projects? (E.g. guidance from government researchers, government sourced funding, etc.)

Yes, we seek guidance/information from the Ministries of the Environment and of Natural Resources and Forestry, and the Mississippi Valley Conservation Authority as matters arise. In reciprocity we provide data to the Lake Partners Program.

As noted above, we received a grant from the County of Frontenac; and the Watersheds Canada fisheries enhancement program is supported by the Federal Department of Fisheries and Oceans.

Rob Bell
- Name of Lake Association: Mississippi Lakes Association
- Position with Lake Association: President

1. When did you first become interested in the condition of the lake(s) in your region? When I bought the property in November 2007. What sparked the initial interest?

We take water from the lake for personal use. We also love swimming and boating. So, we have been interested in ‘lake health’ from day 1.

2. Why did you become involved with the Lake Association in your area?

The Association was planning to do a Lake Plan and I went to a meeting to volunteer my help. In the months that followed I became the ‘chair’ of the lake plan committee and then president of the association in 2015.

3. How was the Lake Association in your area started?

The Mississippi Lakes Association was established on 6 October 1944 by a small group of dedicated individuals who saw great benefit in forming an organization to provide two vital services to the lake community: (a) aquatic vegetation (weed) control; and (b) marker buoys for safe navigation. For details see: http://mississippilakesassociation.org/index.php/about-the-mla

4. Are the board members or the Lake Association elected or do they volunteer for the position?
Board members are all volunteers and are elected for two year terms by the association membership. Is anyone at your Lake Association paid for the work they do? No.

5. What are the primary concerns regarding the health of the lake(s) in your region? (E.g. phosphorous levels, algal blooms, invasive species, etc.)

Algal Blooms, phosphorous levels and invasive species are all important issues for us. In fact we have developed a Lake Plan with over 60 identified actions to help us address them. We are in the midst of implementing them. See it at: http://mississippilakesassociation.org/index.php/lake-plan

6. In what ways has your Lake Association engaged with the public to raise awareness concerning the health of the lakes in your region?

Annual General Meetings of the membership, Public consultation sessions and surveys when doing the lake plan, use of social media, participation in local events where we can have a booth to share our message with the public. In 2016 we are running the Love Your Lake program which will engage every shoreline owner in the process. See loveyourlake.ca

7. Is your Lake Association involved with any citizen science projects in relation to water quality? If so, can you explain a bit about these initiatives (number of volunteers, how long it has been going on, the aim of the project, etc.)?

Water quality information on Mississippi Lake has been gathered under a variety of programs since 1968, primarily to examine the trophic status of the lake. Today it’s done via the Lake Partner Program: http://desc.ca/programs/lpp The aim of this program is to collect data on: nutrient levels (phosphorus), clarity (secchi disk) and active chlorophyll. With respect to blue green algae, we have also been reporting using www.citizenwaterwatch.ca as well as the government spills hotline: https://www.ontario.ca/page/blue-green-algae

8. Is there a trend in the demographics of the people who participate in projects associated with the Lake Association? (E.g. age range, occupation, etc.)

We have not conducted research on this topic however the majority of our board members are retirees in the 55-80 age range.

9. What kinds of challenges do you encounter when working with the public on water quality projects (e.g. difficulties finding volunteers, difficulties getting funding, not enough board members, etc.)

Today our volunteer for water quality sampling happens to also be an employee of Watersheds Canada, so she is well equipped and motivated to continue the program. We also get assistance from the Mississippi Valley Conservation Authority. See http://watersheds.ca/ and also http://mvc.on.ca/
10. Where does the funding come from for your projects? Is it difficult to acquire?

*Over the years most of the funding has come from the annual membership of our lake association ($10/year/member). For recent projects (Lake Plan, Love Your Lake) a significant source has been the Trillium Foundation ([http://www.otf.ca/](http://www.otf.ca/)) with assistance from Watersheds Canada. Watersheds is a charitable organization that assists citizen organizations in tackling fresh water related projects. Along with the Mississippi Valley Conservation Authority they have been key in our success.*

11. Is the government on any level involved with your projects? (E.g. guidance from government researchers, government sourced funding, etc.)

*Primarily the Mississippi Valley Conservation Authority. With the efforts associated with our Lake Plan we have also engaged the local municipal governments: Beckwith, Carleton Place, Mississippi Mills, Drummond North Elmsley. And Leeds, Grenville and Lanark District Health Unit, Ontario Ministry of Natural Resources and Forestry, Mississippi Rideau Septic System Office, Ontario Ministry of the Environment and Climate Change. We are also in the process of collaborating with Jesse C. Vermaire, Ph.D Department of Geography and Environmental Studies & Institute of Environmental Science, Carleton University who is conducting research and produce reports to increase awareness of water quality changes and aquatic plants in eastern Ontario lakes, particularly to provide educational material to lake users about algae and aquatic plants in their lakes.*

**Christine Kilburn**

- Name of Lake Association: Otty Lake Association (OLA)
- Position with Lake Association: Secretary

1. When did you first become interested in the condition of the lake(s) in your region? What sparked the initial interest? *My husband and I moved to Otty Lake 6 years ago.*

*Shortly after our arrival, we were welcomed by a volunteer (called a Counsellor) of the OLA. She provided us with our own Otty Lake Shoreline Handbook. This binder contained valuable information about living on a lake, and taking care of its health. And thus began our interest.*

2. Why did you become involved with the Lake Association in your area?

*After such a friendly welcome to the lake, we joined the OLA upon moving here. Two years ago, I volunteered to be secretary, and a year later my husband volunteered to be president. We feel very blessed to live on this lake, and thought we could help make a difference in the education of others on the lake, by joining the Board of the OLA.*
3. How was the Lake Association in your area started?

The Otty Lake Association appears to have been established in the 1930s and was oriented to water sports including the organization of an annual Regatta. By the 1960s a second lake association, the Otty Lake Protective and Conservation association, was actively promoting fishing and related outdoor activities. The population of Otty Lake had increased considerably by the late 1960s and there was a growing concern for the water quality of the lake. In response to these concerns a Pollution Control Committee was formed in 1970. Under the auspices of the Pollution Control Committee, the lake was organized into nine Areas, each one with a Counsellor, to provide a communication link between the Lake Association and the Area residents.

Beginning in 1973, with the encouragement and help of the Ministry of the Environment, an Otty Lake water quality monitoring program was established. Over the next 30 years fecal counts were sampled at 32 sites around the lake. This program continues today with Ecoli and nutrient levels monitoring.

By 1976 the Otty Lake Pollution Control Committee had assumed all of the responsibilities – and more – of the former association and it was decided to rename the organization. In 1978 it officially became the OTTY LAKE ASSOCIATION (OLA).

The goals of the Otty Lake Association since its early days have been: to provide a pollution-free lake environment, to maintain good recreational facilities and to be generally concerned with matters that affect property owners. Through the years members of the OLA have encouraged municipal and provincial authorities that are responsible for the regulations that protect lakes, to develop sound lake management practices. As well, dedicated volunteers have worked hard to educate permanent and seasonal lake residents on good environmental practices and have run programs to monitor the health of the lake.

For almost 40 years many caring volunteers have devoted their time and skills to ensure that the water quality and environment of Otty Lake is maintained and enhanced for future generations.

4. Are the board members or the Lake Association elected or do they volunteer for the position? Is anyone at your Lake Association paid for the work they do?

Lake residents volunteer for a position on the Board, and must be elected at the Annual General Meeting of the OLA. No one is paid for the work they do.

5. What are the primary concerns regarding the health of the lake(s) in your region? (E.g. phosphorous levels, algal blooms, invasive species, etc.)

There are concerns regarding Ecoli, phosphorous and nitrogen levels. OLA sampling is conducted throughout the spring, summer and fall. For example, 54 Ecoli samples were taken in 2015. All were well within the Ontario Provincial Standard for swimming. The OLA also participates in the Ministry of the Environment and Climate Change Lake Partner Program and takes samples for phosphorus six times a year at Otty Lake. The Rideau Valley Conservation Authority (RVCA) also conducts its Watershed Watch
program four times each year with the assistance of an OLA volunteer providing boat transportation.

Another concern relates to the Zebra Mussel invasive species. Dedicated volunteers build structures out of different materials and attach them to docks around the lake in the spring, to determine which compounds appeal to the Zebra Mussels. They collect these structures in the fall to make these determinations.

Algal blooms, blue-green algae and Eurasian water milfoil are also a concern, and are monitored by volunteers.

Groundwater sampling is ongoing.

6. In what ways has your Lake Association engaged with the public to raise awareness concerning the health of the lakes in your region?

The OLA is part of the Lake Networking Group. This organization works together, sharing resources and ideas for the betterment of all our lakes.

The OLA has organized BioBlitzes around Otty Lake, inviting residents to learn more about the species who live in and around the lake, as well as the health of the lake itself. The OLA has worked with the Toronto Zoo to conduct educational explorations of the wetlands around Otty Lake.

The OLA had a team of dedicated volunteers who worked on the Lake Management Plan for Otty Lake, in co-operation with the RVCA, municipalities, government agencies and other community partners. A comprehensive Management Plan was produced in 2008, with the intent to provide a community developed, long-term plan that works to protect the health and special features of Otty Lake. It included goals, objectives and actions that addressed the 11 issues identified by the lake community. Implementation of the actions would result in the protection of our lake through education, stewardship action and land use regulation. In 2013, a survey was distributed to request input from residents re issues of concern. A Five Year Review Report was presented at the 2014 AGM to identify what had been accomplished to preserve and improve Otty Lake over the past 5 years and to identify areas which still needed work, based on the 2013 survey results.

In 2013, in conjunction with Watersheds Canada (known as Centre for Sustainable Watersheds at that time) the OLA took part in the Love your Lake Program. The result was the distribution of individual reports to each property owner on Otty Lake, promoting stewardship by providing a property-specific report outlining voluntary stewardship actions that improve the health of the lake.

Annually, the OLA works with the RVCA to offer native shoreline plants to OLA members for planting to help preserve a natural shoreline, and reduce erosion.

A septic inspection program was implemented in conjunction with the municipalities to ensure each property has a properly working septic system. This reduces bacteria and nutrient inputs into the lake. It has been a very successful program. A mandatory re-inspection program has been introduced as the second phase.

We are now entering the 4th year of our Habitat Enhancement Project in conjunction with the RVCA. Over the past 3 years, the concentration has been on building nests for small mouth bass. This has been successful for the small mouth bass, as well as an education for the volunteers who take part in the work of building the nests. This year we will
concentrate on large mouth bass habitat. The OLA volunteers have also built wood duck boxes, swallow/bluebird boxes and this year bat boxes to providing nesting opportunities. Owners who assist with the building, as well as offering locations for the boxes, are learning more about the birds and bats in their area. Volunteers around Otty Lake take part in bird counts, reported nationally. All these various projects and activities are helping to educate those who take part. Reports are provided at our AGM, as well as in our Newsletter issued 3 times a year, in the hopes that more residents can learn about their lake and environment, and the impact they can have on its health. In addition, Area Counsellors visit residents in their area with information, and to answer any questions.

7. Is your Lake Association involved with any citizen science projects in relation to water quality? If so, can you explain a bit about these initiatives (number of volunteers, how long it has been going on, the aim of the project, etc.)?
As identified in Question 6, OLA volunteers are involved in a variety of activities. More information can be found in our Newsletters which are on our website www.ottylakeassociation.ca. The website itself also contains additional information. The number of volunteers on each project vary. In total, we can count on a core group of about 35 individuals to do the work required.
In addition to the projects listed above, the OLA has also been involved in projects such as the Canadian Lakes Loon Survey, Ice In/Ice Out, the Citizen Water Watch and more recently the reporting of any sightings of blue green algae which is critical to the health of our residents on the lake.

8. Is there a trend in the demographics of the people who participate in projects associated with the Lake Association? (E.g. age range, occupation, etc.)
The majority of our volunteers are retired individuals, who are over 60.

9. What kinds of challenges do you encounter when working with the public on water quality projects (e.g. difficulties finding volunteers, difficulties getting funding, not enough board members, etc.)?
We have about 575 properties on Otty Lake. As indicated above, we have a core of about 35 volunteers, many of whom are couples. Board members are also hard to find.

10. Where does the funding come from for your projects? Is it difficult to acquire?
Funding comes from the annual membership fees of $20/household. About 270 households are members.

11. Is the government on any level involved with your projects? (E.g. guidance from government researchers, government sourced funding, etc.)
As indicated above, the OLA works with various government organizations, including municipalities. We do on occasion apply for small grants to assist with projects.
Jayne MacDonald
- Name of Lake Association: Upper Rideau Lake Association
- Position with Lake Association: President

1. When did you first become interested in the condition of the lake(s) in your region? What sparked the initial interest?

The lake was in a deplorable state in the late 80s early 90s. Algae was terrible, the lake stunk!

2. Why did you become involved with the Lake Association in your area?

I had a small child and didn't even want him near the water. Everyone needed to help to make things better.

3. How was the Lake Association in your area started?

Locals started it in response to the terrible conditions. A sewage treatment facility was discharging into the lake.

4. Are the board members or the Lake Association elected or do they volunteer for the position? Is anyone at your Lake Association paid for the work they do?

Everyone is elected but we rarely get enough volunteers to actually have an election. No one is paid.

5. What are the primary concerns regarding the health of the lake(s) in your region? (E.g. phosphorous levels, algal blooms, invasive species, etc.)

Phosphorus levels are high and we have had blue-green algae blooms. These have resulted in health unit warnings to stay out of the water. We have had invasive zebra mussels for some time.

6. In what ways has your Lake Association engaged with the public to raise awareness concerning the health of the lakes in your region?

Our main connection with the public is at our AGM and through a newsletter (Spring and Fall). We hosted an all candidates meeting before the last municipal election. We have a Facebook site and try to post any relevant information there.

7. Is your Lake Association involved with any citizen science projects in relation to water quality? If so, can you explain a bit about these initiatives (number of volunteers, how long it has been going on, the aim of the project, etc.)?

Yes, a project titled The People, Aquatic Plants and Healthy Lakes with the conservation authority (RVCA), Carleton Univ., and other area lake groups (Friends of the Tay). (just
ending after a couple of years) Lake mapped for plant matter and app developed for reporting.

Another project was -Love your Lake with Centre for Sustainable Watersheds (now Watersheds Canada). Volunteers boated students around to photograph and analyze waterfront developments and eventually created individual reports for each site, which were available free of charge (prob. 10 volunteers)

Lake Partner Program volunteers collect water samples for P analysis and water clarity.

(3 long term volunteer groups)

We also hand out free plants for shoreline restoration annually. (4 volunteers) (We will have 500 plants ordered for distribution in May)

8. Is there a trend in the demographics of the people who participate in projects associated with the Lake Association? (E.g. age range, occupation, etc.)

Most volunteers are old, many are retired.

9. What kinds of challenges do you encounter when working with the public on water quality projects (e.g. difficulties finding volunteers, difficulties getting funding, not enough board members, etc.)

We could always use most volunteers and input. Educating the public and getting them on-board is key. Even though we have a lake in trouble some people insist on dong what they damn well please!

10. Where does the funding come from for your projects? Is it difficult to acquire?

Most of our funds come from memberships. We have a charitable foundation we share with another association but we get limited donations. The project with the conservation authority had a Trillium Grant.

11. Is the government on any level involved with your projects? (E.g. guidance from government researchers, government sourced funding, etc.)

Not really.

I'm not sure where it fits in but I served on the Technical Steering Committee for the Environmental Assessment for the Westport Wastewater Facility (Sewage Treatment Plant) that was completed in December. In 2014 the village was forced to discharge partially treated sewage, under emergency conditions, into the lake. Their holding lagoons were full. We have been monitoring the situation and we are in communication with the Ministry of the Environment and Energy (MOECC) to help prevent this from ever happening again.

In 2014 we gave interviews with local newspapers and radio stations. We have also formed a relationship with the local health unit. We are now able to work together if toxic blue-green algae blooms require a quick notification of the public around the lake. We have a network of people and e-mail listings.
We have contacts with the local Ministry of Natural Resources and Forestry (MNRF) who will help us with questions about the health of the fish stock and the commercial fishery.

One of our local Municipalities (Township of Rideau Lakes) from around the lake is going to begin mandatory septic system inspections and we hope to cooperate with them starting this summer. Previously re-inspections were voluntary.

Appendix E- Websites and Online Media

Tämnarens Vatten:
http://www.tamnaren.se
https://www.facebook.com/groups/tamnaren/

Uppsala Nya Tidning (Uppsala’s Newspaper) articles:

Rideau Valley Conservation Authority: http://www.rvca.ca

People, Aquatic Plants, and Healthy Lakes project site:
http://rvca.ca/programs/algae_watch/index.html

Lake Partner Program: http://desc.ca/programs/lpp

Rouge Valley Conservation Authority Citizen Science:
http://www.citizenscientists.ca/Volunteering.html
https://www.facebook.com/CitizenScientistsToronto/?fref=ts

The Couchiching Conservancy:
http://www.couchichingconserv.ca
http://www.orilliapacket.com/2014/03/28/conservancy-seeking-citizen-scientists
Appendix F: Reports sent from participants of the research

Sent from Anna DeSellas:
Sent from Anna DeSellas:
“Assessing variability in total phosphorus measurements in Ontario lakes” PDF, available at: http://dx.doi.org/10.1080/07438141003712139

Sent from Paul MacInnes:

The Coalition of Haliburton Property Owners Associations (C.H.A.) - A Brief Overview www.cohpoa.org

Structure
• All volunteer, nonprofit, Ontario Registered Corporation.
• Managed by a Board of Directors – currently 10 Board Members
• Founded 2009 by 23 lakes
• Members vote on Board members and major projects at AGM

Membership
• Lake Area Property Owners Associations
• Full members from Haliburton County
• Associate members from outside the county
• No individual members unless the lake has no lake association
• Currently 48 member associations representing 120 lakes and approx. 16,000 properties – virtually every lake association in the County belongs

Funding
1. Social Enterprise +
2. Membership fees ( $50 per member) +
3. Voluntary Value Received Contributions from members +
4. Some funding applications for specific projects

Mission Statement - The CHA is a broadly-based Haliburton Coalition of Lake Area Property Owners Associations, drawing upon the collective knowledge and strength of its member associations to create synergy through sharing best practices, effectively studying common issues, developing common solutions, recommending county-wide policies and influencing outcomes. Member associations always remain autonomous

Major Priority = Protecting and Enhancing Lake Health through 2 issues – Septic Health & Natural Shorelines

Community Engagement – in addition to the above main priority the C.H.A. tries to contribute to the economic and social health of the Community
• Business, Event & Charity of the year
• Promote community engagement to seasonal and year round residents
Many of our projects are carried out in partnership with other community organizations such as the Haliburton Highlands Land Trust, Trent University and Fleming College.

**Ongoing Activities**
- Annual Lake Stewards Meeting – Expert Presentations, Training and Info Sharing
- AGM - Expert Presentations and Info Sharing
- Newsletter Article Sharing

**Past Projects**
- Decision Maker Information Series (DMIS)
  - Septic Systems
  - Wetlands
  - Natural Shorelines
  - County Wide Information Sessions
    - Mandatory Septic Re-Inspection
    - Where Have All The Fish Gone? – with Dr John Casselman etc.
- Rental Posters
- The Lake Stewards Handbook

**Priorities**
- Septic System Health
- Natural Shorelines

**Septic System Health**
1. Presentations to the Lake Stewards
2. DMIS – to councils
3. *Poop Talk* Video
4. Septic Re-Inspection Day
5. Rental posters
6. Septic Tip sheet
7. Speeches at lake association AGM’s – over 74 so far
8. Newsletter & Media Articles
9. Broadening of DMIS to include seminars for Pumpers, Installers, Builders, Landscapers, Real Estate Agents and Community Groups & Septic Community days

**Natural Shorelines**
1. Presentations to the Lake Stewards & Lake Presidents
2. DMIS – to councils
3. 2 new videos –Release Date – April 12th 2014
   a. The Ribbon of Life
   b. A Beginners Guide to Shoreline Stewardship
4. Resources on our website
   a. Guide to Native Plants
   b. Where to buy native plants
   c. Expert Resources for shoreline re-naturalization
5. The Shoreline Assessment & Restoration Project (Love Your Lake)
6. 10 Naturalization Demonstration Lots – goal 1-2 on each of our 102 lakes plus
   4 municipal properties
7. Newsletter & Media Articles
8. Broadening of DMIS - seminars for Builders, Landscapers, Real Estate
   Agents and Community Groups

Lake Health Information
1. Current study re Community Wide Lake Quality Data Collection combining
   a. Citizen science with
   b. Standardized training, equipment and protocols with
   c. Sharing of equipment (lower costs) with
   d. Government acceptance of results and
   e. Community wide information access in a timely manner

Appendix G: Photos of the Cases

Ontario

Algal Blooms. Credit: Rideau Valley Conservation Authority
(http://rvca.ca/programs/algae_watch/index.html)
Rouge Valley Citizen Scientists involved in monitoring projects. Credit: Citizen Scientists (http://www.citizenscientists.ca/Volunteering.html)

Lake Tämanren

Low water levels near property on the lake. Credit: Ulf Nygren.
Increased plant growth near docks. Credit: Ulf Nygren.

Plant growth on the docks at the lake. Credit: Ulf Nygren.
Trying to take a boat out on the lake, some sections have many water lilies, which easily become tangled in the motors of the boats. Credit: Ulf Nygren.
