The Agricultural Community and its Contribution to Collaborative Environmental Problem-Solving

by

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A thesis
presented to the University of Waterloo
in fulfillment of the
thesis requirement for the degree of
Doctor of Philosophy
in
Geography

Waterloo, Ontario, Canada, 2014

AUTHOR'S DECLARATION

I hereby declare that I am the sole author of this thesis. This is a true copy of the thesis, including any required final revisions, as accepted by my examiners.

I understand that my thesis may be made electronically available to the public.

ABSTRACT

Collaboration has been proposed as an inclusive forum for bringing together state and non-state stakeholders to deliberate and negotiate solutions to complex environmental problems. A key aspect of collaborative approaches is the potential to help stakeholders share and integrate expert science and local knowledge with their beliefs and values. This process creates a vernacular knowledge that is necessary to address the quasi-scientific characteristics of complex environmental problems. Stakeholder networks have an important role in collaborative processes, and the creation and sharing of knowledge. The manner in which stakeholder networks form, function, and contribute to the creation and sharing of knowledge, both internally and externally, is not well understood from both a theoretical and empirical perspective.

The purpose of this research is to provide insight concerning this gap in the literature by addressing three research objectives: (1) to develop a conceptual framework for evaluating the creation and sharing of vernacular knowledge by a stakeholder network within collaborative problem-solving processes; (2) to use the conceptual framework to evaluate the contribution of stakeholder networks to the creation and sharing of vernacular knowledge in an actual example of a collaborative problem-solving processes; and (3) to develop recommendations for the design of collaborative problem-solving processes in order to facilitate the creation and sharing of vernacular knowledge using stakeholder networks.

A case study was used to evaluate a multi-stakeholder problem-solving process that has involved stakeholder network representatives at the watershed and provincial scales in Ontario, Canada. This was undertaken through an extensive literature review, and the analysis of data collected through participant observation, survey questionnaire, and a review of publicly available documents using a mixed methods research approach. The research focused on the evaluation of the formation and function of an agri-environmental network composed of

representatives from key provincial farm organizations and the provincial agricultural ministry. This research seeks to provide insight concerning the role of stakeholder networks in the creation and sharing of vernacular knowledge within collaborative problem-solving processes, and provide insights for both theoretical and practical applications of collaborative approaches to problem-solving. This addresses questions in the literature regarding the effectiveness of stakeholder networks to contribute knowledge to problem-solving within forums that are intended to be collaborative in nature, but may also include elements of a regulatory approach. Further, this agri-environmental network has supported the development and function of a diverse group of farm community representatives involved in a prescribed environmental problem-solving process. The research demonstrates that this network has been effective in contributing to the creation and sharing of vernacular knowledge in a coordinated fashion at the local and provincial scale. This responds to questions in the literature concerning how stakeholder networks communicate and cooperate across different scales and administrative, physiographic and political boundaries. The study also provides recommendations for practice concerning the selection of community representatives, the creation of vernacular knowledge, and the promotion of stakeholder network involvement as part of collaborative approaches to problem-solving. Although the research results are situated in an Ontario context, the results of the study can be applied in other jurisdictions where stakeholder networks exist or may emerge to participate in collaborative approaches to environmental problem-solving.

ACKNOWLEDGEMENTS

I have heard that it takes a village to raise a child. I believe, at least in my case, that it takes a community to support a student to research and write a dissertation. I would like to take some time to acknowledge the members of my community who have helped me to achieve this task. It was not an easy road, but the encouragement and support I received – academic, emotional and financial – has helped me to be able to complete this task.

I want to thank all those who participated, both directly and indirectly, and took an interest, in this study. This includes: the members, chairs and staff of the nineteen Source Protection Committees; the agricultural representatives, members of the Ontario Farm Environmental Coalition Source Water Protection working group, and other members of the farm community; and staff with Conservation Ontario, and the ministries of Agriculture and Food, Rural Affairs, Environment, and Natural Resources. Your contributions have been an essential part of my research.

I want to thank those who provided me with ongoing support, including my friends from my academic, church and work communities. I have greatly appreciated your interest, suggestions, and support, while listening to me through the throes of the research process. I particularly appreciate the encouragement, flexibility and time that my colleagues and my employer, the Ontario Ministry of Agriculture and Food, provided me with during my coursework and research.

I want to thank my advisory committee members: Jean Andrey, David Rudolph and John Smithers. Jean has challenged me to ponder the theoretical aspects of my research, which improved my research approach and helped me grow as a researcher. David challenged my assumptions and perspective that has helped me to undertake and document research more rigourously. John has provided advice and editorial suggestions that have helped me to focus and

hone the quality of my writing. My committee was also extremely generous with their time and support, which has improved the quality of my thesis, and made my research experience more fulfilling. Thank you also to Dan Walters, my external examiner, who posed challenging questions during my oral examination, and provided many excellent suggestions for improving the quality of the thesis.

I would also like to thank my supervisor Rob de Loë for his steadying guidance and support. Rob provided a pragmatic mixture of direction and freedom during the research process, allowing me to strike a balance between creativity and procedure. All this was shared with a sense of humour, and a positive tone, which allowed me to skirt the depths of despair and keep moving forward.

Finally I want to thank my family for their continuing humour, patience and support. For my two daughters – Isabelle and Rebecca – thank you for helping me to place my research into a broader life context. And of course for Margaret, my wife, who has played a more important role than she would acknowledge. You have inspired me to keep moving forward, while helping me to embrace and enjoy each day.

DEDICATION

I have been blessed by being loved and supported by intelligent and strong women who have inspired me all my life. For my mother, who kept going when she wanted to stop, who inspired in me a passion for learning, and who encouraged me to take the opportunity to keep learning, formally and informally, all my life. For my wife, who has supported my passion, has inspired me to keep going when it all seemed all too much, and without whose help I think I would have foundered.

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CHAPTER ONE

INTRODUCTION

1.1 Research Context and Problem Rationale

Solutions to environmental challenges have commonly been sought using traditional risk analysis. This approach focuses on expert evaluation of objective and quantitative knowledge that has been created through normal science (Jasanoff, 1998; Functowicz and Ravetz, 1993; Wynne, 2002; Jasanoff, 2003; Dilling, 2007; Renn, 2007b). The goal of normal science has been the acquisition of knowledge through basic research, removed from normative questions associated with moral, political and religious concerns (van den Daele, 2004). Many would argue that the pursuit of theoretical knowledge by normal science has resulted in an increasing separation from the practical, and discouraged the creation of new applied knowledge for social practice (van den Daele, 2004). This separation has been reinforced by the academic peer-review process, agency funding research proposal processes and political priority and budget-setting controls, all of which ensure that state-sponsored research is consistent with a discipline's priorities, theories and methods (Jasanoff, 2003; Dilling, 2007).

There is increasing acknowledgement that such an expert-driven approach is not adequate for dealing with complex problems associated with concerns related to the environment and risk (Lach *et al.*, 2005; Renn, 2008). On its own, some suggest, normal science has not been able to meet the growing and increasingly complex needs of the state that have emerged in the late twentieth century (Functowicz and Ravetz, 1993; Ravetz, 1999). In particular, challenges concerning risk and the environment are posing questions that are laden with uncertainty and societal values. Turner (2004, 253) classifies these questions – where the contributions of normal science alone is not enough because more than scientific knowledge is required to make competent decisions – as 'quasi-scientific'. Quasi-scientific problems have proven to be a

particular challenge because traditional risk analysis and normal science have difficulty comprehending and incorporating local knowledge and societal values – both of which tend to be qualitative and subjective in nature (Jasanoff, 1998; Slovic, 1998; Smith, 2004). Nonetheless, normal science continues to be used to address questions associated with quasi-scientific, complex problems (Turner, 2004).

A disconnect between normal science and the problem-solving that it is intended to inform has been the subject of growing concern within both the scientific and broader communities. This concern has led to the development of a number of alternative scientific approaches, including 'Mode 2', 'Post-Normal', and 'Reflexive' science (Nowotny *et al.*, 2003; Functowitz & Ravetz, 1992; Ravetz, 1999; Wynne, 2002). A common theme among these alternative scientific positions is the need for a formal and deliberate forum that will enhance problem-solving concerning complex problems by incorporating the concerns of the broader community.

In response to these concerns, many authors have suggested that a new approach is required for environmental problem-solving for complex problems (Functowicz and Ravetz, 1992; Ravetz, 1999; Wynne, 2002; Nowotny *et al.*, 2003; Renn, 2007a; Renn, 2007b), one which incorporates scientific and local knowledge, and societal beliefs and values (Lee, 1993; O'Riordan and Rayner, 1993; Fischer, 2000; Lach *et al.*, 2005). The outcome of this new approach, a vernacular knowledge, is a process where environmental problems are deliberated and solutions are negotiated by stakeholders (Orr, 1991; Lach *et al.*, 2005; Bartel, 2013). Vernacular knowledge is widely thought necessary for finding solutions to complex problems. Proponents suggest that its creation can help to reduce differences in power between actors, encourage discussion of value-based issues, build social capital (Mitchell and Breen, 2007; van Wyk *et al.*, 2007) and provide a foundation for collaborative problem-solving (Lach *et al.*, 2005).

The creation of vernacular knowledge is important for encouraging greater community involvement in problem-solving concerning complex problems that have a societal context (Lach *et al.*, 2005, 12). This involves the collaboration of scientists, state and non-state actors to engage in social learning, where they share and incorporate expert science and local knowledge, discuss belief- and value-based issues, and create social capital by building relationships that promote trust, accountability, legitimacy, reciprocity, common rules, shared values, inclusion and empowerment (Carr, 2004; Turner, 2004; Cash *et al.*, 2006; van Wyk *et al.*, 2007).

- Social capital encourages collaborative thinking; contributes to process accountability, legitimacy, and responsibility (Stoker, 1998; Carr, 2004; Turner, 2004; Mitchell and Breen, 2007; van Wyk *et al.*, 2007); promotes connectedness, reaching common rules, achieving equity and mutual empowerment; and developing shared values and trust that are critical for collaborative problem-solving (Carr, 2004; Turner, 2004; Cash *et al.*, 2006; Falkenmark, 2007; Mitchell and Breen, 2007; van Wyk *et al.*, 2007).
- Social learning, and the vernacular knowledge it generates, can help eliminate power differentials between different actors, encourage reasoned debate and negotiation, and promote the discussion of value-based issues (Innes and Booher, 2010; Paquet, 2001; Schusler *et al.*, 2003; Carr, 2004; Reed and McIlveen, 2004; Lach *et al.*, 2005; van Wyk *et al.*, 2007). Social learning can also improve problem-solving by incorporating local perspectives that will promote greater rigour through the co-production of vernacular knowledge (Carr, 2004; Cash *et al.*, 2006; van Wyk *et al.*, 2007).

The development of social capital, encouragement of social learning, and co-production of knowledge, can help participants collectively to adjust their perspectives and expectations so that they can make concessions that will benefit the broader community and the environment (Lach *et al.*, 2005). Such collective action is critical because no single actor, public or private, has all the

expertise or knowledge required for solving complex problems (Stoker, 1998; Lach *et al.*, 2005; Blackstock and Richards, 2007). Collaborative efforts are also necessary to achieve the 'radical shift in thinking' [and practice] that will be critical to achieve the 'societal acceptance of trade-offs and limitations' that are necessary for good problem-solving involving complex problems (Lach *et al.*, 2005; Falkenmark, 2007, p. 74).

Environmental problem-solving practices such as these have been linked to good governance (Lach *et al.*, 2005; Paavola, 2007). Governance includes the mechanisms, processes and structures through which societies make or influence decisions and share power (WRI, 2004; Folke *et al.*, 2005; Lemos and Agrawal, 2006; de Loë and Kreutzwiser, 2007). This is part of a growing interest in a shift away from traditional approaches involving the management of the environment primarily or solely by governments, where the state mandates change primarily through regulation, to forms of problem-solving where non-state actors play key roles, and where other ways of making decisions are used alongside traditional approaches (Glasbergen, 1998; Gunningham, 2005; Jordan *et al.*, 2005; Lemos and Agrawal, 2006).

Environmental governance concerns decision-making processes regarding problems related to environmental resources, and includes collaborative approaches to problem-solving (Lemos and Agrawal, 2006). Two key characteristics of collaborative approaches to environmental problem-solving include (1) the broad participation of state and non-state actors in the problem-solving process (WRI, 2004; Lemos and Agrawal, 2006: Ansell and Gash, 2007; Reed, 2008); and, (2) contributions of stakeholder networks based on mutual understanding, shared vision, joint-working capacity, and economy of scale and scope that can foster collaboration, robustness, social learning, and the elimination of power differentials (Stoker, 1998: Paquet, 2001; Carr, 2004; van Wyk *et al.*, 2007). What is envisioned is an "institutionally embedded" form of stakeholder participation that will promote problem-solving that is 'fairer, more environmentally sound and more broadly accepted', by 'harness[ing] the energy and creativity of those with the

greatest stake in successful environmental management: the people who live in or depend on the affected ecosystems' (WRI, 2004, 2; Reed, 2008, 2426-7)).

In particular, Lemos and Agrawal (2006, 303) provide several additional points in support of collaborative approaches to environmental problem-solving:

- It can bring problem-solving closer to those affected directly, thereby promoting higher participation and accountability;
- It can help decision makers take advantage of more precise time- and place-specific knowledge about natural resources;
- It can stimulate communication between decision-makers at different scales, and with their constituents; and
- It can influence the "subjective relationships of people with each other and the environment".

There is a growing recognition that social networks contribute to collaborative forms of problem-solving in at least four important ways. First, networks help build social capital, by promoting 'bonding' through relatively close relationships and shared values in well integrated and cohesive networks, and by encouraging 'bridging' between diverse groups (Blanco *et al.*, 2011). Second, networks can foster social learning both as a process and outcome, when people from different backgrounds work together to integrate expert science, local knowledge and community beliefs and values. Third, networks can encourage the creation of vernacular knowledge that provides a foundation of knowledge to support collaborative problem-solving concerning complex problems (Peters, 1998; van Wyk *et al.*, 2007; Sørenson and Torfing, 2009; Innes and Booher, 2010; Reed *et al.*, 2010; Taylor *et al.*, 2012). Fourth, networks promote communication and co-operation concerning issues that cross horizontal and vertical scales

(Paquet, 2001) through multi-level governance approaches (Eckerburg and Joas, 2004; Peters and Pierre, 2004). This promotes the movement of power vertically (downwards) from senior levels of government to local agencies, and shifts authority horizontally (outwards) from state to non-state actors, across different scales and administrative, physiographic and political boundaries (Paquet, 2001; Peters and Pierre, 2004).

It has been proposed that stakeholder networks have an important role in creating and sharing knowledge as part of collaborative problem-solving processes (Peters, 1998; Innes and Booher, 2010). However, the role of stakeholder networks in creating vernacular knowledge, and how effective these networks have been in sharing this knowledge within the collaborative problem-solving processes, remains unclear (Peters, 1998; Bogasan and Zølner, 2007). As a consequence, additional research is needed to inform both theory and practice concerning the role that stakeholder networks play concerning the creation and sharing of vernacular knowledge as part of collaborative governance.

One example of a horizontally and vertically-integrated stakeholder network is the agricultural network, which is composed of representatives of farm organizations and agricultural government agencies at the national, provincial/state, and local scale (Daughberg, 1998; Montpetit, 2003; Lubell and Fulton, 2007; Simpson and de Loë, 2014). Agricultural networks have traditionally focused on issues related to increasing agricultural production, but have expanded their scope of interest and influence in the last 30 to 40 years to include agri-environmental issues (Daugbjerg, 1998; Marsh, 1998; Montpetit, 2003). Agricultural networks have also distributed knowledge to its constituents about agri-environmental best management practices (Lubell and Fulton, 2007) and educated non-farmers about agriculture (Tsouvalis *et al.*, 2000).

This research seeks to provide insight concerning the role of stakeholder networks in the creation and sharing of vernacular knowledge within collaborative problem-solving processes, and to provide insights for both theoretical and practical applications of collaborative approaches to problem-solving. The research has three related research objectives:

1. To develop a conceptual framework for evaluating the formation and function of a stakeholder network, and its role in the creation and sharing of vernacular knowledge within a collaborative problem-solving processes;
2. To use the conceptual framework to assess whether or not a stakeholder network functions in a collaborative manner, and to evaluate its contribution to the creation and sharing of vernacular knowledge as part of an actual example of a collaborative problem-solving processes; and
3. To develop recommendations for the design of collaborative problem-solving processes in order to facilitate the creation and sharing of vernacular knowledge by stakeholder networks.

Findings from the research are presented using a manuscript-style thesis. The thesis includes stand-alone papers that address the objectives of the research and are written for publication in journals. The organization and structure of the thesis is discussed in greater detail in the final section of this chapter.

1.1.1 Empirical Context

Source water protection (SWP) is a process that has been developed for ensuring that water resources that form the basis for potable human water supply purposes are not degraded by land use activities (Trax, 1999; Reid *et al.*, 2001; Gullick, 2003; Harrigan-Farrelly, 2002; Barten and Ernst, 2004; Peckenham *et al.*, 2005; Ivey *et al.*, 2006; Patrick *et al.*, 2008). Fundamentally, SWP is an example of a complex environmental problem for which collaborative approaches to problem-solving are well-suited, where alternative courses of action are evaluated, with a specific

focus on land and water management practices, often involving competing financial, institutional, political, social and technical considerations (O'Connor, 2002b; FitzGibbon and Plummer, 2004; Ivey *et al.*, 2006; Patrick *et al.*, 2008). As such, the SWP process provides an example of a quasi-scientific and complex problem, where state and non-state actors must share expert science, local knowledge, along with community beliefs and values, and which can inform the broader development of theory and practice.

Source water protection efforts in North America have typically been implemented using the two complementary approaches of wellhead protection and watershed management (Fitzgibbon and Plummer, 2004):

- Wellhead protection planning is a process for preventing the contamination of the recharge area and groundwater of a water supply well or wellfield (U.S. EPA, 1993).
- Watershed management is a process that takes a broader geographical and contextual perspective, considers environmental, social and economic concerns within the context of the hydrological cycle at the watershed and subwatershed scale (WPI, 1995).

Although the watershed management process is more inclusive than wellhead protection planning, both approaches are typically dominated by state experts who generally control opportunities for substantive community involvement in what are in practice largely inwardly-focused technical exercises (Fitzgibbon and Plummer, 2004). Further, both wellhead protection and watershed management approaches have been criticized for their inability to consider broader economic and social interests adequately (Skinner, 1985; Biswas, 2004; Blomquist and Schlager, 2005). This is consistent with criticisms of traditional problem-solving approaches for addressing complex problems such as SWP, which have been hampered and contested because of their reliance on expert science and limited consideration of broader community concerns. Such

problem-solving approaches are built around a system where technical expertise is implemented using a hierarchical command and control approach (Crona and Hubacek, 2010).

One example of a competing social and economic interest that SWP has encountered is the use of water for the production of food and other agri-environmental goods and services (Simpson *et al.*, 2011). These other services include moderation of water cycling, retention and release of nutrients to plants, decomposition of organic materials, recycling of nutrients, and regulation of the earth's major element cycles (Lavelle, 2000; Ashman and Puri, 2002; Tan, 2009). The traditional view of agriculture as a food production system has broadened as ecological concepts, such as sustainability, have increasingly been applied to agriculture, and led to the emergence of the concept of agri-ecosystems (Lal, 1998; Lavelle, 2000; Tilman *et al.*, 2002; Robertson and Swinton, 2005).

Competition for water globally is anticipated to intensify, particularly near urban areas, leading to increasing conflict between the competing interests of producing food and supplying potable water for a growing and increasingly urban population (Hoff, 2011). It is currently estimated that the global population, which passed the seven billion mark in late 2011, may exceed nine billion by 2050 (FAO, 2009; UNDESA, 2012). It is also estimated that food production will need to increase globally by a minimum of 70 per cent compared to current levels (FAO, 2009; WEF, 2009). This increased food demand will be intensified by an ongoing shift in consumption patterns through an increasing demand for more water resource-intensive foods (*e.g.*, meat, fruit and vegetables). There is also anticipated to be an increased demand for non-food agricultural products, such as feed stocks for biofuels, industrial chemicals and pharmaceuticals (CCA, 2013). These demands are largely due to an expanding and more affluent middle class, particularly in emerging and developing countries, which are anticipated to increase water demand by at least 25 per cent over current needs (WEF, 2009; Hoff, 2011).

The demand for more water will also be exacerbated by increasing pressure on agricultural lands in peri-urban areas to increase food production in order to meet the needs of a continually growing global population, which translates to doubling food production over a 25 year period (Lavelle, 2000). In industrialized countries, such as those located in Europe and North America, most high quality agricultural soils are currently being used for agriculture, and are under increasing pressure to meet urban and rural non-farm growth demands (Tan, 2009). As a consequence, it is anticipated that the increasing demand for food can only be met by intensifying production, by applying nutrients at greater rates to maintain or increase crop yields, increasing the risk of contamination of water resources, and through the greater use of agricultural irrigation, increasing the potential for impacts on water sources (Tan, 2009; CCA, 2013).

1.1.2 Source Water Protection in Ontario

Source water protection came to the forefront of the water landscape in Ontario, Canada, shortly after the Walkerton tragedy in May 2000. Seven persons died, and several thousand became temporarily or permanently ill when the municipal water supply for the Town of Walkerton was compromised, and contaminated water was distributed to homes and businesses (O'Connor, 2002a). In response, the provincial government established an inquiry led by Justice Dennis O'Connor to investigate the causes of the tragedy, and 'to make findings and provide recommendations to ensure the safety of water supply systems in Ontario' (O'Connor, 2002a, 2).

Justice O'Connor focused his recommendations around the establishment of a multi-barrier approach for municipal drinking water systems, calling for environmental problem-solving using the principles of risk analysis, but incorporating an expanded public debate and advice, guided by the precautionary principle (O'Connor, 2002b). In this instance, Justice O'Connor described the precautionary principle as involving the 'taking of precautionary measures in the face of possible irreversible harm' in 'situations in which risk cannot be estimated with any reliability and in which uncertainty prevails in the relationship, if any, between cause and effect' (O'Connor,

2002b, 77). Justice O'Connor observed that "the management of risks to public health is a value-driven exercise that must be informed by, and must respond to, the views of the public, just as it must call on the best that science can offer" (O'Connor, 2002b, 76).

Municipal water systems are those that serve more than five households (*e.g.*, urban areas, private establishments such as rural schools and trailer parks) (O'Connor, 2002b). Private water systems (those serving fewer than five residences) were acknowledged as the responsibility of the owner, but in need of additional educational support from the Province (O'Connor, 2002b). The second through fifth barriers address concerns regarding the operation of a municipal water supply (O'Connor, 2002b). With a few exceptions, these barriers were implemented through new Provincial regulations for larger municipal water systems (*i.e.*, capacity more than 50,000 litres/day) under the authority of the *Ontario Water Resources Act* (Province of Ontario, 2000) and consolidated later under the Ontario *Safe Drinking Water Act* and Ontario Regulation 170 (Province of Ontario, 2002a; OMOE, 2012).

The first barrier addresses concerns regarding raw water quality for municipal water systems, and includes three components: the development of watershed-based source protection plans (SPPs), upgrading sewage treatment, and choice of water sources. Justice O'Connor did not provide any recommendations concerning the second and third components, but he did provide substantial detail concerning the first of these components, and recommended that SPPs should include the following main elements (O'Connor, 2002b, 90):

- The Ontario Ministry of the Environment (OMOE) should lead SWP efforts, including developing a framework for, and funding and participating in, the preparation of SPPs;
- SPPs should be prepared at a watershed scale because this is meaningful both from a technical and a community perspective;

- A local and open planning process should be coordinated by local conservation authorities to promote participation and acceptance by those who will be affected by SPPs;
- Draft SPPs should be approved by the OMOE to ensure consistency province-wide and to 'avoid undue influence by local interests'; and
- To ensure the effectiveness, provincial (*e.g.*, Permits To Take Water) and municipal (*e.g.*, official plans) instruments should be consistent with an approved SPP.

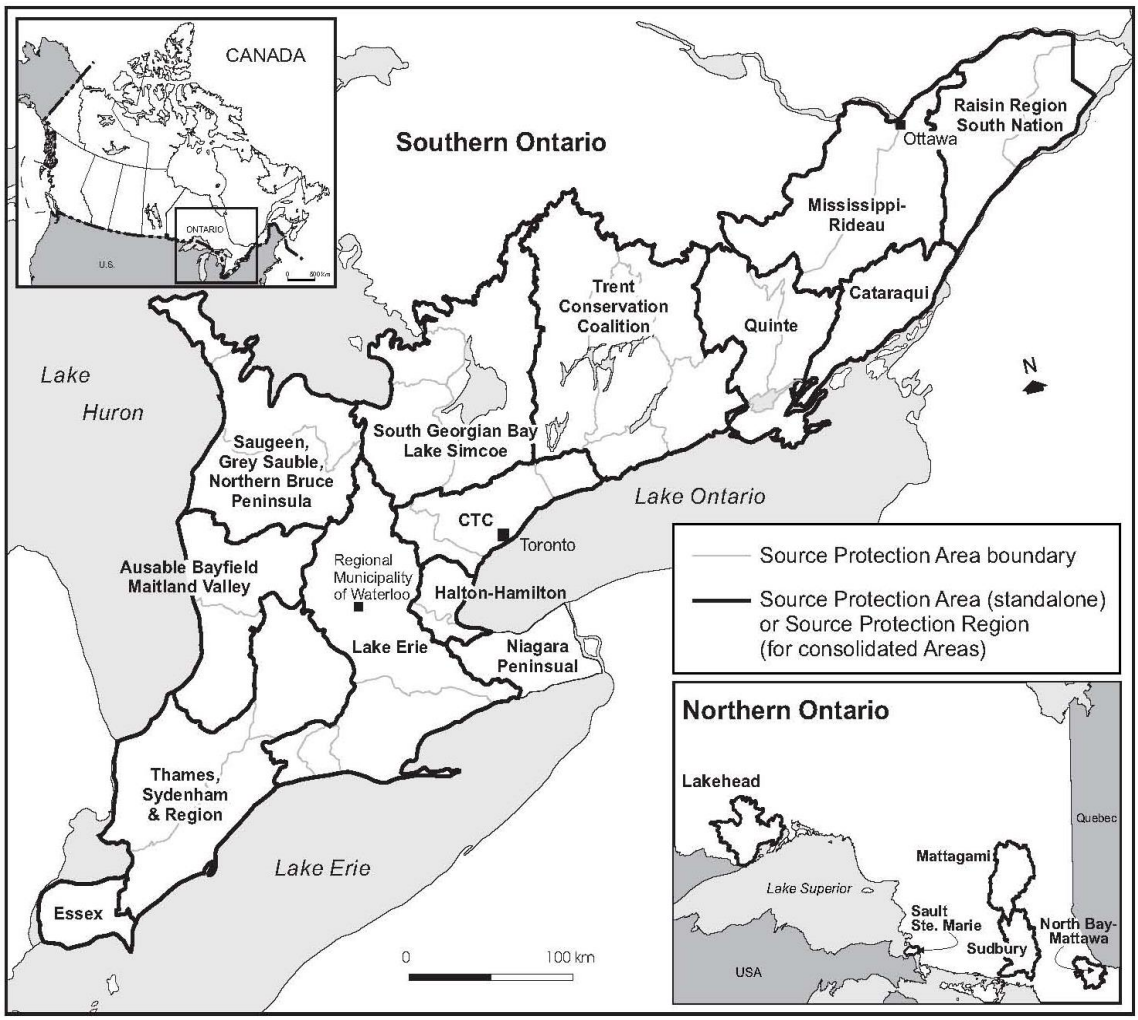
The Province of Ontario's response to Justice O'Connor's recommendation has been to develop and implement SWP under the authority of the *Clean Water Act, 2006* (Province of Ontario, 2006), through a process that has been termed Source Protection Planning.

Ontario's framework for SPP is a hybrid of the WHPP and watershed management approaches, and is being implemented in two stages. The first stage is built around a semi-quantitative risk assessment (SQRA) process (OMOE, 2006) that is based on the wellhead protection planning approach traditionally practiced in Ontario (Fitzgibbon and Plummer, 2004). The SQRA process prescribes the approach that SPCs must use when evaluating and classifying the risks to municipal water supplies posed by land use activities located within or adjacent to wellhead protection areas (WHPAs) and surface water intake protection zones (IPZs). Land use activities that are classified as a significant threat using the SQRA approach are required to implement mandatory risk management measures (OMOE, 2008). The SQRA process has been used to generate risk scores for existing land use activities by multiplying vulnerability scores, derived from technical evaluations of the vulnerability of municipal WHPAs and surface water IPZs, by land use threat scores, which have been assigned using OMOE reference tables for chemical and pathogen threats (OMOE, 2009). The results of the SQRA process have been summarized in an Assessment Report for each source protection area; these reports have been reviewed and approved by the OMOE following a prescribed public consultation process that has

been coordinated by the local conservation authority. This expert science forms the basis for the development of SPP policies at a watershed scale (OMOE, 2007), and establishes benchmarks with which landowners and residents must comply.

The second stage of the SPP process concerns the development of local SPP policies. These will provide requirements for mitigating the risks associated with significant drinking water threats, and will be guided by technical information summarized in the Assessment Reports. This stage of the SPP process uses a watershed management approach by providing an opportunity for a collaborative problem-solving process that is structured around a local multi-stakeholder source protection committee (SPC). The location of SPCs in Ontario is shown in Figure 1.1. Each SPC is organized at a watershed-scale, and is responsible for developing a SPP for each Source Protection Area (SPA), which encompass a single watershed, or Source Protection Region (SPR), which include two or more watersheds. Each SPC is composed of a combination of members selected from, or nominated by, the local community, through a process that is coordinated by watershed-based conservation authorities (OMOE, 2007). The exceptions to this arrangement are SPC Chairs who are appointed by and must report directly to the Ontario Minister of the Environment, and municipalities and First Nation communities can also select their own representatives (Province of Ontario, 2007e). The OMOE has stated that a number of policy tools may be used to achieve this purpose, ranging from education and outreach through to outright prohibition (OMOE, 2009). The policy development process provides an opportunity for the broader community to contribute to the development of SPP policies, either indirectly through the involvement of SPC members or directly by providing comments at specific times during the prescribed consultation process (OMOE, 2007; OMOE, 2009). The level of access to the SPP process varies from one SPC to another because this aspect of the SPP process has not been prescribed through the requirements of the CWA.

Figure 1.1 Source Protection Areas and Regions in Ontario



The SPP process in Ontario provides a relevant context for making a contribution to the empirical literature by evaluating the involvement and contribution of a stakeholder network – in this instance the agricultural network –within a prescribed environmental problem-solving process that has been described by the government as a collaborative approach (OMOE, 2007). This is important in two ways. First, SWP provides an example of a quasi-scientific, complex problem, where decisions have a risk of adverse consequences, and where problem-solving processes have no clear end-point and societal involvement is required. Second, the example provides an opportunity to evaluate the involvement of the Ontario agricultural network in a

collaborative approach to environmental problem-solving, an area of activity with which it has been criticized for having had little past involvement (Skogstad, 1990; Monpetit and Coleman, 1999).

This research will provide insight concerning the ability of the agricultural network to participate in and contribute to the development of knowledge within a collaborative problem-solving process. This will include identifying the circumstances and factors that have given rise to the agricultural network, and how its subsequent evolution and behavior has influenced its involvement with environmental problems (Hay, 1998; Torfing, 2007). It will also provide an opportunity to evaluate the factors that affect the structure and strength of relationships within and between stakeholder networks (Blanco *et al.*, 2011), and better understand how these factors have influenced the creation and sharing of vernacular knowledge within the network.

The SPP process in Ontario also provides an important opportunity to contribute to the theoretical literature concerning the role of stakeholder networks in collaborative problem-solving processes designed to address complex environmental problems. Specifically, it provides an opportunity to examine the opportunities and challenges for stakeholder network participation within a problem-solving process that combines elements of the traditional regulatory (*i.e.*, WHPP) and more recent collaborative approaches from two perspectives. First, what challenges and opportunities does a highly prescribed process provide for stakeholder representatives to contribute to and participate in the development and sharing of vernacular knowledge within the formal problem-solving process? This is related to questions in the literature regarding how effectively stakeholder networks can contribute knowledge to problem-solving within forums that are intended to be collaborative in nature, but may also include elements of a regulatory approach (Peters, 1998; Bogasan and Zølner, 2007). Second, how do stakeholder networks organize, and create and share knowledge, outside of the formal problem-solving process? This is related to questions in the literature concerning how stakeholder networks communicate and cooperate

across different scales and administrative, physiographic and political boundaries (Paquet, 2001; Peters and Pierre, 2004).

1.2 Organization of the Thesis

This dissertation is structured around a 'manuscript' model that includes three chapters that are framed by introductory, research approach, and concluding chapters. The research approach chapter discusses the philosophical perspective, the methodology, research positionality (*i.e.*, my relationship with the research subjects), data collection and data analysis. Chapters Three, Four and Five are stand-alone manuscripts that concern specific objectives of the research project. As a consequence, there will be some overlap and repetition of material among the different chapters. For instance, each chapter has a common theoretical and empirical foundation, and includes research results, discussion and conclusions that are presented in the other manuscripts.

Manuscript I (Chapter Three) is entitled "Evaluating an Agri-Environmental Network and its Role in Collaborative Problem-Solving". This chapter proposes a conceptual framework drawn from the collaborative governance literature, and then uses key framework attributes to evaluate the degree to which the agri-environmental policy network in Ontario corresponds to a collaborative governance problem-solving process. This chapter addresses the first and second research objectives, and establishes a broader and historical context for Manuscripts II and III of the thesis. The manuscript was written for the audience of the Journal of Environmental Management, and will be reformatted to meet the submission requirements of this journal following the successful defence of this thesis.

Manuscript II (Chapter Four) is entitled "The Agricultural Community as an Actor Network – Its Function in Knowledge Production". This chapter uses criteria from the conceptual framework developed in Chapter Three to describe and evaluate the structure and related capacity of a stakeholder network to participate in the creation and sharing of vernacular knowledge. This

chapter addresses the second research objective. It was written for the audience of the journal Society and Natural Resources, and will be reformatted to meet the submission requirements of this journal following the successful defence of this thesis.

Manuscript III (Chapter Five) is entitled "Vernacular Knowledge – Towards the Integration of Expert Science, Local Knowledge and Societal Values". This chapter uses the conceptual framework to evaluate how effectively stakeholder networks have contributed to the creation of vernacular knowledge within the collaborative process underlying SPP in Ontario. This chapter addresses the second theoretical research objective. The manuscript was written for the audience of the journal Water Alternatives, and will be reformatted to meet the submission requirements of this journal following the successful defence of this thesis.

The final chapter reviews the key research findings presented in the three manuscripts, and examines the broader implications of the key research findings for the theoretical and empirical literature. As such, it addresses the third research objective by providing recommendations concerning the design of collaborative problem-solving process to encourage the contribution of stakeholders to the creation and sharing of vernacular knowledge.

Appendices following the final chapter contain a copy of the blank survey questionnaire, a copy of the key informant interview questions, and a list of documents that were reviewed.

Chapter Two

Research Approach

2.1 Philosophical Perspective

This research has been conducted from a Pragmatist perspective. Pragmatism is a philosophy that arose in the late 19th century. It waned in the mid-1900s, but has experienced a revival during the second-half of the 20th century (Johnston *et al.*, 2000; Innes and Booher, 2010). In contrast with Positivist normal science, which is associated with the traditional problem-solving approach, Pragmatism measures the value of knowledge by its utility (Lauzon, 1997; Johnston *et al.*, 2000), and holds a "unifying or mediating philosophy, trying to link science and religion, speculative thought and analysis, knowledge and action…" (Lauzon, 1997, 9). Pragmatists promote a rigourous problem-solving approach, structured around the critical use of the "scientific method as a means for problem-solving … [with] direct application to lived human experience" (Lauzon, 1997).

A theoretical foundation for collaborative approaches to problem-solving is found in the work of Jurgen Habermas (Habermas, 1989; Habermas, 1992), which proposes that problem-solving should be based on deliberation between stakeholders rather than a process based purely on normal science (Murray, 2005; Taylor *et al.*, 2012). Habermas, who promoted the development of an emancipatory knowledge and challenged the dominance of science and technology as the underlying foundation of normal science, was influenced by Pragmatism (Bernstein, 1991; Innes and Booher, 2010). Pragmatism advances the idea of a community of inquiry that promotes efforts to "merge together scientific inquiry, praxis, joint learning, and democracy"; this perspective complements the idea of a collaborative dialogue that is central to collaborative approaches to problem-solving (Innes and Booher, 2010, 26), and is reflected in two key tenets of Pragmatism. The first concerns the "fallibilism" of knowledge, and that no idea

should be accepted without being questioned (Bernstein, 1991; Johnston *et al.*, 2000). The second is the importance of a "self-criticizing community" of inquiry for creating and questioning knowledge within a democratic society in which all can participate (Bernstein (1991, 207). In this way, Pragmatism "portrays life as a continuous process of experience, experiment and evaluation through which beliefs are continually reconstructed; such reconstruction is a social process, whereby individuals learn and behave in the context of the beliefs of those with whom they interact" (Johnston, 1997, 197). This process is centred around 'social systems', which 'may be a family, community … or any other group of people who engage in joint problem-solving' (Lamble, 1984, 33). Pragmatism provides a philosophical foundation for evaluating the co-production of knowledge through deliberative forums of individuals and networks with different backgrounds and perspectives within the context of a collaborative problem-solving approach.

Pragmatism also provides a structured and theoretical basis and approach for integrating data collected using different research methods that have been drawn from different philosophical contexts (Johnson and Onwuegbuzie, 2004; Hesse-Biber, 2010). This mixed methods research (MMR) approach encourages a more systematic use of different research methods selected from the traditional qualitative (constructivist and interpretist) and quantitative (positivist) paradigms (Johnson and Onwuegbuzie, 2004; Hess-Biber, 2010). This facilitates confirming, cross-validating and corroborating findings using different methods within a single study (Cresswell, 2003). In this way research can draw the best from the qualitative and quantitative paradigms, which is particularly important in the social sciences where subjects of inquiry have an inherent qualitative and quantitative nature. The MMR approach is discussed in more detail from a methodological perspective in the following section.

2.2 Methodology

The methodology for this research was influenced by the fact that I am a mid-career public servant, with more than twenty years' experience as a groundwater professional with provincial and municipal governments in Ontario. The focus of my work has been encouraging state and non-state actors to work together collaboratively in both voluntary and regulatory groundwater management programs. Specifically, I have been employed by the Ontario Ministry of Agriculture and Food (OMAF) since 2000, during which time I have provided technical support to the Ministry of the Environment concerning the SPP program by leading or participating in the development of technical guidance concerning groundwater vulnerability and chemical and pathogen threats; this work provided the technical foundation for the OMOE Technical Rules under the CWA (OMOE, 2009). I have also served as the program lead for SWP efforts within OMAF, interacting directly with OMOE staff, SPC Chairs and Project Managers concerning technical matters related to OMAF legislation and programs, and coordinating a working group of senior managers from within OMAF and the OMOE who have an interest in the SPP process. Finally, I am a member the Ontario Farm Environmental Coalition (OFEC) Source Water Protection working group. OFEC is an organization that represents a coalition of farm and commodity organizations concerning agriculture and the environment, and has provided support and training to the agricultural members of the local Source Protection Committees. As a result of this activity, I have had a high level of involvement concerning the SPP process, and relatively free access to state and non-state actors who are involved in or have an interest in the program. However, my position also created special challenges for the research.

Although my position has provided me with valuable access and insight to the topic of my research, which would not normally be available to a graduate student, it has also presented several conflict of interest situations that needed to be managed. These included the requirements of the Office of Research Ethics at the University of Waterloo, through which permission was

obtained for conducting research with human subjects, and complying with the policy concerning conflict of interest as an employee of OMAF, which stipulates that I cannot use my position as a public servant inappropriately. As a consequence, the development of a research design and methodology was guided by the two objectives of ensuring the academic integrity of my research, and honouring my obligations and responsibilities as an employee of OMAF and a member of the Ontario Public Service.

The development of my methodology was also guided by the need to incorporate a flexible approach in order to accommodate the lack of external clarity that is common with stakeholder networks, to identify the different factors that may influence the behaviour of networks and their members, and to account for the different roles of networks, particularly where there are prescribed roles (Bogasan and Zølner, 2007). Further, a flexible and open methodology and methods also helped to 'confirm, reject or modify' research results obtained by different techniques, and helped enhance opportunities for interpreting meaning and behaviour, and reducing uncertainties, associated with the data collected (Hoggart *et al.*, 2002; Bogasan and Zølner, 2007, 10).

A case study approach was used because it was suitable for pursuing all of my research motives – namely to explore, describe and explain a phenomenon (Babbie, 2001, Yin, 2009). The case study has become increasingly popular for investigating "one or more phenomena in some depth at one place, region or country", and has been the basis of a "growing body of theoretically informed empirical research" concerning the effects of environmental policies and governance on water resources (Castree, 2005, 541-2). The case study format also provides an opportunity "to lay out as coherently as possible what the researcher can expect to find in the site before entry" (Burawoy, 1991, 9), providing an opportunity to "rebuild or improve theory instead of approving or rejecting it" (Babbie, 2001, 286). As a result, the case study format empowered me to make use of my knowledge of the SPP program that existed prior to the initiation of the study, and to

draw on my relationships with the actors and networks involved. Finally, a case study format accommodated the integration of data collected using multiple research methods (*i.e.*, interviews, survey questionnaires, observation of subjects) or generated using different analytical techniques (*i.e.*, document analysis, statistical analysis, social network analysis) (Yin, 2009; Cresswell and Plano Clark, 2011).

A MMR approach was used to formally combine data that were collected and analyzed using the case study method. MMR is an inclusive and pragmatic approach that encourages the systematic use of different research methods that share the same research question, collect data that is complementary, and conduct data analysis in a coordinated manner (Johnson and Onwuegbuzie, 2004; Yin, 2009). The MMR approach was considered necessary given that both qualitative and quantitative methods were used to explore, describe and explain the behavior and interaction of stakeholders (Winchester, 2000) during the co-production of knowledge. Quantitative methods were useful for describing questions related to the 'what, where, when and how' behaviour of stakeholders (Babbie, 2001, 93; Payne and Payne, 2004). For instance, they were useful when exploring relationships between phenomena at a particular location (Johnston, 1978). In a complementary fashion qualitative methods were used to interpret and explain the underlying reasons; the 'why' of observed behaviour (Payne and Payne, 2004; Babbie, 2001). This also helped to identify contextual factors (*e.g.*, cultural, economic, environmental, political or social influences) that affected problem-solving directly or indirectly (Winchester, 2000).

Data collected using different research methods were given equal priority, and were analyzed and evaluated concurrently. This is consistent with the concurrent triangulation approach to MMR where the emphasis is to confirm, cross-validate and corroborate findings using the different methods within a single study (Cresswell, 2003). This approach provided for different forms of data to be collected concurrently and integrated during the data interpretation portion of the study. This approach also facilitated the triangulation of quantitative and qualitative

data collected by different methods, and supported the interpretation of data and development of conclusions in a manner that promoted comprehensiveness, increased credibility, encouraged reliability, and demonstrated validity of the research process and its findings (Morse, 2003; Teddlie and Tashakkori, 2009). Details concerning the manner in which data were collected and analyzed are presented in Sections 2.4 and 2.5 of this chapter, respectively.

2.3 Researcher Positionality

The flexibility offered by the MMR approach was also appropriate because it allowed me to draw on data and experiences prior to the start of the formal research period. As noted previously, I have had considerable prior involvement with my research subject – the agri-environmental network in Ontario – prior to the start of my research. Specifically, I worked extensively with network members from 1992 until 2000, and then became a member of the network when I starting working for the Ontario Ministry of Agriculture and Food in 2000. During this time I have worked closely with network members to develop and implement agri-environmental policy and programs at a municipal and provincial scale. As a consequence, the research discussed in this chapter has benefited from involvement and relationships with network members, both individually and collectively, and has also been influenced by perspectives that have been developed during my involvement with the network.

Although this form of situated research is not unique, it is a relatively innovative form of case study research where the researcher attempts to develop an understanding from both inside and outside the community of interest. In this context I was positioned within and have been a member of the network under investigation, and as a result I have been able to access and collect situated knowledge (Johnston *et al.*, 2000; Foley and Valenzuela, 2005). In particular, acting as a participant-observer enabled me to provide insight concerning how the network functions both internally and externally, something that would not usually be available to an external researcher

(Woods, 2010). In this instance, taking on the role of a participant-observer has allowed me to explore both the "emic" and "etic" research perspectives. The concept of "emic" refers to the perspective of someone within an organization, and helps the researcher to understand the behaviour of a network. The concept of "etic" refers to the external, "social science" perspective which attempts to relate and explain observed behaviour of a network within the context of the scientific literature (Fetterman, 1998; Currall and Towler, 2003).

A key challenge of such situated research is to avoid the loss of analytical perspective. This concern was addressed by acting as a "reflexive practitioner", and keeping the roles of network member and participant in mind and separated from those of the researcher during observation and evaluation through a continual process of reflexivity (Lewis and Russell, 2011; Burns *et al.*, 2012). In this way explicitly considering positionality – which concerns the relationship between the researcher and the researched – can help "acknowledge our own power, privilege, and biases" as researchers (Woods, 2010; Castagno, 2012, 381). This reflexive process of occupying what has been described as the "space between" (Burns *et al.*, 2012), is a familiar one for OMAF staff members who must frequently avoid a conflict of interest between the goals of the agri-environmental network, the objectives of the government, and the needs of the broader population the government serves.

2.4 Data Collection

An overview of the methods used for collecting and analyzing data is presented in this section; additional information about the specific application of the methods described here is provided in detail in Chapters Three, Four and Five. Data sources included semi-structured interviews of key informants, a questionnaire survey of all SPC members and relevant organization representatives, a review of pertinent documents, and non-obtrusive observations at meetings and workshops. Interaction with human subjects was approved by the Office of Research Ethics (ORE) at the

University of Waterloo through two separate reviews of ethics of research involving human participants. ORE Approval #16314 provided permission to conduct the key informant interviews and collection of non-obtrusive observations. ORE Approval #16515 provided permission to administer the survey questionnaire. No ORE approvals were required for the review of pertinent documents.

A key source of information was the questionnaire survey that contained a mixture of closed and open-ended questions. In addition to collecting a range of demographic information (*e.g.*, age category, level of education), questions queried respondents concerning their attitudes on how closely the problem-solving process met the criteria for collaborative approaches to problem-solving, and the role of stakeholders and stakeholder networks in the creation and sharing of vernacular knowledge as part of the SPP process. The purpose of attitudinal questions was to seek the views of respondents on the SPP process in general, and their SPC in particular, as a forum for collaborative problem-solving within which stakeholders and stakeholder networks could co-produce vernacular knowledge. Closed-ended attitudinal questions concerned four key roles: (1) the contribution of stakeholders to the problem-solving process; (2) the role of stakeholder networks in the problem-solving process; (3) individual SPC members with whom they shared and received information; and (4) stakeholder groups involved in the SPP process with which they shared and received information. The closed-ended attitudinal questions used a five-point Likert-type scale (Strongly Disagree, Disagree, Undecided, Agree, Strongly Agree). The questionnaire also asked respondents to identify the people from whom, or with whom, they received or shared knowledge, and to rank how frequently they exchanged information with these individuals. The purpose of the relational questions was to determine the people with whom the respondents shared information, and what value they placed on the relationship with the person with whom they shared information. The closed-ended relational questions used a five-point Likert-type scale (Very Often or Always, Often, Neither Often nor Seldom, Seldom, Very

Seldom). Open-ended questions were interspersed within the closed-ended questions; these sought specific examples for the themes queried through the closed-ended questions.

The questionnaire was hosted on the Faculty of the Environment web server at the University of Waterloo. A prototype version of the survey was pre-tested on a group of graduate students and government staff members with experience with voluntary and regulatory water management programs who were not part of the research project. The purpose of the pre-test evaluation was to determine if the questions were understandable, to determine the length of time it would take to complete the questionnaire, to ensure that respondents were able to access and complete the internet version of the survey, and to confirm that survey responses to the survey were being recorded in the survey database. The survey questionnaire was revised based on comments received during the pre-test. An internet web link and generic password were distributed by email to all 405 SPC members and 30 representatives of organizations with an interest or involvement in the SPP process. Email addresses for respondents were collected from online lists maintained by individual SPCs, or from lists that were provided by SPC staff. A copy of the survey questionnaire is contained in Appendix A. Response rates for the various parts of the survey fell within accepted rates for this type of survey (Kaplowitz *et al.*, 2004; Gigliotti, 2011), and are discussed in Chapters Four and Five.

Nine in-depth, semi-structured key informant interviews were conducted with key informants representing various sectors that had a significant interest and role in the SPP process, individuals who were considered to have had significant experience with voluntary water management programs, and who would be able to provide significant insight about the SPP process in general, and from their sector's perspective in particular. Informants included representatives of an environmental non-governmental organization, a provincial agricultural organization, a lower-tier elected municipal official, an upper-tier municipal water programs manager, and staff members with Agriculture and Agri-Food Canada, Conservation Ontario, the

Ontario Ministry of Agriculture and Food, and the Ontario Ministry of the Environment. Key informant interviews had two main purposes. The first was to test the themes that had been identified from document analysis and initial observations from meetings and workshops related to the SPP process, and which were later used to develop the closed and open-ended questions. The second was to identify different local and provincial-scale stakeholder networks that were involved in the SPP process, and should be included in a list of potential information for SPC members in the survey questionnaire. The list of open-ended questions that were used during the semi-structured interviews is contained in Appendix B. All interviews were digitally recorded and transcribed verbatim by the author or by a professional stenographer. All transcripts were first verified against the interview recordings, and then sent back to the participants for feedback to confirm their accuracy and to ensure fair representation of their views.

In total, 312 publicly-available documents were collected and reviewed as part of the research. These documents included peer-reviewed articles, texts, provincial regulations, policy and program publications, position papers issued by organizations with an interest in the SPP process, and articles from non-academic publications. Documents were reviewed and interpreted to identify common themes, and to develop a better understanding of how "particular understandings, imageries or systems of knowledge are informing and/or shaping network governance and concrete ways of acting within networks" (Esmark and Trianafillou, 2007, 101; Matthews and Ross, 2010). It was recognized that the different documents that were available concerning the SPP process reflected the perspectives of the individuals and organizations that have generated them. However, the purpose of this research was not to actively 'deconstruct' information to determine underlying perspectives, but rather to be aware that such perspectives may have existed and ensure they were accounted for in the interpretation of information acquired through the research (Babbie, 2001). This is in contrast with a representational approach that

considers documents to be factual records of what has transpired at the time of their writing, and not subject to interpretation (Esmark and Trianafillou, 2007).

Participant observation was used to record comments by state and non-state actors at public meetings and workshops; this technique is a valuable part of the MMR approach (Kearns, 2000; Payne and Payne, 2004). Crossley (2010) observes such open-ended observation has several advantages. First, a participant observer is able to spot changes in the attitude of participants as discussion on different themes progresses, and how the group did or did not manage to collaborate to find a mutually acceptable solution to any disagreements that arose, which is something that would likely be missed if the researcher was not present. Second, a participant observer is able to identify and assess the influence of what Crossley (2010, 20) describes as the "mechanisms of relationship formation" which include "identities, expectations, rituals, shared feelings and meanings" that create a collective identity.

Two types of observation were used as part of the research. First, observation was used to gain a contextual interpretation or understanding of what was taking place at a particular time and place using a 'participant-as-observer' approach (Kearns, 2000). This was the case at the monthly meetings and six workshops where I was presenting or interacting directly with participants; these settings provided opportunities to collect key qualitative data. For instance, observation was useful for identifying key concerns that participants had with the creation and sharing of vernacular knowledge, and provided useful anecdotes concerning their experiences as part of the SPP process. Second, observation was used to collect complementary evidence to corroborate data collected through more structured methods, such as interviews or a survey, using an 'observer-as-participant' approach (Kearns, 2000). This was the case at a meetings and workshops where I was not directly involved with participants, where I had an opportunity to listen actively to interchanges between participants, and which helped to explain or illustrate a concept that arose elsewhere in the data collection process. For instance, observation was

extremely helpful in learning about the successes and challenges that different individuals and stakeholder groups had experienced when creating or sharing knowledge.

2.5 Data Analysis

Data were analyzed to discover if the problem-solving processes were consistent with a collaborative governance approach (Objective 1) and to evaluate the contribution of stakeholder networks to the creation and sharing of vernacular knowledge within these processes (Objective 2). As noted, a key purpose of the data analysis approach was to facilitate the triangulation of data collected by different methods, and to support the interpretation of data and development of conclusions in a manner that promoted comprehensiveness, credibility, reliability and validity of the research process and its findings (Morse, 2003; Hoggart *et al.*, 2002; Bogason and Zølner, 2007; Teddlie and Tashakori, 2009). The manner in which qualitative and quantitative data were analyzed is discussed in general below, with detailed accounts provided in Chapters Four and Five.

Qualitative data included responses to open-ended questions provided during key informant interviews, notes taken during observation at workshops, and answers to open-ended questions from the online survey questionnaire. Digital recordings from key informant interviews were transcribed into digital transcripts. Responses to open-ended questions were downloaded from the online survey database, and organized and stored as digital files using Microsoft Excel software.

The qualitative data were analyzed in a systematic way designed to identify and categorize understandings and perspectives provided by the research subjects (Babbie, 2001; Esmark and Trianafillou, 2007). The goal was to search for extended phrases or sentences that formed themes (Morse and Richards, 2002; Saldana, 2011; Guest *et al.*, 2012) that were consistent with elements of the conceptual framework developed in Objective 1. This process of what Guest *et al.* (2012) describe as “winnowing”, involved an iterative, manual process of categorizing and interpreting

the text of notes, survey responses and transcripts. In this way the analysis of the data collected during the case study was theory-led (Howitt and Cramer, 2008; Howitt, 2010), anchored in the themes developed from the earlier review of the theory and experience (Morse and Richards, 2002), and built on rather than created new theory (Burawoy, 1991).

Quantitative data were provided by the online survey questionnaire in two forms. The first form included responses to closed-ended Likert-type scale questions with an interval level of measurement of respondent attitudes. Attitudinal data were downloaded from the online survey database, and then organized and sorted using Microsoft Excel software. Data were then transferred into SPSS Statistics Version 20.0 software (IBM, 2011) for descriptive and inferential statistical analysis. Details about inferential statistical analysis are provided in Chapter Five. The second form also included responses to closed-ended Likert-type scale questions that indicated the existence and frequency of knowledge sharing relationships with other state or non-state actors (*e.g.*, other SPC members). Relational data were organized and sorted in a similar manner as the attitudinal data, but were then encoded into matrices using Microsoft Excel software. The matrix data were transferred into UCINET Social Network Analysis software (Borgatti *et al.*, 2002) for analysis and interpretation. Specific details about social network analysis are provided in Chapter Four.

Chapter Three

Evaluating an Agri-Environmental Network and its Role in Collaborative Problem-solving

3.1 Introduction

Complex problems that cannot be resolved using a traditional problem-solving approach guided by expert science are becoming more common (Turner, 2004). Complex environmental problems, many of these associated with contemporary water management, are particularly challenging because they are set within a broader societal context that includes financial, institutional, economic, political, social and technical considerations (Patrick *et al.*, 2008). This has led to the recognition that an alternative approach is necessary for making decisions about water management, one that incorporates the knowledge and perspectives of different stakeholder groups (Functowicz and Ravetz, 1993; Wynne, 2002). In this chapter the focus is on a particular alternative approach – collaborative approaches to environmental problem-solving – that brings diverse stakeholders together to integrate different forms of knowledge with community beliefs and values, and to engage in problem-solving using a consensus-based approach (Lemos and Agrawal, 2006; Paavola, 2007).

The contribution of stakeholder networks to collaborative approaches to problem-solving involving complex problems has received growing attention. Stakeholder networks can help encourage the development of relationships between and within groups (Blanco *et al.*, 2011). Stakeholder networks are particularly useful for helping diverse interests to work together to share and integrate knowledge (Sørensen and Torfing, 2009; Taylor *et al.*, 2012), and for promoting communication and co-operation among stakeholders concerning issues across vertical and horizontal scales and administrative, physiographic and political boundaries (Paquet, 2001; Peters and Pierre, 2004; Reed and Bruyneel, 2010).

Given their potential significance for collaborative approaches to problem-solving, it is important to better understand what stakeholder networks are, how they function, and how they contribute to the creation and sharing of knowledge. In this chapter, a mixed-methods study is used to explore two related questions. First, what form of problem-solving process – traditional or collaborative – is used within a stakeholder network to reconstruct and reconcile new and existing ideas (Peters, 1998; Torfing, 2007; Bevir and Richards, 2009)? Second, do such closed networks resist or facilitate the integration of new and existing ideas and information with the beliefs and values of network members as part of internal problem-solving processes (Peters, 1998; Torfing, 2007; Bevir and Richards, 2009)? This case study examines these questions at the watershed and provincial-scale by interpreting a network that is involved in a mandated collaborative problem-solving process in the Canadian province of Ontario. This case study focuses on the involvement of a network of farmers who were elected to represent their local farm communities. This network is situated within the broader context of agricultural and agri-environmental networks in Ontario. The chapter begins with a brief review of the related literature. This is followed by an overview of the methodology. The results of the research concerning these two questions are then presented. The chapter closes with a discussion that relates the research results to the literature presented, and provides insight for the theoretical and empirical literature.

3.2 Challenges and Opportunities

3.2.1 Complex Problems and Problem-solving

There is growing consensus that an expert-driven approach is not adequate for dealing with complex problems concerning the environment and risk (Lach *et al.*, 2005; Renn, 2008). On its own, expert science is not suited to the growing and increasingly complex needs of the contemporary state (Functowicz and Ravetz, 1993; Ravetz, 1999). Complex problems are characterized by different forms of risk - complexity, uncertainty, and ambiguity. They also have no clear end point or obvious solution, involve many state and non-state interests, and have an

unknown risk of adverse outcomes (Gough, 1997; Ravetz, 1999; Wynne, 2002; Turner, 2004; Lach *et al.*, 2005; Dilling, 2007). Indeed, complex problems have been characterized as 'quasi-scientific' because more than scientific knowledge is required to make competent decisions (Turner 2004, p. 253). They have proven to be a particular challenge because traditional risk analysis and expert science have difficulty rationalizing and incorporating local knowledge and societal beliefs and values – which tend to be qualitative and subjective in nature (Jasanoff, 1998; Slovic, 1998; Smith, 2004). In a large part, because of these challenges and despite associated limitations, expert science continues to be the primary basis for addressing complex questions (Turner, 2004).

The disconnect between expert science and the complex problems that it is intended to help society resolve has been the subject of growing concern within both the scientific and broader communities. This concern has led to the development of a number of alternative scientific approaches, including 'Mode 2', 'Post-Normal', and 'Reflexive' science (Nowotny *et al.*, 2003; Functowitz & Ravetz, 1992; Ravetz, 1999; Wynne, 2002). These alternative approaches share a number of common requirements including greater accountability; expanded involvement of citizens in research planning, practice and implementation; increased reflexive engagement on the purpose and use of knowledge; and, incorporation of expert science and local knowledge through a formal and deliberate forum that involves the concerns of the broader community. An alternative problem-solving approach is needed that can incorporate these requirements in order to deliberate and find solutions to complex problems in a more efficacious manner.

3.2.2 Collaborative Approaches and Vernacular Knowledge

Environmental problem-solving approaches have been linked to good governance. Governance includes the mechanisms, processes and structures through which society makes or influences decisions and shares power (Lemos and Agrawal, 2006; Innes and Booher, 2010). Growing interest in governance is part of a shift from problem-solving primarily or solely by governments,

where the state mandates change primarily through regulation, to one where stakeholders play key roles, and where other ways of making decisions are used alongside traditional approaches (Glasbergen, 1998; Gunningham, 2005; Jordan *et al.*, 2005).

Collaborative approaches to environmental problem-solving have been identified as an approach that is well suited for addressing complex problems because it can involve stakeholders and incorporate their knowledge and concerns into the problem-solving process (de Loë and Kreutwiser, 2007; Lemos and Agrawal, 2006; Paavola, 2007). Collaborative approaches to environmental problem-solving bring diverse stakeholders together, often including government representatives, to make decisions collectively using a consensus-based approach where power and responsibility are shared (Innes and Booher, 2010). Collective action is a critical part of collaborative problem-solving because no single interest, public or private, has all the knowledge required to solve complex problems (Stoker, 1998; Lach *et al.*, 2005; Blackstock and Richards, 2007).

An important aspect of collaborative problem-solving is its potential to integrate expert science, local knowledge, community beliefs and values (Lee, 1993; O'Riordan and Rayner, 1993; Fischer, 2000). Local knowledge in this context is defined as knowledge that has been gathered by the community through experience, rather than through scientific observation or measurement, over one or more generations (Folke, 2004). This process of integration involves stakeholders in generating vernacular science or knowledge during their deliberations and negotiations of solutions to problems (Orr, 1991; Lach *et al.*, 2005; Bartel, 2013). Vernacular knowledge can provide stakeholders with "a much more accurate form of knowledge … that is more relevant to their problem than is scientific expertise" (Wagner, 2007, 14-5). As a consequence, vernacular knowledge can empower participants involved in collaborative processes and enable them to move beyond the limitations of expert science by providing a mutually relevant foundation for deliberating complex environmental problems in several ways.

First, the process helps scientists, state representatives and stakeholders to engage in sharing and integrating scientific and local knowledge, discussing value-based issues, and building relationships that promote trust, common rules, shared values, inclusion and empowerment (Carr, 2004; Turner, 2004; Cash *et al.*, 2006; van Wyk *et al.*, 2007). This process helps participants adjust their perspectives and expectations so that they can make concessions that are necessary for efficacious problem-solving involving complex problems (Lach *et al.*, 2005; Falkenmark, 2007). This will also help promote more rigourous outcomes by incorporating local perspectives (Carr, 2004; Cash *et al.*, 2006; van Wyk *et al.*, 2007).

Second, the process helps overcome questions regarding what constitutes valid knowledge for supporting the development of solutions to environmental concerns (Rogers, 1997). Determining what valid knowledge is has been a key challenge associated with the transition to collaborative problem-solving because multiple forms of knowledge have historically been excluded from the problem-solving process (Rogers, 1997; Montpetit, 2003; Innes and Booher, 2010). The co-production of knowledge allows the concerns of competing stakeholder groups to be acknowledged, can help resolve or avoid conflict between state representatives and stakeholders, and helps move them towards negotiating shared outcomes (Innes and Booher, 2010).

Third, the process helps to reduce the perceived distinction between expert science and local knowledge. Scientific experts often insist that expert science is the only valid knowledge, and have dismissed the knowledge of stakeholder groups as invalid (Montpetit, 2003; Innes and Booher, 2010). This distinction has been difficult to justify with the recognition that some stakeholder groups have participated in formal scientific training and have incorporated this knowledge into their practices (Raymond *et al.*, 2010). For example farmers may integrate local knowledge about their specific farm operation with agricultural and environmental science that

they have received through formal academic training (Tsouvalis *et al.*, 2000; Moore, 2006; Ingram *et al.*, 2010).

3.2.3 Collaborative Approaches and Stakeholder Networks

Human communities comprise an overlapping network of networks (Wellman, 1979; Crossley, 2010; Brummel, *et al.*, 2012). A network is formed by a group of interdependent persons who typically have a mutual understanding and shared vision concerning some activity or interest (Stoker, 1998; Paquet, 2001). A key feature of a network is that the members are connected or linked by relationships through which resources can flow (Brummel, *et al.*, 2012). These resources can be tangible, such as assisting a neighbour to build a structure, or intangible, such as the sharing of information on a topic of mutual interest. In this way networks can help to "harness the energy and creativity of those with the greatest stake in successful environmental management: the people who live in or depend on the affected ecosystems" (WRI, 2004, 2).

Networks can help promote the collective action necessary for collaborative approaches to environmental problem-solving. In particular, they can support the creation and sharing of vernacular knowledge. First, networks can promote the development of relationships through 'bonding', involving relatively close relationships and shared values within well integrated and cohesive networks (Blanco *et al.*, 2011). The development of relationships is important because it encourages a sense of responsibility, connectedness, shared values and trust among and between stakeholder groups, and helps them to develop common rules, equity and mutual empowerment, all of which are critical for collaborative approaches (Carr, 2004; Turner, 2004; Mitchell and Breen, 2007; van Wyk *et al.*, 2007). The benefits of building closer relationships were demonstrated when a diverse group of stakeholders worked collaboratively to develop an approach to support the re-introduction of a threatened bird species in an intensively farmed part of Texas (Yaffee and Wondolleck, 2000).

Second, interaction between networks can encourage stakeholders from different backgrounds to create "bridges" by building connections between diverse stakeholder groups (Blanco *et al.*, 2011), and to work together to co-produce knowledge (van Wyk *et al.*, 2007; Sørenson and Torfing, 2009; Reed *et al.*, 2010; Taylor *et al.*, 2012). This can help to mitigate power differentials that often exist between different stakeholder groups, encourage reasoned debate and negotiation, and promote the discussion of value-based issues (Innes and Booher, 2010; Paquet, 2001; Schusler *et al.*, 2003; Carr, 2004; Reed and McIlveen, 2004; Lach *et al.*, 2005). The benefits of building bridges between diverse interests were demonstrated in the Rural Water Quality Program in Ontario, Canada, which was designed and implemented collaboratively by representatives of farm and government agencies (Simpson and de Loë, 2014).

Third, networks can also promote communication and co-operation between stakeholders concerning issues that cross horizontal and vertical scales (Paquet, 2001) through a process of multi-level governance (Eckerburg and Joas, 2004; Peters and Pierre, 2004). Multi-level governance promotes the movement of power vertically (downwards) from senior levels of government to local agencies, and shifts authority horizontally (outwards) from the state to stakeholder groups, across different scales and administrative, physiographic and political boundaries (Paquet, 2001; Peters and Pierre, 2004; Reed and Bruyneel, 2010). For instance, agricultural networks have been successful in sharing knowledge about better farming practices within the farm community, and raising awareness about farming within the non-farm communities (Lubell and Fulton, 2007; Tsouvalis *et al.*, 2000).

Despite the existence of a growing body of scholarship, the circumstances and factors that give rise to networks, and how they form, evolve and function, are not well understood from both a theoretical and empirical perspective (Hay, 1998; Torfing, 2007). Stakeholder networks have been characterized (and often dismissed) in the literature as closed and static entities that have actively resisted the entry and influence of external ideas and societal pressure to change

(Daugbjerg, 1998; Sørensen and Torfing, 2007). It has also been alleged that stakeholder networks have acted to shield activities from environmental regulation, and representatives of environmental regulatory agencies and non-governmental organizations have been excluded from decision-making processes (Skogstad, 1990; Daugbjerg, 1998; Montpetit, 2003). The result is a form of problem-solving that only includes members of the stakeholder network (Montpetit and Coleman, 1999). Conversely, networks have also been portrayed as porous to external influence, allowing new ideas to enter through contact with broader society and by the inclusion of new members (Bevir and Richards, 2009). For example, agricultural networks have been recognized as horizontally and vertically integrated entities (Lubell and Fulton, 2007) through which knowledge can flow. Although agricultural networks in western democracies have traditionally focused on issues related to optimizing agricultural production, they have expanded their scope of interest (and influence) in the last 30 to 40 years to include environmental issues associated with farming (Daugbjerg, 1998; Marsh, 1998; Montpetit, 2003). Further, agricultural networks are now known to be important vehicles for distributing knowledge to its members about agri-environmental best management practices for protecting water resources (Lubell and Fulton, 2007), and for helping the farm community to share knowledge about farming with the non-farmer community (Tsouvalis *et al.*, 2000). As a consequence, agricultural networks have evolved to provide farmers, researchers and government representatives involved in agri-environmental and other issues with an outlet for creating and sharing knowledge as part of problem-solving processes operating at local, provincial/state and national scales (Skogstad, 1990; Lubell and Fulton, 2007).

These different perspectives suggest that there continues to be a lack of understanding concerning stakeholder networks. In particular, two questions stand out concerning the development and function of role of stakeholder networks. First, do stakeholder networks adopt a collaborative or more traditional approach for reconstructing and reconciling new and pre-

existing ideas (Peters, 1998; Torfing, 2007; Bevir and Richards, 2009)? For instance, is problem-solving within a stakeholder network bound by historical norms and practices, or have problem-solving practices evolved to become more collaborative and open? Second, do stakeholder networks participate in the creation and sharing of vernacular knowledge, and if so, how does this occur? For instance, how does the problem-solving process within a stakeholder network promote the integration of new and existing ideas and information with the beliefs and values of network members (Peters, 1998; Torfing, 2007; Bevir and Richards, 2009)? These questions are particularly relevant for networks that operate with little societal involvement and oversight, and whose membership and activities remain largely the subject of speculation (Daugbjerg, 1998; Montpetit, 2003). It is anticipated that the answers to these questions will provide insight concerning the operation of stakeholder-state networks that attempt to operate in a more open manner, and their contribution to collaborative approaches to problem-solving.

3.3 A Conceptual Framework

Collaborative approaches are an important emerging way of supporting the co-production of vernacular knowledge as part of a multi-stakeholder problem-solving process for finding robust outcomes concerning complex environmental problems. Six key inter-related attributes gleaned from the theoretical and empirical literature can be used to determine whether or not a problem-solving process conforms to a collaborative approach. These six factors are summarized in Table 3.1. The rationale for emphasizing these characteristics is provided in the next section

3.3.1 Stakeholder Involvement

Stakeholder involvement is important for influencing the manner and extent to which environmental problem-solving is undertaken. Specifically, it has been suggested that the limitations of expert science can be addressed by involving state representatives with other stakeholders in guiding environmental problem-solving initiatives through a front-end, reflexive

questioning of the process (Wynne, 2002; Jasanoff, 2003). This is different from the traditional linear model of expert science where the public becomes involved once the scope and context of problem-solving process has been defined by the state. Reed (2008, 2426-7) envisions "institutionally embedded" stakeholder participation where state representatives and stakeholders networks work collaboratively to solve problems that they could not solve independently of each other. Such a level of involvement is an important part of building trust and promoting the co-production of knowledge, where stakeholders discuss and develop an understanding of each other's positions. This can also lead to outcomes that are less divisive, are more likely to be accepted, and have a greater chance of being implemented (NRC, 2000; Lemos *et al.*, 2010).

Table 3.1: Key Attributes of Collaborative Approaches

Attribute	**Significance**
Stakeholder Involvement	Process should involve stakeholders in framing the process, and developing and implementing solutions
Reciprocal Communication	Process should promote the multi-way sharing of information and interests that reflect different perspectives
Stakeholder Capacity	Process should encourage stakeholders to develop capacity for action
	Process should provide an opportunity for stakeholders to develop capacity for self-interest
Stakeholder Expertise	Process should provide opportunities for stakeholders to build contributory expertise in order to share local or scientific knowledge more effectively
	Process should help stakeholders build interactional expertise in order to understand, share, and translate information between different (contributory) knowledge communities
Accountability	Process should encourage stakeholders to consider and represent interests and concerns of network members
	Process should encourage stakeholder representative actions to reflect broader interests of stakeholder network
Legitimacy	Process should provide an adequate forum in which diverse interests are adequately represented
	Process should promote outcomes that will contribute to the common good, will be effective, and can be implemented

3.3.2 Reciprocal Communication

Promoting reciprocal communication helps to change the movement of information from a one-way flow, where state technical experts educate stakeholder groups about water concerns, to a multi-way flow, where state representatives and stakeholders share information from their different perspectives (Bellamy *et al.*, 1999; Lach *et al.*, 2005). Reciprocity can also encourage the collaboration of scientists, state representatives and stakeholders to engage in sharing and integrating scientific and local knowledge, and discussing value-based issues (Carr, 2004; Turner, 2004; Cash *et al.*, 2006; van Wyk *et al.*, 2007). This helps state representatives and stakeholders to better understand conflicting and shared perspectives and concerns that can arise as part of the problem-solving process. Reciprocity also helps to build vernacular knowledge, which is important for encouraging greater public involvement in problem-solving concerning complex problems which have a societal context (Lach *et al.*, 2005, 12). This improves problem-solving by incorporating the local perspectives of stakeholder groups – promoting greater rigour through the co-production of knowledge (Carr, 2004; Cash *et al.*, 2006; van Wyk *et al.*, 2007), and by helping participants to adjust their perspectives and expectations so that they can make concessions that will benefit society and the environment (Falkenmark, 2007).

3.3.3 Stakeholder Capacity

Stakeholder capacity is necessary for stakeholder groups to participate effectively in problem-solving (Carr, 2004; van Wyk *et al.*, 2007). Ivey *et al.* (2006) state that there are two potentially opposed forms of capacity. The first is 'capacity for action' where individuals or groups working to meet externally imposed objectives. The second is 'capacity for self-determination' where individuals or groups seek to 'establish and achieve their own goals and agendas' (Ivey *et al.*, 2006, 946). Collaborative approaches to environmental problem-solving accommodate both forms of capacity, although the latter could be perceived by state representatives and stakeholders as an impediment to achieving consensus among stakeholder groups. However, Mitchell (2005,

1340) states that “the reality is that individuals and agencies do have their own goals and mandates, and it would be unwise to ignore them, or pretend they did not exist”. As a consequence, although stakeholders have their own agendas, they can share and discuss perspectives. This can help stakeholders to work together to achieve a balance between their own and external motivations, and provide a forum to make concessions necessary for the success of the project (Lach *et al.*, 2005). It is possible at the outset of the problem-solving process that stakeholder groups will be more interested in the latter form of capacity than in the former. However, stakeholder groups can support the overall goals of the problem-solving process, even though they may not completely agree with the process as envisioned by stakeholder groups, or required by legislation.

3.3.4 Stakeholder Expertise

Stakeholder expertise is an emerging concept in the theoretical and experimental literature that concerns the ability of actors to participate effectively in collaborative problem-solving. Contributory expertise has been described as the ability of stakeholders to share knowledge from a single perspective, either local or scientific. Alternatively, interactional expertise helps a stakeholder to understand and share information between different perspectives (Carolan, 2006). A stakeholder with contributory expertise has and can share abstract/general or local/practical knowledge concerning a particular topic. A stakeholder with interactional expertise can facilitate the exchange of knowledge between contributory experts, which can facilitate a perspective by participants (Collins, 2004). However, an individual who has interactional expertise in two different knowledge communities does not have to have contributory expertise. As a result, a stakeholder with interactional expertise can help both different stakeholder group members to share and understand each other’s perspectives, assisting them to work together to integrate different types of knowledge in order to achieve a balance between their own and external motivations as well as to make necessary concessions as part of the collaborative process.

3.3.5 Accountability

Accountability is important for ensuring that the problem-solving process reflects the concerns of stakeholders and the broader community (Murdoch and Abram, 1998; Stoker, 1998; Blackstock and Richards, 2007). Bringing together individuals and groups, often with different backgrounds, interests and expectations, can lead to accountability concerns of two types. The first involves individual stakeholder group members who may not accept the arrangements agreed to by their representatives in the network, but who may not express or act on their concerns because of their loyalty to the group or the network (Stoker, 1998; Carr, 2004; Turner, 2004; Cash *et al.*, 2006; Mitchell and Breen, 2007; van Wyk *et al.*, 2007). The second concerns individuals or groups who represent the network, but whose concerns do not represent those of the network. As a consequence, the decisions of the network may reflect only the self-interest of the network representatives, and decisions may be made at the expense of the stakeholder community (Stoker, 1998; Carr, 2004; Turner, 2004; Cash *et al.*, 2006; Mitchell and Breen, 2007; van Wyk *et al.*, 2007).

3.3.6 Legitimacy

Legitimacy is important for ensuring that the efforts of collaborative approaches to environmental problem-solving are effective over time by striving to represent the interests of all affected stakeholders (Stoker, 1998; Blackstock and Richards, 2007). A key related challenge is how legitimacy can be maintained in a process where it is impossible for all interests to be represented (Montpetit, 2003). It has been proposed that if a decision results in a common good, then a collaborative approach that does not include all possible interests may be legitimate, particularly where specialized technical knowledge is involved (Scharpf, 1997; Montpetit, 2003). Process legitimacy issues include those that are internal, such as providing an adequate forum for resolving stakeholder issues, and external, such as ensuring adequate representation of interests and concerns of groups with the issue(s) under discussion (Blackstock and Richards, 2007;

Fawcett and Daugbjerg, 2012). Both outcome and process concerns will require a balance to be struck between inclusiveness and efficiency (Dreyer Hanson, 2007; Provan and Kenis, 2007).

3.4 The Emergence and Evolution of an Agri-Environmental Network: An Example from Ontario Canada

Collaborative approaches to problem-solving concerning complex problems involving the environment, such as those common in many water management situations, require the involvement of key stakeholder groups (WRI, 2004; Lemos and Agrawal, 2006: Ansell and Gash, 2007; Reed, 2008). One example relates to concerns about the potential impacts of agricultural practices on water resources at global, regional, and local scales (CCA, 2013). Impacts on water resources from agricultural practices have come under growing scrutiny and criticism as more intensive methods and technologies have been used to increase production to meet the food requirements of a growing global population (Jarosz, 2000; Wilson, 2009). With the global population estimated to reach 9 Billion by 2030, it is anticipated that food production will need to increase globally by a minimum of 70% compared to current levels, resulting in an estimated increased water demand of at least 25% over current needs (FAO, 2009; WEF, 2009; Hoff, 2011).

Agri-environmental networks will continue to have a significant role in collaborative problem-solving processes involving this and other environmental concerns related to agricultural activities (Montpetit, 2003). An example from Ontario, Canada, provides an opportunity to probe questions concerning the evolution of an agri-environmental network that includes representatives of the provincial ministry of agriculture, agricultural commodity groups, and provincial farm organizations, and other interested individuals and groups, and its participation in policy and program initiatives at the local and provincial scale. The Ontario example is significant in two ways. First, it demonstrates how a stakeholder network that has existed in one form or another for more than a century can evolve to address complex problems that lie outside of its traditional focus. Second, it is an example of how an established network can modify its approach and

participate in emerging multi-stakeholder problem-solving processes. This evaluation is useful from an empirical and theoretical perspective for two reasons. First, the network provides insight for understanding how an agri-environmental network may emerge and function in situations where the agricultural community and state are beginning to work together to address environmental challenges such as water management. Second, it is an example of how an established agricultural network can evolve to address concerns that have been outside of its traditional focus – in this case the integration of environmental issues into a production-oriented mandate – and participate in collaborative approaches for addressing them.

The Ontario example is assessed in two ways. First, the conceptual framework presented and discussed above is used to guide the evaluation of the agri-environmental network in two ways. The key attributes presented in Table 3.1 serve as a rubric for evaluating if the behaviour of the network is consistent with the characteristics of a collaborative problem-solving approach. This provides an opportunity to explore how non-state actors in general, and farm organization representatives in particular, can work with the state to create a stable stakeholder network, and how this network has evolved and contributed to external problem-solving processes. Second, the manner in which this network has participated in the integration of expert science, local knowledge, and community beliefs and values, is evaluated. This provides insight concerning how a stakeholder network can create and share vernacular knowledge within the network as part of its involvement and contribution to multi-stakeholder problem-solving processes.

3.4.1 Ontario's Farm Network

Several related initiatives have contributed to the emergence of an agricultural network in Ontario that is integrated at the local, county and provincial scales, and includes farmers and representatives from farm organizations, a state agency, and other local and provincial organizations that share an interest in agriculture. Local farm communities in Ontario began organizing as early as the mid-1700s in order to improve farmers' conditions, share agricultural

knowledge, and generally advance the interests of the rural community (James, 1914; Fowke, 1942; Dodds, 1980; Fuller, 1985). An example of this was a network of Agricultural Societies that was established to coordinate local, regional and provincial-scale activities (James, 1914; Fowke, 1942; Dodds, 1980; Fuller, 1985). Such voluntary efforts were promoted more formally by the Province of Ontario, when the Department of Agriculture [now known as the Ontario Ministry of Agriculture and Food (OMAF)] began working with the farm community in 1907. These efforts have included building leadership in the farm community by helping to organize local farm organizations (*e.g.*, 4H clubs), and helping the farming community to establish elected entities including County Farm Federations, provincial commodity groups, and educational associations (Reaman, 1970; Veeraraghavan, 1985; Biesenthal, 1991).

Local agricultural networks became formally connected at the provincial scale with the formation of the larger Ontario Federation of Agriculture (OFA) in 1936 (Reaman, 1970: Dodds, 1980; Zwerver, 1986), and the smaller Christian Farmers Federation of Ontario (CFFO) in the 1960s (Veeraraghavan, 1985; Reaman, 1985). These provincial farm organizations have a direct membership structure, with individual farmers electing provincial and local representatives who are supported by member services and policy staff. The Province encouraged these efforts, and provided support by implementing legislation in 1993 that required farmers to register their farms and pay an annual fee to either farm organization (Struthers, 2007). Farm leaders have also increased leadership and capacity by serving within a network of farm, commodity, local organizations (*e.g.*, municipal government, service organizations), by participating on agriculture-related committees, and by helping to negotiate solutions to agriculture-related issues with state representatives at local, regional and provincial-scales (Martin, 1972; Dodds, 1980; Veeraraghavan, 1985; Biesenthal, 1991; Montpetit and Coleman, 1999.

The agricultural network has also supported a research and educational system coordinated by farmers, farm organization and OMAF representatives, and researchers (Reaman, 1970;

Martin, 1972; Haslett, 1985; Biesenthal, 1991). One key objective of this system has been to encourage the development and uptake of progressive agricultural science and practices that are suitable for Ontario conditions (Reaman, 1970; Haslett, 1985; Veeraraghavan, 1985; Montpetit and Coleman, 1999). This objective has been implemented by incorporating expert science and local knowledge through two complementary initiatives. The first initiative involved actively encouraging farmers throughout Ontario to participate in cooperative scientific agricultural research coordinated through the University of Guelph (James, 1914; Reaman, 1970; Fuller, 1985; Haslett, 1985; Milburn *et al.*, 2010). The second initiative involved the incorporation of this emerging agricultural scientific knowledge into farming practices across the province (Reaman, 1970; Biesenthal, 1991). These initiatives were implemented initially through OMAF on-farm extension science programs, and were later supported by farm educational organizations and conservation authorities, (James, 1914; Reaman, 1970; Haslett, 1985; Milburn *et al.*, 2010). On-farm extension efforts were replaced in the mid-1980s with a more centralized technology transfer approach (Milburn *et al.*, 2010), which has been integrated with regular education events such as farm demonstrations, workshops, and conferences throughout the province.

3.4.2 Emergence of the Ontario Agri-Environmental Network

Efforts to mitigate impacts on the environment from agriculture in Ontario have been influenced by two social movements. The first was a conservation movement that began in the late 1800s (James, 1914; Reaman, 1970; Biesenthal, 1991; Paehlke, 1997). One objective of the conservation movement was making farmers aware of the need to adopt progressive agricultural approaches voluntarily, such as the implementation of alternative nutrient and soil management practices (Croil, 1861; Reaman, 1970; Fuller, 1985). This objective was promoted through agricultural extension efforts, where extension workers helped farmers to identify and implement alternative practices (Cressman, 1981; Paehlke, 1997; Forkey, 2012).

Broader societal awareness of the environment resulted in the 1960s and 1970s following the publication of domestic and international research that demonstrated that land use activities were impacting the environment (Richards, 1987; Montpetit and Coleman, 1999; AGCare, 2007). For instance, the International Reference Group on Great Lakes Pollution from Land Use Activities (also known as PLUARG) studies of the Great Lakes concluded that society was having a negative impact on water quality in the Great Lakes with agricultural and urban land use activities identified as significant sources of water quality degradation (IJC, 1978; Cressman, 1981; OCSCSA, 1983). Conservation efforts were then intensified through a series of state-sponsored cost-share programs in Canada and the United States that were delivered to Ontario by conservation authorities in collaboration with farm organizations, OMAF, and the newly established Ontario Ministry of the Environment (OMOE) (Cressman, 1983; AGCare, 2007; CCA, 2013).

Increased environmental awareness in the 1970s also led to a second movement that contributed to the formation of non-government organizations and efforts of newly-formed state environment regulatory agencies that shared an interest in protecting the environment (Paehlke, 1997; Daugbjerg, 1998; Forkey, 2012). Environmental non-government organizations (ENGOs) and state regulatory agencies focused their early efforts on advocating for or developing regulatory programs for eliminating pollution sources associated with industrial activities in urban areas (Paehlke, 1997; Forkey, 2012).

The scope of the environmental community broadened in the late 1980s to include agricultural land use activities. This new interest in agriculture led to a commitment by the newly elected provincial government in Ontario to follow through on an election promise to introduce environmental legislation that farmers considered draconian (Grudens-Schuk, 2000; Skogstad, 2008). In response to these pressures, 37 farm and commodity organizations formed a provincial agri-environmental network in 1991 called the Ontario Farm Environmental Coalition (OFEC).

OFEC was created to develop and implement a province-wide program for addressing environmental concerns associated with agricultural production practices (Verkley *et al.*, 1998; Fitzgibbon *et al.,* 2004; Morrison and Fitzgibbon, 2014). OFEC also provided farm and commodity organizations with a single organization that could negotiate with the provincial government and other organizations with an interest in agri-environmental issues (Grudens-Schuk, 2000; Skogstad, 2008).

Given strong reticence and resistance to formal environmental regulations among farmers, OFEC advocated for, and eventually implemented, a non-regulatory alternative for addressing agri-environmental concerns (Morrison and Fitzgibbon, 2014). OFEC brought forward this alternative, the Environmental Farm Plan (EFP), during an impasse between OMAF and OMOE concerning agri-environmental legislation at this time (Verkley *et al.*, 1998). A fundamental part of the EFP was that each farmer should develop and implement an environmental plan for their farm operation to address agri-environmental concerns associated with air, natural habitat, soil and water resources (OFEC, 1992; Verkley *et al.*, 1998). The EFP format was negotiated by a working group composed of representatives from the agri-environmental network, and the OMOE and the Ministry of Natural Resources (). The outcome of the negotiations was the EFP program, which has been delivered since 1993 using a two-day workshop during which farmers complete risk assessment worksheets for their farm operation, and then prepare a risk management plan for addressing the identified risks. The content of each worksheet was developed using a consensus-based process to negotiate risk assessment benchmarks by a working group that included farmers, researchers and representatives from OMAF, conservation authorities, regulatory agencies, and other interested groups such as ENGOs (Robinson, 2006).

3.4.3 Walkerton: A Trigger for Collaboration

In May 2000, seven persons died, and several thousand others became ill, when the municipal water supply was compromised and contaminated water was distributed to homes and businesses

in Walkerton, Ontario (O'Connor, 2002a). Justice O'Connor, who led an inquiry concerning the Walkerton tragedy, recommended that future outbreaks could be avoided by implementing a five-part multi-barrier approach for municipal drinking water systems. A key component was a decision-making approach incorporating public involvement, based on the principles of risk analysis and guided by the precautionary principle (O'Connor, 2002b). The second through fifth barriers concerned the operation of a municipal water supply (O'Connor, 2002b), and have been implemented through the *Safe Drinking Water Act, 2002* (Province of Ontario, 2002a; OMOE, 2012). The first barrier addressed concerns with the raw water quality for municipal water systems, and included the development of watershed-based source protection plans (SPPs). In 2007, the Province of Ontario implemented the *Clean Water Act, 2006* (CWA) (Province of Ontario, 2006) and first phase of regulations, which had the objective of preparing local SPPs for municipal drinking water systems (OMOE, 2007).

Farm organizations had initially expressed support for source water protection during the Walkerton inquiry, and had offered to work with the OMOE during both the development and implementation of the SPP process. The intent was to build on past efforts by the farm community to protect water resources in Ontario (Armitage, 2001). However, the OMOE implemented a prescribed form of collaboration that disregarded "historical practices and shared understandings, especially in rural areas with long agricultural traditions" (Ferreyra *et al.*, 2008, 318). This retreat to the familiar, centralized regulatory command and control response has been a predictable reaction of government programs when presented with a high profile crisis (Jordan *et al.*, 2005; Innes and Booher, 2010). This action was also consistent with the behavior of environmental agencies such as the OMOE, which have promoted a policy approach in which the environment should be protected from land use activities using a regulatory approach (Montpetit, 2003). This regulatory approach is also part of a historical trend in Canadian society to restrict

land use activities in rural areas in order to protect natural resources on the part of, and for the benefit of, the majority urban population (Forkey, 2012).

The responsibility for developing SPPs was delegated under the authority of the CWA to 19 Source Protection Committees (SPCs) (Figure 1.1). Each SPC was responsible for a Source Protection Area, which consisted of a single watershed, or a Source Protection Region, which consisted of two or more watersheds. The Chair of each SPC was appointed by the Ontario Minister of the Environment, with one-third the members divided among representatives of municipalities, industry, and the broader local community such as "environmental, health and other interests of the general public" (Province of Ontario, 2007e, 2). Membership also included First Nations representatives where a band has reserve lands located within the SPA or SPR. Municipalities and First Nations bands were given the authority to select their members. The authority for selecting representatives of other sectors was given to Source Protection Authorities, which comprised the Boards of Directors of pre-existing watershed-based conservation authorities (OMOE, 2007). Administrative and technical support was provided by local conservation authority staff.

Unable to participate directly in the design of the SPP process, farm organizations initiated an advocacy process to encourage the province to align the SPP process with agri-environmental legislation and stewardship programs that promoted economically and environmentally sustainable farming (Legislative Assembly of Ontario, 2006; OFA, 2006). The OFA also contacted provincial legislative members directly by letter to make them aware of the farm community's support for source water protection in general, and to outline its outstanding concerns with the proposed SPP process. One outcome of these efforts was the creation of the Ontario Drinking Water Stewardship Fund by the Ministry of the Environment, which would provide $7 Million per year for four years to help farmers and rural residents to implement

activities such as beneficial or best management practices (or "BMPs") that would reduce threats to drinking water (OMOE, 2006).

Another outcome of the OFEC advocacy process was agreement by OMOE that any SPC with significant agricultural activity should include a minimum number of local agricultural representatives. The OFEC SWP working group had recognized the importance of having farmers participate in the SPP problem-solving process directly, and OFEC and the local County Federations of Agriculture organized local elections to select agricultural representatives from within the local farm communities to sit as SPC members. Although the process for electing agricultural representatives was initially challenged by the OMOE and Conservation Ontario, an organization representing the 36 watershed-based conservation authorities in Ontario, 34 of the 37 candidates selected by the local farm community were eventually appointed as members of local SPCs. This outcome, farmers believed, provided parity with the provision in CWA regulations that permitted municipalities and First Nations to select their SPC representatives.

To coordinate agri-environmental network efforts during the SPP process, OFEC established a Source Water Protection (SWP) working group that included representatives from the four major farm organizations – namely OFA, CFFO, Agricultural Groups Concerned About Resources and the Environment (AGCare) and the Ontario Farm Animal Council (OFAC). Two OMAF program staff with technical expertise in extension education and source water protection also participated at the invitation of OFEC and with the approval of their Deputy Minister. The OFEC SWP working group determined that the agricultural representatives would need the support of the farm community to help them to participate as effectively as possible in the SPP problem-solving process. OFEC applied for and received funding from farm organizations and federal and provincial agencies to deliver six workshops. All 37 agricultural representatives – both those appointed by the Source Protection Authorities and those elected by the farm community – were invited to attend these workshops. These workshops were designed to increase

the communications and technical capacity of the agricultural representatives. Presentations were delivered by academic, municipal and provincial government and private sector speakers on a variety of topics (OFEC, 2007; OFEC, 2008b; OFEC, 2008d; OFEC, 2010; OFEC, 2011a; OFEC, 2012). An opportunity was provided at all meetings for agricultural representatives and OMOE senior management to share concerns and dispel misunderstandings concerning the SPP process. The workshops were also augmented with frequent teleconferences and online discussions concerning local and provincial issues.

3.5 Methods

A mixed methods research (MMR) approach was used to combine qualitative data collected using different research techniques. Although MMR has been associated most commonly with integrating qualitative and quantitative data, it also provides a structured approach for integrating qualitative data collected using different research methods with different philosophical contexts (Johnson and Onwuegbuzie, 2004; Hesse-Biber, 2010). This data collection approach was consistent with the concurrent triangulation approach to MMR where the emphasis was on confirming, cross-validating and corroborating findings using different methods within a single study (Cresswell, 2003). The MMR approach provided flexibility, allowing qualitative data collected using different techniques to be assembled concurrently and then integrated during the data interpretation portion of the study.

The example presented in this chapter required a flexible methodology because the primary source of qualitative data was observations collected using a non-obtrusive participant observation approach (Crossley, 2010) over a four-year period. These observations were organized, classified and interpreted using the conceptual framework presented above in Table 3.1. This approach was appropriate in this instance because collecting data concerning networks from an internal perspective, particularly a network that has been largely inaccessible, can be

challenging with more structured techniques such as interviews and questionnaires (Hesse-Biber, 2010). An open-ended participant observation approach was advantageous because it facilitated the observation of changes in the attitude of participants – such as a change in body language or tone of speech – as the discussion on different topics progressed, and to observe when and how a group did or did not manage to find mutually acceptable solutions to any disagreements that arose (Crossley, 2010). Such subtle group dynamics might have been overlooked by a researcher who was not present, and thus had relied on a survey or interviews to collect data. An open-ended approach was also useful for identifying and assessing the influence of what Crossley (2010, 20) describes as the "mechanisms of relationship formation", which include the "identities, expectations, rituals, shared feelings and meanings" of the community. The use of participant observation was approved by the Office of Research Ethics at the University of Waterloo.

Qualitative data were also collected through the evaluation of 312 publicly available documents, and included provincial regulations, and policy and program publications, position papers issued by various interested organizations, and articles from non-academic publications. The interpretation of these documents was guided using the conceptual framework presented in Table 3.1, with the goal of developing a better understanding of how "particular understandings, imageries or systems of knowledge" informed and/or shaped the network and its function (Esmark and Trianafillou, 2007, 101). It was recognized that documents reflected the perspectives of the organizations that generated them, rather than providing factual records of what has transpired at the time of their writing (Esmark and Trianafillou, 2007). However, the purpose was not to actively 'deconstruct' information to determine and analyze the underlying perspectives, but rather to be aware that perspectives may have existed and to account for these perspectives during analysis (Babbie, 2001).

3.6 Results

3.6.1 Stakeholder Involvement

Stakeholder involvement has been a core activity within the agricultural network, at both the local and provincial scales (Reaman, 1970; Veeraraghavan, 1985; Beisenthal, 1991), and was incorporated into the OFEC SWP workshop process in two ways. First, the agricultural representatives themselves were nominated and elected by the local farm community, with the dual purpose of representing their interests during the SPC problem-solving process and keeping them informed about how the SPP process would affect them. The OFEC SWP workshop process drew the local farm community into the SPP process through the election of the agricultural representatives, and raised their awareness about the possible implications of the SPP process for them and their farm operations. Second, the OFEC SWP workshop approach was endorsed by the farm leadership, a point that was reinforced by the President of the OFA when he addressed the agricultural representatives at the first OFEC SWP workshop in December 2007 (OFEC, 2007). This signaled that direct farm participation was important for ensuring that the interests of the farm community were incorporated into the SPP process, both locally and provincially, and that OFEC would look after their interests by supporting the involvement of the agricultural representatives on the farm community's behalf.

The agri-environmental network had also contributed to the ongoing creation and sharing of vernacular knowledge by promoting the integration of top-down and bottom-up efforts across the province. This is consistent with the role of stakeholder networks in communicating knowledge vertically and horizontally across different scales and boundaries (Pacquet, 2001; Peters and Pierre, 2004; Reed and Bruyneel 2010). In this instance, farmer involvement within these efforts has been central, with technical expertise provided by university researchers, OMAF, OMOE, conservation authorities, and local and provincial farm and environmental organizations. For instance, the OFEC SWP workshops provided a forum in which agricultural representatives

interacted with and learned how agricultural and environmental science related to source water protection in general and the SPP process in particular. The workshops also provided a forum for agricultural representatives to discuss agricultural and environmental science, relating and reconciling it with local knowledge and concerns, with support from technical experts from academia and government. In this way, agricultural and environmental science could be integrated with local knowledge, beliefs and values held by the agricultural representatives and their local farm communities to create vernacular knowledge that could be shared with their SPC colleagues. The agricultural representatives also acted to connect the agri-environmental network with the SPP process, by encouraging their SPC colleagues to participate in a similar process where expert science, local knowledge, beliefs and values could be shared to co-produce vernacular knowledge. Building of trust and the co-production of knowledge through bonding between network members, and through the act of bridging between the network members and representatives of different stakeholder groups and networks, is an important part of collaborative problem-solving (Blanco *et al.*, 2011).

3.6.2 Reciprocal Communication

Reciprocal communication has been a longstanding characteristic of the relationships involving farm organizations and OMAF within the agricultural network, as illustrated by the participation of farm organization and OMAF representatives during development of policy and programs affecting the farm community (Skogstad, 1990; Biesenthal, 1991). It is not surprising, then, that reciprocal communication was incorporated into and promoted within the OFEC SWP workshop process. The workshops were designed to provide an opportunity for the agricultural representatives to identify agenda items, and to make suggestions for modifying the workshop format, so that the learning process would better serve their needs. For instance, an exit survey was provided at each workshop for agricultural representatives and OFEC SWP working group members to rate the effectiveness of each topic on the workshop agenda, to identify additional

topics that should be presented at the next workshop to meet their needs, and to suggest changes to the content and format of future workshops. Informal comments provided by agricultural representatives either during or after the workshops were also noted and discussed by the OFEC SWP working group members when evaluating the effectiveness and outcomes of each workshop as part of the planning process for subsequent workshops. As a result, the content and format of workshops changed to reflect the evolving needs of the agricultural representatives as they and their SPCs progressed through the SPP process. In this way collaboration was encouraged and the concerns and interests of participants were addressed (Carr, 2004; Cash *et al.*, 2006; van Wyk *et al.*, 2007).

Although OFEC SWP working group members facilitated the workshops, agricultural representatives were encouraged frequently by workshop facilitators to ask questions of technical speakers, and to discuss and relate expert science concepts presented during the discussions of their local knowledge, and individual and shared concerns. Time was built into the workshop between formal presentations to encourage bonding among agricultural representatives through informal discussions, relationship building, and opportunities for reflection. Time was also scheduled at the end of each day of the workshop to revisit any topics that the agricultural representatives wanted to discuss further. This was part of an overall objective of providing opportunities for agricultural representatives to share concerns as part of informal small group discussions, to encourage the sharing of information and opinions, to help each find solutions to their individual and shared concerns, and to build a sense of community that would extend beyond the time spent together at the workshops. This sense of community was reinforced outside the workshops by encouraging agricultural representatives to take advantage of online and teleconference discussions, with or without the involvement of OFEC SWP working group members. The sharing of and discussion of information and concerns can encourage members to make concepts and associated discussion relevant to their particular circumstances and needs

(Yaffee and Wondolleck, 2000; Carolan, 2006), and promote the sharing and integration of expert science, local knowledge, and beliefs and values (Carr, 2004; Cash *et al.*, 2006; van Wyk *et al.*, 2007) which helps promote the co-production of vernacular knowledge.

3.6.3 Stakeholder Capacity

The building of leadership and technical capacity has been an ongoing activity within the Ontario agricultural network since the early 1900s (James, 1914; Reaman, 1970; Haslett, 1985; Biesenthal, 1991). The increased capacity enabled subsequent innovation, such as the establishment of the agri-environmental network, and the development of the EFP process, which has helped build trust and promote the co-production of knowledge among farmers, farm organization representatives and OMAF technical specialists (Smithers and Furman, 2003; Knierim, 2007). As a consequence, the OFEC SWP working group recognized the need to enhance the leadership and technical capacity of the agricultural representatives, which had been previously developed through involvement in local, provincial and federal initiatives. A training program was undertaken to help the agricultural representatives increase their capacity to understand and discuss contentious and technical issues. Several key concepts that were deemed to be essential background information to prepare the agricultural representatives to participate effectively in the SPP in the problem-solving process were emphasized. These included an overview of the history of agri-environmental actions in Ontario, the development of source water protection (SWP) principles from the perspective of the agricultural community, communications training on "how to win friends and influence people", stakeholder mapping and the likely positions that other stakeholder groups would be bring to the SPC problem-solving process, and technical aspects of the SPP process that could affect agricultural land use activities across Ontario (OFEC, 2007). This information would help agricultural representatives to demonstrate that the farm community had been involved in agri-environmental initiatives for more than thirty years, help them to engage with and understand the concerns that other SPC members would have

regarding the SPP process, and give them the capacity to collaborate with other SPC members to develop vernacular knowledge through the problem-solving process (OFEC, 2007; OFEC, 2008b; OFEC, 2008d; OFEC, 2010; OFEC, 2011a; OFEC, 2012). As a result, the agricultural representatives were prepared through the OFEC SWP workshops to develop the two types of capacity outlined by Ivey *et al.*, (2006) – capacity for action and capacity for self-determination – enabling them to meet both the needs of the farm community and the SPP process.

3.6.4 Stakeholder Expertise

The development of stakeholder expertise within the farm community and agricultural network has focused historically on the development of contributory expertise, which is consistent with agricultural extension efforts in Ontario and elsewhere. There has also been an increasing need for interactional expertise with the emergence of the agri-environmental network, and the ability to engage and communicate with individuals and organizations that did not have a farming background. For instance, the importance of being able to share and integrate different types of knowledge was reinforced during the EFP process when representatives of organizations from the agricultural and environmental science communities came together to negotiate the contents of the EFP worksheets (Verkely *et al.*, 1998). As a result, the OFEC SWP working group also concluded that it would be prudent to build contributory and interactional expertise among the agricultural representatives in order to be able to participate as effectively as possible in the SPP problem-solving process. It was recognized that the level of contributory expertise varied among the agricultural representatives, with some having had considerable experience with agri-environmental concerns such as climate change, nutrient management, and water management, at either or both the provincial and federal level, whereas others had fewer opportunities to develop contributory expertise.

Also, many agricultural representatives had participated in formal post-secondary education studies that included both agricultural and environmental science, which had been supplemented

with information and experience gained through formal and informal learning events. Technical presentations were provided during the OFEC SWP workshops to enhance the contributory knowledge of the agricultural representatives. An example of this was a presentation by the Executive Director of AgCare, who provided a summary of the history of agri-environmental initiatives in Ontario (OFEC, 2007). This was structured around different agri-environmental initiatives, such as the EFP program, which provided a provincial context for agri-environmental activities within which local initiatives and participation could be attributed. The development of contributory and interactional expertise has been recognized as a promising approach for facilitating the sharing of knowledge at different scales and from both an abstract and general perspective between researchers and stakeholders (Carolan, 2006).

Some agricultural representatives also had previous opportunities to develop considerable interactional expertise through activities such as serving as elected officials in municipal government, volunteering on service organizations, and by representing the farm community on local and provincial initiatives. A common comment from agricultural representatives during informal discussion both at and outside the workshops was that they had been asked by urban and rural non-farm neighbours to provide explanations about agriculture in general, and about their commodity in particular. As a consequence, many agricultural representatives had some basic level of interactional expertise that they had developed by having to help share insight about agriculture with urban and non-farm neighbours who had little or no knowledge of the topic. Agricultural representatives who had participated in a formal capacity, such as serving as elected representatives on provincial and federal farm or commodity organizations, or as elected municipal or provincial government positions often had a more advanced level of interactional expertise.

This interactional expertise had been developed by communicating regularly with individuals and groups with little or no knowledge of the farming, such as elected officials and

staff members in municipal, provincial and federal government agencies. To help agricultural representatives enhance their interactional expertise, a number of technical presentations were provided by OFEC SWP working group members that introduced and explained SWP concepts, and discussed how these concepts were related to agricultural science and practice (*e.g.*, OFEC, 2007). These presentations were also supported by plain language technical publications that reinforced these concepts (e.g., Simpson *et al.*, 2006a; Simpson *et al.*, 2006b; Simpson *et al.*, 2006c; Simpson *et al.*, 2006d). Discussions at subsequent OFEC SWP workshops indicated that these presentations had provided the agricultural representatives with a more comprehensive understanding of SWP concepts than their SPC colleagues, demonstrating the benefits of enhancing their interactional expertise, and prepared them to discuss and negotiate them effectively as part of the SPP problem-solving process. This is consistent with experience elsewhere where network members have become more confident in their ability share their knowledge, and also serve as a bridge between the agricultural and environmental science communities, by increasing their contributory and interactional expertise (Carolan, 2006).

3.6.5 Accountability

Accountability has been a strong theme in the agricultural network in Ontario, with an ongoing tradition of member-controlled farm organizations that have been overseen by an annually-elected farm leadership (Reaman, 1970; Veeraraghavan, 1985; Struthers, 2007). The process developed by the OFEC SWP working group promoted accountability in two ways. First, the Agricultural Representative was someone that the local community had known and had trusted to act in their interest, and they had chosen to represent their interests as part of the SPP process. Because agricultural representatives continued to be members of their farm community, accountability has been reinforced by the level of accessibility. This level of accessibility provided an opportunity for the Agricultural Representative to keep the local farm community informed about initiatives at the SPC table, and to seek ideas and support regarding how local

concerns should be addressed. Conversely, this accessibility has provided an opportunity for the local farm community to share concerns and ideas with the Agricultural Representative regarding how their interests should be addressed as part of the SPP process.

Second, the OFEC SWP workshop process promoted accountability to the farm community because the actions of OFEC have been overseen by the farm leadership, which was elected by and represented the interests of the farmers of Ontario at a provincial scale, and guided and supported by farm and commodity organization representatives. As a consequence, state and non-state organizations have been assured that OFEC is accountable to and represents the concerns and interests of farmers and farm organizations across Ontario (Coleman and Skogstad, 1990; Montpetit and Coleman, 1999). This accountability has also empowered OFEC with significant leverage during negotiations with state and non-state organizations, providing a unified voice for the farm community concerning agri-environmental matters (Veeraraghavan, 1985; Verkely *et al.*, 1998). Promoting accountability has helped ensure that broader community concerns and interests have been represented in the problem-solving process (Stoker, 1998; Carr, 2004; Turner, 2004; Cash *et al.*, 2006; Mitchell and Breen, 2007; van Wyk *et al.*, 2007).

The OFEC SWP workshop process has also been accountable to and reflects agri-environmental knowledge at the local and provincial scale through the involvement of representatives of farm and commodity organizations and OMAF. The OFEC SWP working group brought together state and academic experts to present agricultural and environmental science within the workshops, and openly encouraged agricultural representatives to share and discuss their knowledge, and beliefs and values. This enabled the local farm community to develop a vernacular knowledge that they then shared with their SPC colleagues. The agricultural representatives were also actively involved in the development of the OFEC SWP principles by debating and revising draft positions that were presented to them by members of the OFEC SWP working group (OFEC, 2007). The SWP principles were developed to assist the different agri-

environmental network members to provide a consistent position concerning the preferred outcome for the SPP problem-solving process. The SWP principles have also been used by agricultural representatives as part of their involvement with SPCs during the development of vernacular knowledge, and by OFEC SWP working group members when negotiating the desired approach and outcomes of the SPP process with state and non-state organizations. The process used to identify the broader interests of stakeholder network members is an important aspect of promoting accountability. Specifically, it is important to provide an opportunity for network members to raise their concerns and interests, and have them incorporated into the problem-solving process where possible (Stoker, 1998; Carr, 2004; Turner, 2004; Cash *et al.*, 2006; Mitchell and Breen, 2007; van Wyk *et al.*, 2007).

3.6.6 Legitimacy

Legitimacy, like accountability, has been a strong theme within the agri-environmental network, and both process and outcome legitimacy were incorporated into the OFEC SWP workshop process. Process legitimacy was incorporated by drawing on the tradition of stakeholder involvement in the farm community in two ways. First, once the agri-environmental network ensured the ability for the farm community to be represented on SPCs, the OFEC SWP working group implemented a process for the farm community to participate in the selection of agricultural representatives who would fill this role. This process included developing a list of qualifications and requirements for the agricultural representatives, which were then circulated through local farm organizations and the farm press, and then a series of publicly advertised elections were organized by OFEC in cooperation with the local County Federations of Agriculture. The use of an open and transparent approach has been identified as an important feature for enhancing the legitimacy of problem-solving processes (Montpetit, 2003). In this case, all network members could not be directly involved with the SPP problem-solving process, so the use of a democratic process to selection agricultural representatives was valid. Second, OFEC

implemented a program to enhance the capacity and expertise of the agricultural representatives to help them participate as effectively as possible in the SPP problem-solving process. This helped ensure that the interests of the local farm community, and broader objectives of the agri-environmental network, were acknowledged and incorporated into the local SPP process. This is an example of how a stakeholder network contributed to a broader problem-solving forum by helping to identify and discuss stakeholder issues, and helping to ensure that the concerns and interests of the community were represented and incorporated into problem-solving processes (Blackstock and Richards, 2007; Fawcett and Daugbjerg, 2012).

Enhancing the capacity and expertise of the agricultural representatives also contributed to outcome legitimacy by promoting the development of SPP policies that complemented existing farming approaches in the province, and built on existing agri-environmental policy and programs. Specifically, outcome legitimacy was promoted in three ways. First, the OFEC SWP working group provided ongoing technical support for the agricultural representatives by participating in teleconference and internet discussion groups concerning general and specific concerns that were raised by the agricultural representatives. This support outside the OFEC workshops helped the agricultural representatives to relate their local concerns to the OFEC SWP principles, helping them to present a consistent message within and between SPCs. Second, members of the OFEC SWP working group provided presentations to many of the SPCs concerning the OFEC SWP principles that had been developed during the OFEC SWP workshops, and endorsed by the farm leadership. These technical presentations helped reinforce the OFEC SWP principles, and assisted the agricultural representatives to explain them to their SPC colleagues. Third, OMAF issued technical guidance that explained how existing agri-environmental regulatory standards and voluntary BMPs supported the objectives of the SPP process (OMAF, 2012). This bulletin helped provide legitimacy for complementary farm community policies, such as the OFEC SWP principles, which were built on a common

foundation of agri-environmental science. As a consequence, the agri-environmental network contributed to outcome legitimacy by helping to incorporate vernacular knowledge that was based on agri-environmental science, practice and programs in a consistent manner into the problem-solving process, making it more efficient and technically-sound from the farm community perspective. This would help increase the efficiency of the overall process, help ensure that decisions provided for the common good, and that the outcomes were effective and could be implemented (Montpetit, 2003; Dreyer Hanson, 2007; Provan and Kenis, 2007; Fawcett and Daugbjerg, 2012).

3.7 Discussion and Conclusions

Stakeholder networks have been recognized as necessary participants for developing and implementing outcomes for complex problems, such as those involving the environment (Yaffee and Wondolleck, 2000). This recognition has been due in part to a growing awareness that networks, and the members whose interests they represent, are entities that can support and contribute to collaborative problem-solving processes (Eckerburg and Joas, 2004; Blanco *et al.*, 2011). This is in contrast with earlier characterizations of networks as unable or unwillingly to participate in collaborative problem-solving processes. Despite this growing awareness, the problem-solving process used to reconcile new and existing ideas within networks, and how networks integrate ideas and information with the beliefs and values of members, is not well understood (Peters, 1998; Torfing, 2007; Bevir and Richards, 2009).

In this paper, a Canadian example was used to explore the involvement and contribution of an agri-environmental network to a state-mandated multi-stakeholder problem-solving process. This agri-environmental network, and the broader agricultural network within which it has emerged and functioned, has been characterized as an entity that has been closed to external ideas and influences, and has been static and unable to evolve to address emerging concerns (Skogstad,

1990; Monpetit and Coleman, 1999). However, the results presented above suggest that the agri-environmental network did not behave in this manner. Rather, it demonstrated a more open and dynamic manner, adapting to problem-solving involving a complex problem using a non-regulatory initiative developed in a collaborative manner.

This example therefore provided insight concerning two related questions regarding the contribution of stakeholder networks to collaborative problem-solving. First, what form of problem-solving process, traditional or collaborative, is used within a stakeholder network to reconstruct and reconcile new and existing ideas (Peters, 1998; Torfing, 2007; Bevir and Richards, 2009)? Second, do such closed networks resist or facilitate the integration of new and existing ideas and information with the beliefs and values of network members as part of internal problem-solving processes (Peters, 1998; Torfing, 2007; Bevir and Richards, 2009)? These questions were explored in the context of the agricultural network, given that the contribution of circumstances and factors related to the formation, evolution and function of how stakeholder networks such as the one featured in the case study are not well understood in both the theoretical and empirical literature (Hay, 1998; Torfing, 2007).

Regarding the problem-solving approach observed, the results suggest that the agri-environmental network has operated in a manner that has been consistent with the attributes of collaborative approaches to environmental problem-solving (see Table 3.1). This consistency was demonstrated from two perspectives. From an internal perspective, the agri-environmental network, through the efforts of the OFEC SWP working group, developed a forum to support agricultural SPC members during a prescribed environmental problem-solving process. This reflected the importance of developing a process for promoting stakeholder involvement (Wynne, 2002; Jasanoff, 2003), accountability (Murdoch and Abram, 1998; Blackstock and Richards, 2007) and legitimacy (Blackstock and Richards, 2007; Fawcett and Daugbjerg, 2012). This process was promoted by supporting the election of agricultural representatives using a

transparent approach that was endorsed and organized at the local and provincial level, and encouraging the participation of agricultural representatives in workshops and through email and teleconference discussion groups. However, accountability and legitimacy of the agricultural representatives to the local communities could not be verified because this was not part of the research.

The process also demonstrated the benefits of promoting reciprocal communication between network members (Bellamy *et al.*, 1999; Lach *et al.*, 2005), and the importance of developing their capacity (Carr, 2004; van Wyk *et al.*, 2007) and expertise (Carolan, 2006) to participate effectively in local problem-solving processes. Non-obtrusive observation at workshops and as part of email and teleconference discussion groups verified substantial reciprocal communication and stakeholder capacity. However, it was evident that the development of interactional stakeholder expertise was a challenge for some agricultural representatives, particularly with the more complex concepts that arose during workshop presentations and discussions, such as understanding the threat posed by different land use activities to water sources (OFEC, 2008a; OFEC, 2008c; OFEC, 2009; OFEC, 2010b: OFEC, 2011a; OFEC, 2012b) .

From an external perspective, the agri-environmental network demonstrated support for, and a willingness to work collaboratively with the OMOE in developing the SPP process. Unfortunately, the OMOE chose to impose the SPP process through regulation and overlooked the opportunities to build on the past efforts and existing multi-level approach to environmental governance that was available through the agri-environmental network (Ferreyra *et al.*, 2008). However, when OFEC's efforts to participate formally in the SPP process were unsuccessful, OFEC developed and implemented a process whereby it could participate informally. This behaviour is consistent with observations from other mandated problem-solving processes where

informal networks have been established in parallel to formal problem-solving processes (Robins, 2008).

The research results indicate that the agri-environmental network actively supported the creation and sharing of vernacular knowledge by facilitating the integration of expert science, local knowledge, and community beliefs and values in two ways. Internally, the OFEC workshop process was designed to provide an opportunity for agricultural representatives to learn about and discuss agricultural and environmental science – provided by external experts, OFEC SWP working group members, and agricultural representatives – and to reconcile this information with their knowledge, beliefs and values. A forum was encouraged for the creation and sharing of vernacular knowledge (OFEC, 2007; OFEC, 2008b; OFEC, 2008d; OFEC, 2010; OFEC, 2011; OFEC, 2012), which was then summarized and shared as a series of OFEC SWP principles.

Externally, the OFEC SWP principles provided a consistent source of technical information that has been disseminated within the vertically and integrated agri-environmental network in two ways. First, the SWP principles provided a source of knowledge that the agricultural representatives could share at a watershed scale during the creation and sharing of vernacular knowledge with their colleagues as part of the problem-solving process within individual SPCs. Second, the SWP principles provided a common approach for OFEC SWP working group members to advocate for during negotiations with OMOE and SPC staff representatives involved with the SPP process at a provincial scale. This demonstrates how networks can create an approach for communicating knowledge across, and empower stakeholder members to engage in problem-solving at horizontal and vertical scales in an integrated manner (Paquet, 2001; Peters and Pierre, 2004; Reed and Bruyneel, 2010).

The research also provided broader insight for the theoretical and empirical literature in two ways. First, the research demonstrated the importance of context for the function of networks -

namely what circumstances and factors led to the formation, evolution, and formation of the agricultural network. The historical literature indicates that the formation of the overarching agricultural network in Ontario was shaped by several-related factors, where the relationship between the state and farm community evolved from a traditional command and control to a more collaborative approach. It is important to note that the relationship between the farming community and the province prior to the formation of OMAF was one that could be characterized by a lack of cohesion and distrust of the state on the part of the former, and lack of a strategic vision and consistent support for the farm community on the part of the latter (James, 1914; Reaman, 1970). Following the formation of the Province of Ontario, OMAF extension staff implemented a program to develop leadership, organizational, and technical capacity within the farm community (Biesenthal, 1991; Milburn *et al.*, 2010). OMAF reinforced these efforts by including farm organization representatives to participate on its problem-solving bodies, providing an opportunity for farm leaders to enhance their leadership capacity and participate in negotiating agricultural policy and programs.

OMAF also transformed its approach for supporting the farm community, moving from agricultural extension to technology transfer approach once the agricultural network had attained a highly developed level of leadership, organizational and technical capacity (Milburn *et al.*, 2010). As a result, the agricultural network has evolved to work collaboratively to resolve problems both internally and externally. The establishment of an agri-environmental network, which has involved representatives from farm organization, OMAF, and other interested agencies and organizations, is a recent example of how the agricultural network has been able to use a collaborative approach for addressing an emerging complex problem (Verkley *et al.*, 1998; Robinson, 2006).

Second, the capacity and interest of the agricultural network to create and share vernacular knowledge has increased along with its growth in leadership and organizational capacity.

Specifically, the province, in cooperation with the University of Guelph, has actively promoted the development of a forum within which farmers have participated in the development of progressive agricultural science and practice across Ontario (Reaman, 1970; Biesenthel, 1991). Farmers have been involved in on-farm research programs starting in the early 1900s, and knowledge gained from the on-farm research process has been promoted systematically through agricultural extension and technical transfer programs to encourage its uptake by the farm community (Reaman, 1970; Biesenthal, 1991; Milburn *et al.*, 2010). To ensure that the research undertaken is relevant and useful for farmers in Ontario, the province has ensured that farmers have served in key roles where they can influence agricultural research undertaken in Ontario. For instance, the Agricultural Research Institute of Ontario, which provides strategic advice directly to the Minister of Agriculture and Food concerning research on agricultural and other areas of interest, is currently chaired by a farmer (OMAFRA, 2012b). Consequently, the ability of the agricultural network to participate in the creation and sharing of vernacular knowledge, and the identification of new research themes necessary to improve agricultural science and practice in Ontario, has evolved over time. As a result, an agricultural network in which representatives from farm organization, provincial government, and university researchers have identified and negotiated mutually-beneficial approaches to issues related to agriculture, such as complex agri-environmental problems such as water management.

Chapter Four

The Agricultural Community as a Social Network in a Collaborative Multi-Stakeholder Problem-Solving Process

4.1 Introduction

Collaborative approaches to environmental problem-solving are built around deliberate forums that ensure that the concerns of the broader community are considered. These approaches are important because no single actor has all the knowledge required for resolving complex problems, such as those that involve the environment and risk (Stoker, 1998; Lach *et al.*, 2005; Blackstock and Richards, 2007; Paavola, 2007; Holley *et al.*, 2012). Collaboration is a highly relational process. As a result, concerns such as the co-production of knowledge and building of trust (Carr, 2004; Turner, 2004; Cash *et al.*, 2006; van Wyk *et al.*, 2007), and the negotiation of vernacular knowledge (Orr, 1991; Lach *et al.*, 2005; Bartel, 2013), are prominent in collaboration scholarship. Social networks support all of these aims (van Wyk *et al.*, 2007; Reed *et al.*, 2010), and are thus highly complementary to collaborative processes.

The ability of non-state actors to participate effectively in the creation and sharing of knowledge is a particularly important concern in collaborative processes (Yaffee and Wondolleck, 2000; Innes and Booher, 2010). Benefits of collaborative processes include providing a forum that leads to more inclusive and robust problem-solving (Carr, 2004; Cash *et al.*, 2006; van Wyk *et al.*, 2007). Such an inclusive approach supports the participation of non-state actors with scientists and state actors to co-produce knowledge that integrates scientific and local knowledge with community beliefs and values (Carr, 2004; Turner, 2004; Lach *et al.*, 2005; Cash *et al.*, 2006; van Wyk *et al.*, 2007.

Diverse stakeholders increasingly are being asked to participate in collaborative processes formed to address environmental concerns because their involvement is critical for problem-

solving processes, and to establish legitimacy (Yaffee and Wondolleck, 2000; Innes and Booher, 2010). Examples include the negotiation and implementation of solutions for managing natural resources through the collaborative efforts of watershed partnerships in Australia, Europe and North America at different scales (Leach, 2006; Blackstock and Richards, 2007; Taylor *et al.*, 2012). In some of these processes, participants are embedded in larger social networks (Innes, 2005). While empirical evidence exists supporting the claim that social networks assist with the creation and sharing of knowledge, less well understood is the extent to which collaboration can be strengthened through the direct contribution of knowledge by network members embedded in problem-solving processes.

The social ties between network members can be mapped, as can the knowledge that is embedded in, and flows through, the social ties that connect them, using methods that are known collectively as social network analysis (Wasserman and Faust, 1994; Scott, 2000; Prell *et al.*, 2009; Brummel, *et al.*, 2012). Social network analysis is being used increasingly to help understand the structure and function of these networks, and to measure how they influence the creation and sharing of knowledge (Prell *et al.*, 2009). Additionally, they are being used to better understand how knowledge sharing within a network can help build shared values, promote social learning, build social capital, and lead to innovation (Wenger, 2000: Liebowitz, 2007). Traditional quantitative approaches to social network analysis are currently being augmented with the use of qualitative data in a complementary fashion (Edwards and Crossley, 2009; Crossley, 2010).

In this paper, multi-stakeholder collaborative processes formed to develop drinking water source protection plans in the Province of Ontario, Canada, provide an empirical setting for evaluating the structure and function of a critical social network. Farmers are important participants in these processes. In Ontario, the farm community functions as a provincial-scale network (Skogstad, 1990; Montpetit and Coleman, 1999; Montpetit, 2003). Using a mixed

methods approach involving social network analysis and participant observation, the ability of a provincial farm organization to organize a group of locally elected farmer representatives into a cohesive network, and the success of that group in co-producing vernacular knowledge, are evaluated. The chapter begins with an overview of the literature related to the role of stakeholder networks in collaborative problem-solving. The case study background and methods are then presented. Study results are then presented, along with the discussion of the research findings in the context of the literature. Finally, conclusions for research and practice are presented.

4.1.1 Collaborative Approaches to Environmental Problem-solving

Collaborative approaches to environmental problem-solving are built around formal and informal forums that typically are designed to ensure that the concerns of the broader community are considered. Such collaborative approaches are important because the knowledge possessed by different interests is required for developing solutions to complex problems (Stoker, 1998; Lach *et al.*, 2005; Blackstock and Richards, 2007; Paavola, 2007; Holley *et al.*, 2012). The literature indicates that these forums have several benefits. First, collaboration encourages the co-production of knowledge involving scientists, along with state and non-state actors, through the sharing and integration of scientific and local knowledge, and the discussion of beliefs and value-based issues (Carr, 2004; Turner, 2004; Cash *et al.*, 2006; van Wyk *et al.*, 2007). Second, collaboration helps nurture the development of relationships, trust, accountability, legitimacy, reciprocity, common rules, shared values, and a sense of inclusion and empowerment (Carr, 2004; Turner, 2004; Cash *et al.*, 2006; van Wyk *et al.*, 2007). These forums, according to proponents, also improve problem-solving by incorporating local perspectives that will promote robust outcomes through the co-production of knowledge (Carr, 2004; Cash *et al.*, 2006; van Wyk *et al.*, 2007). Finally, the integration of expert science, local knowledge, and beliefs and values within such a forum can produce vernacular knowledge. Vernacular knowledge is the outcome of a process where environmental problems are deliberated and solutions are negotiated

by stakeholders (Orr, 1991; Lach *et al.*, 2005; Bartel, 2013). Vernacular knowledge incorporates expert science and local knowledge with community beliefs and values, and provides a mutually acceptable foundation for the problem-solving process. The co-production of vernacular knowledge encourages greater participation by engaging the community in the discourse and development of a relevant knowledge that will help in the development and implementation of solutions to complex problems (Lach *et al.*, 2005; Wagner, 2007).

Collaborative approaches benefit from the broad participation of state and non-state actors in the problem-solving process (WRI, 2004; Lemos and Agrawal, 2006: Ansell and Gash, 2007). This level of participation is well beyond traditional consultation where stakeholders are provided with information via a one-way flow from the technical expert. In collaborative processes, there is a movement towards an organizational culture where state and non-state actors can share and develop an understanding of each other's interests and positions (Yaffee and Wondolleck, 2000). This provides an opportunity for stakeholders to participate throughout the problem-solving process (Newig and Kvarda, 2012) by sharing and incorporating their beliefs, knowledge, and values, and by helping to achieve shared outcomes. Land owners who have participated in local watershed planning processes have also become involved in implementing measures to protect water quality and quantity (NRC, 2000). Such substantial involvement of the community helps promote problem-solving that is broadly accepted and "harness[es] the energy and creativity of those with the greatest stake in successful environmental management: the people who live in or depend on the affected ecosystems" (WRI, 2004, 2).

There is a growing recognition that networks can support collaborative approaches to problem-solving (Yaffee and Wondolleck, 2000; Innes, 2005). This support can help network members to overcome challenges and innovate more quickly – within and between networks – than those who are not connected to a network (Wenger, 2000: Liebowitz, 2007). This support typically takes three forms. First, networks can encourage the development of relatively close

relationships, and shared beliefs and values by helping network members bond to form well integrated and cohesive networks, and encouraging bridging between members of diverse groups (Yaffee and Wondolleck, 2000; Blanco *et al.*, 2011). Second, this knowledge sharing within and between networks can help to challenge or reinforce existing positions (Prell *et al.*, 2008), and to facilitate the sharing of expert science, local knowledge, and community values and beliefs (Yaffee and Wondolleck, 2000). Finally, networks can encourage the creation of vernacular knowledge by providing a setting for the deliberation of problems, and the negotiation of solutions, during the problem-solving process (Orr, 1991; Lach *et al.*, 2005; Bartel, 2013).

4.2 Case Study

Source water protection (SWP) became part of the water governance landscape in Ontario following the Walkerton Tragedy in May, 2000. Seven people died and several thousand became ill when an extreme storm event flushed farm runoff into an improperly maintained and operated municipal water supply (O'Connor, 2002a). In response, Justice Dennis O'Connor investigated the causes of the tragedy, and made recommendations to ensure the safety of water supply systems in Ontario. These were structured around a five-part multi-barrier approach (O'Connor, 2002b). The first barrier addresses concerns with the quality of source waters for municipal drinking water systems, and includes the development of source protection plans (SPPs) at a watershed scale. The Province of Ontario responded in 2006 by implementing the *Clean Water Act*, 2006, which created a system of nineteen watershed-based Source Protection Committees (SPCs) that were charged with preparing local SPPs (Fitzgibbon and Plummer, 2004, OMOE, 2008). Each SPC has a mandated structure and timeline, overseen by a local Source Protection Authority (SPA), with one-third of the members representing, respectively, municipal, business, and public interests within the watershed (OMOE, 2007). First Nation communities are also represented where the watershed contains reserve lands. These committees function in a manner consistent with the attributes of collaboration outlined above.

Farmers were identified as a key stakeholder group, who, although comprising only approximately two percent of the overall population, own or rent approximately 33 percent of the land in southern Ontario (OMAFRA, 2012a). Agriculture in southern Ontario occurs alongside urban areas, and exists in the watersheds that serve the urban populations that will be protected by source protection planning. As a result, between one and three member(s) of the SPC were mandated to be representatives of agriculture in each catchment where agriculture was deemed to be a significant local land use activity. Farm organizations expressed support for the concept of source water protection from the outset; they initiated a process to participate in the SPP process, and to promote consistency among forthcoming SPPs and existing programs that promote farming that is economically and environmentally sustainable (Legislative Assembly of Ontario, 2006). To coordinate farm sector efforts, the Ontario Farm Environmental Coalition (OFEC), which represents 37 farm and commodity organizations concerned with agri-environmental matters, established a SWP working group. The working group includes staff from four major farm organizations, and two program staff from the Ontario Ministry of Agriculture and Food (OMAF) with technical expertise involving extension education and source water protection. OMAF staff members participate in the working group at the invitation of OFEC and with the support of their Deputy Minister. The author of this chapter is one of the OMAF program staff members, and has participated in the working group since its inception.

The OFEC SWP working group recognized the importance of having agricultural representatives on SPCs who have both the capacity to participate effectively in a multi-stakeholder problem-solving setting, and the legitimacy that comes from having been elected by their local farm communities. The OFEC SWP working group prepared a list of qualifications, which was published in provincial and local farm publications in Ontario; a series of meetings and elections was then organized by OFEC and the County Federations of Agriculture throughout Ontario to elect agricultural representatives to participate on SPCs. Although each SPA had been

given authority under the Clean Water Act to select agricultural members for its SPC, 34 of the 37 agricultural representatives elected by the local farm community were appointed to the 15 of the 16 SPCs with agricultural members.

The OFEC SWP working group also recognized the importance of preparing the agricultural representatives to take an active role during the creation and sharing of vernacular knowledge as participants in the SPP multi-stakeholder problem-solving process. There was a shared belief on the working group that an important role of agricultural representatives was to educate the largely urban membership of SPCs by sharing agricultural science and local farmer knowledge during the SPP problem-solving processes. This would help SPC members to recognize that protecting municipal drinking water sources and promoting economically and environmentally sustainable agriculture can be complementary objectives (Simpson, 2012).

It was concluded that a three-part approach would be the most expedient way to prepare the agricultural representatives to take part in a collaborative problem-solving process. The first part involved bringing the agricultural representatives together at a series of workshops where they would engage in social learning, integrating agricultural and environmental science, their local knowledge, beliefs and values to develop a vernacular knowledge that they could share with their SPC colleagues. The second part involved encouraging the agricultural representatives to develop a network within which they could share ideas and provide emotional and technical support to each other outside of the formal workshop setting through discussions in person, over the telephone, and using the internet. The third part involved the OFEC SWP supporting committee members by participating in ongoing technical aide to the agricultural representatives during telephone and email discussions, and providing presentations at individual SPC meetings where requested.

OFEC secured funding from a combination of farm organizations and federal and provincial government agencies to support delivery of six agricultural representative workshops. These workshops involved a combination of formal and informal learning opportunities, and included presentations by farm organization and OMAF staff and external academic, consultant, municipal and provincial government technical experts. Each meeting also included a facilitated discussion involving the agricultural representatives and Ontario Ministry of the Environment (OMOE) senior management representatives (OFEC, 2007; OFEC, 2008b; OFEC, 2008d; OFEC, 2010; OFEC, 2011; OFEC, 2012). The workshops were supplemented with frequent teleconferences and online discussion sessions concerning SPP-related topics. Collectively, these activities strengthened the existing agricultural network that existed in Ontario.

4.3 Methods

A mixed methods research (MMR) approach was used to combine data collected using different research methods within a single case study. MMR is an inclusive and pragmatic approach that encourages a systematic use of different research methods that share the same research question, collecting data that are complementary, and conducting data analysis in a coordinated manner (Johnson and Onwuegbuzie, 2004; Yin, 2009). This allowed the data collected using different research methods to be used in an integrated fashion, which is difficult to do with studies that are strictly qualitative or quantitative in nature. Although the different types of data were collected at different times, all types of data were given equal priority and were evaluated and analyzed concurrently. This concurrent triangulation approach to MMR emphasizes confirming, cross-validating and corroborating findings collected using the different methods as part of a single study (Cresswell, 2003).

4.3.1 Social Network Analysis

Human communities comprise a series of overlapping social networks, within which members are connected by relational ties. Knowledge flows, and is shared, through these ties (Wellman, 1979; Gladwell, 2000; Crossley, 2010; Brummel, *et al.*, 2012). The movement of knowledge within and between networks is related to the "strength of ties" between different actors in a network (Granovetter, 1973; Prell *et al.*, 2009; Crossley, 2010). Strong ties indicate bonds between network members that support the sharing of information and advice, help build and maintain trust between network members, allow members to influence other members' beliefs and values, and encourage two-way communication between network members (Crona and Bodin, 2006; Newman and Dale, 2007; Prell *et al.*, 2009). Weak ties are formed by network members who bridge with disconnected or dissimilar groups either within or outside their network. These members act as brokers by helping to build trust and mutual understanding by sharing knowledge (Burt, 2005; Currie and White, 2012).

Strong and weak ties form a structure that can be mapped and analyzed to determine patterns, both of the relationships between the actors and the resources they share, using methods that are collectively known as social network analysis (SNA) (Wasserman and Faust, 1994; Scott, 2000). Social network analysis can be used to analyze the number of strong and weak ties between one member and others in a network in order to better understand how knowledge is created and shared within and between network members. These concepts are useful for explaining what is actually transpiring within a social network structure (Crossley, 2010; Hollstein, 2011). This kind of analysis can identify network members who are influential in creating and sharing knowledge. Specific SNA measures presented in Table 4.1 were used to evaluate the structure of a network in order to identify influential network members and to better understand the potential for the creation and sharing of knowledge (Scott, 2000; Hanneman and

Riddle, 2011; Currie and White, 2012). These measures are discussed in the remainder of this section.

Table 4.1: Selected Social Network Concepts and their Importance for Understanding Knowledge Creation and Sharing

Network Concept	Importance for Understanding Knowledge Creation and Sharing
Density	Members of highly dense networks are well connected through ties to other members. A high density network provides a structure that may form a cohesive network within which knowledge is shared, trust is built, and common norms, expectations and behavior are promoted.
Out-Degree Centrality	Members with high out-degree centrality are highly influential because they connect with many other actors, and affect problem-solving by sharing their knowledge and views throughout the network. Where ties are strong, these actors can help share knowledge quickly. These members tend to make contact and make connections with other network members.
In-Degree Centrality	Members with high in-degree centrality are perceived as highly prestigious or prominent, and are important for brokering knowledge to actors, and can connect diverse segments of a network. Knowledge will be trusted where ties are strong. These members tend to attract and make connections with other network members.
Betweenness Centrality	Members with high betweenness centrality can act as intermediaries and help link the network. These actors can help share knowledge quickly and build redundancy.

(Sources: Scott, 2000; Hanneman and Riddle, 2011; Prell, 2012)

Data concerning the strength of ties were collected using a standardized survey questionnaire, consisting of a single closed-ended question for determining the presence and strength of relationships. The survey was completed by agricultural representatives on the SPCs. Each Agricultural Representative was asked to indicate how often he or she shared information with each of the other agricultural representatives. The question was constructed using a five-point Likert-type scale format (*i.e.*, Very Often or Always, Often, Neither Often nor Seldom, Seldom, Very Seldom). The questionnaire was distributed by email, and was followed up with email and telephone reminders. All 37 agricultural representatives on the 16 SPCs that had agricultural members responded to the questionnaire. The questionnaire results were coded accordingly: Very Often or Always =5, Often =4, Neither Often or Seldom = 3, Seldom = 2, and

Very Seldom =1. Agricultural representatives who were not identified in the questionnaire were coded as Never = 0. The coded data were then analyzed using UCINET Version 6, a software tool used to conduct social network analyses (Borgatti *et al.*, 2002).

One aspect of network structure is density. Density represents the number of ties in a network divided by the maximum possible number of ties within that network. In other words, density indicates how well members are connected to one another within a network (Scott, 2000; Hanneman and Riddle, 2011, Currie and White, 2012). A high density network can also indicate the presence of a highly cohesive network, one which enhances opportunities and the likelihood for sharing information and knowledge, strengthening the formation of trust among members, and promoting the formation of norms, shared expectations and behaviours (Scott, 2000; Prell, 2012). A high density network can also enhance the likelihood that knowledge brokering will occur between members because a high number of members are connected and have the opportunity to coordinate their actions, promoting the development and circulation of mutually agreed upon knowledge (Burt, 2005; Crossley, 2010; Currie and White, 2012). These conditions are generally associated with an environment that is supportive of collaborative approaches to problem-solving (Carr, 2004; Turner, 2004; Cash *et al.*, 2006; van Wyk *et al.*, 2007).

Degree or local centrality considers the immediate ties that a member has within a network, and identifies central members who act as brokers because other members seek their knowledge (Scott, 2000; Hanneman and Riddle, 2011; Currie and White, 2012). In directed networks, where the direction of ties has been observed, degree centrality indicates a member's role in knowledge-sharing. Members with many in-degree ties (high in-degree centrality) can be prestigious, or have high prominence, because many other members seek and trust their knowledge (Crossley, 2010). A member with many out-degree ties (high out-degree centrality) can be influential because he or she shares knowledge with many other network members, along with perspective on different issues (Hanneman and Riddle, 2011; Currie and White, 2012). As a consequence, members with

high in and out- degree centrality have important roles in the network: they facilitate and influence problem-solving, help to connect diverse members, and promote new ideas by channeling and mediating knowledge flow (Scott, 2000; Prell, 2012).

Betweenness centrality reflects the number of times a member falls on the geodesic, or shortest path, between two other members within a network (Hanneman and Riddle, 2011; Currie and White, 2012; Prell, 2012). A member with high betweenness centrality can act independently across the network, and has an ability to act as an intermediary and help share knowledge efficiently to different parts of the network (Scott, 2000; Hanneman and Riddle, 2011; Prell, 2012). Members with high betweenness centrality also have a high capacity to broker relationships, serving as the "movers-and shakers" in the network (Currie and White, 2012, 1341). Members with high betweenness centrality can also create bridges between disconnected members or parts of the network, resulting in much of the knowledge in the network to pass through them.

It is important to acknowledge that a measure of network structure does not necessarily infer the presence of non-structural aspects of relationships, such as cohesiveness within a network or trust among its members. For instance, a network with a low density score can be highly cohesive when it is composed of tightly knit sub-groups. Equally, a high density network may not be cohesive (Liebowitz, 2007; Prell, 2012). As a consequence, the presence of a high density network indicates that the structure of the network may facilitate the interaction between members that has been linked with collaborative behaviour, and associated processes and outcomes such as the creation and sharing of knowledge, but further analysis is needed to confirm this pattern.

4.3.2 Participant Observation

Participant observations were conducted during OFEC meetings, workshops, and during telephone and email discussions involving agricultural representatives, OFEC SWP working group members, and representatives of county and provincial-scale farm organizations. Participant observation provided useful anecdotes, and allowed for collection of complementary evidence to corroborate data collected through the survey questionnaire (Kearns, 2000). Participant observation enabled the author to listen actively to interchanges between members, and allowed for collecting information that helped to explain or illustrate concepts that were identified elsewhere in the data collection process. General concerns that had been raised by the agricultural representatives were identified, and then classified according to different themes that were presented and discussed concerning the creation and sharing of knowledge. Crossley (2010) observes that participant observation has several advantages: (1) the observer is able to identify changes in the attitude of participants as discussion on different topics progresses, and how the group did or did not manage to collaborate to find a mutually acceptable solution to any disagreements that arose, something that could not be known by researchers who were not present; and (2) the observer is able to identify and assess the importance of what Crossley (2010, 20) describes as the "mechanisms of relationship formation", such as the "identities, expectations, rituals, shared feelings and meanings" that create a collective identity.

Supplementary data were also collected from summaries of standardized exit questionnaires that had been completed by agricultural representatives at the end of each of the six workshops (OFEC, 2008; OFEC, 2008c; OFEC, 2009; OFEC, 2010b: OFEC, 2011, b; OFEC, 2012b). The standardized questionnaire had been prepared, distributed, collected and analyzed by OFEC SWP working group members. The questionnaire summaries provided descriptive statistics of closed-ended questions and verbatim responses to open-ended questions concerning how useful the agricultural representatives found each of the specific agenda items during each workshop, and

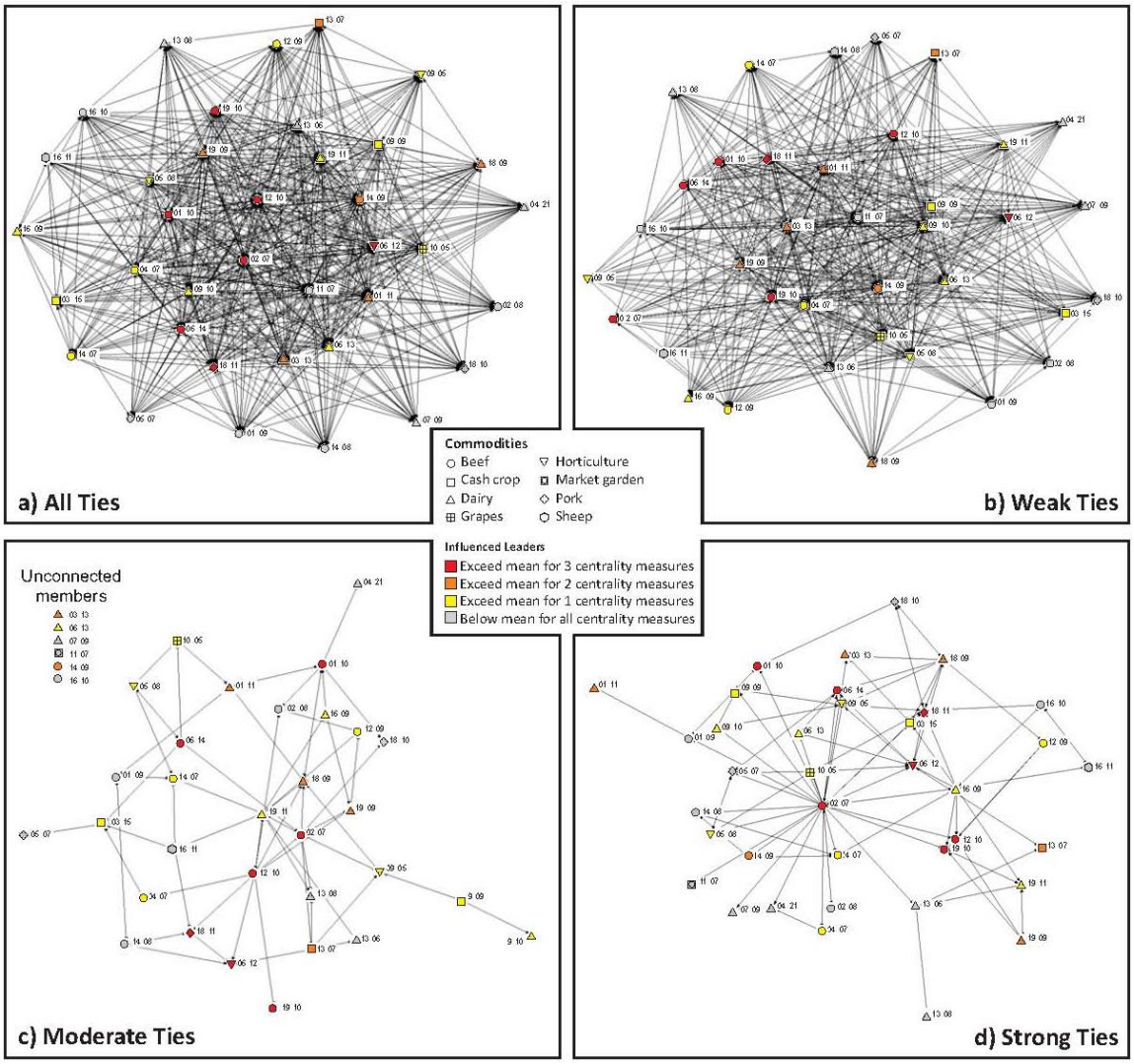
open-ended responses concerning how useful each workshop was in general and what topics the agricultural representatives would like to have included on the agenda for the next workshop (OFEC, 2008a; OFEC, 2008c; OFEC, 2009; OFEC, 2010b: OFEC, 2011, b; OFEC, 2012b). Although the first author participated in the development of the OFEC questionnaires, the data from each of the summaries were treated as secondary because OFEC administered the survey and analyzed the results.

4.4 Results and Discussion

The results in this section are used to evaluate the efforts of a provincial farm organization to organize locally-selected members into a cohesive network, and to determine if the structure of the resulting network was successful in promoting the co-production of vernacular knowledge. It is important to remember that the structure and function of networks evolve over time (Hay, 1998; Crossley, 2010), and thus the results presented here represent the structure of the network at the time when the data were collected.

Figure 4.1a summarizes the pattern of all ties of different strengths between members of the network. A visual inspection of the graph suggests that there are many ties among network members. The network was analyzed using the SNA measure of density (Table 4.1), which provided a measure of how well-connected the members were, and an indication of how cohesive the network was during data collection (Scott, 2000; Hanneman and Riddle, 2011; Currie and White, 2012). A density score of 0.60 was calculated for valued and directional data, indicating that 60 % of the possible ties in the network were present. This score suggests that overall the network was moderately cohesive, which allowed for the sharing of beliefs and values (Burt, 2005), but was not so closed that new ideas could not be introduced and discussed within the network.

Figure 4.1 Strength of Connections in Agricultural Representative Network



Participant observation during workshops suggested that the network was more cohesive than was indicated by the moderate density score; a high level of engagement and agreement among the agricultural representatives was observed at the six workshops. Network members appeared to hold similar views and beliefs on many key issues, suggesting that the network was better connected and more cohesive than the density measure indicated. For instance, when new issues were raised at the workshops, the agricultural representatives often reached consensus quite quickly. Several contentious issues arose that required several meetings for the different

perspectives to be deliberated and for consensus to be negotiated. Discussions were sometimes vigourous in nature, with intense questioning and debate of positions put forth by different agricultural representatives and OFEC SWP working group members. However the process took place in a manner that was respectful, and often with a sense of humour. Participant observation and exit questionnaire results suggested little evidence of frustration with the process and outcomes of the OFEC. In contrast, a common concern identified by the agricultural representatives was that the workshops were not long enough to discuss all their concerns (OFEC, 2008a; OFEC, 2008c; OFEC, 2009; OFEC, 2010b: OFEC, 2011, b; OFEC, 2012b).

The contradiction between the calculated density measure and the highly cohesive behaviour that was observed suggested that the structure and function of the network was more complex than initially thought. In order to better understand how the pattern of ties was affecting the structure and function of the network, the ties were differentiated by strength and were graphed separately as follows: weak (tie strength = 1 or 2 out of 5) in Figure 4.1b; moderate (tie strength = 3 out of 5) in Figure 4.1c; and, strong (tie strength = 4 or 5 out of 5) in Figure 4.1d. This approach has been documented in the literature as a useful approach for finding cohesive sub-groups within a network (Prell, 2012).

Participant observation indicated that many agricultural representatives tended to congregate with their SPC colleagues – travelled together, and then sat with them during formal and informal parts of the workshops. An inspection of Figure 4.1d supported the results of participant observation. The analysis of open-ended responses for the presence of strong ties between the members the same SPC provided striking results: four of the five (80%) of the SPCs with two members reported strong ties for all relationships (strong = 4 or 5 out of 5), and for the eight SPCs with three members, five (63%) had reported strong ties and three (37%) reported moderately-strong (moderately strong = 3 out of 5) ties. The single two-member SPC that reported a weak tie had also experienced the recent replacement of an agricultural member. This

suggested that the majority of network members had bonded tightly and formed cohesive sub-groups (Blanco *et al.*, 2011; Prell, 2012). This also suggested that collaborative processes may be facilitated where conditions that support the formation of strong ties are present, promoting conditions that would support processes and outcomes such as the sharing of knowledge and building trust between network members. This is consistent with the literature that states that individual actors develop relationships and form sub-groups through close and frequent interaction over time as part of their participation in the same event or organization (Faust, 2005; Prell, 2012), which in this case involves being members of the same SPC. This bonding would be important for agricultural representatives to work in concert at frequent SPC meetings, and contribute to the creation and sharing of knowledge during collaborative problem-solving efforts within their SPCs.

The analysis for the presence of strong ties helped explain the level of cohesion within sub-groups formed by network members who belonged to the same SPC, but it did not explain the level of cohesion that was observed within the broader network that showed weak ties (Figure 4.1b) and moderate ties (Figure 4.1c).To better understand the underlying pattern of ties within the broader network, the three centrality measures presented in Table 1 were evaluated. Centrality is an indicator of the relative importance of a network member for influencing the function of the network, and is related to the number and direction of ties that they have with other members of the network (Scott, 2000; Hanneman and Riddle, 2011; Currie and White, 2012). Table 4.2 indicates that 7 (19%) of the members exceeded the mean for all three of the centrality measure scores, 4 (11%) exceeded the mean for two of the centrality measure scores, and 13 (35%) exceeded the mean for one of the centrality measure scores. Overall, this indicates that 24 (65%) of the agricultural representatives had the potential to act as “opinion leaders” (Burt 2005, 37); members who had the potential to influence the function of the network. The out-degree centrality scores are consistent with participant observation during the workshops, teleconference

and online sessions. Specifically, actors with a high out-degree centrality scores often initiated or participated actively and consistently in discussions. The in-degree and betweenness centrality scores also reflect their propensity to be involved in discussions, being asked for their insight, or having opinions referenced implicitly and explicitly by other agricultural representatives, during discussions.

The influence of the opinion leaders is evident by examining and comparing Figures 4.1b, 4.1c and 4.1d. As would be expected, the majority of influence leaders were well-connected within the network, having weak, moderate and strong ties with many other network members. However, the comparison also revealed that the opinion leaders were part of several different sub-groups within the network, with which they were connected through weak, moderate and strong ties. The first sub-group, formed 742 weak ties, and included all network members. Figure 4.1b indicated that the opinion leaders occupy a central position in this sub-group, with many in-degree and out-degree ties. Further, the members who are not influence leaders also have many in-degree and out-degree ties, indicating that they are well integrated into this sub-group of weak ties. The second group, connected by 80 moderate ties, again indicates that the majority of opinion leaders occupy a central role within this sub-group. Figure 4.1c indicates that five members, including three opinion leaders, were not connected to the sub-group through moderate ties. Also, although the number of ties between members is much less than with weak ties,

Table 4.2: Agricultural Representative Centrality Measures and Organizational Involvement

Actor Code	Centrality Measure[1]			Primary Commodity	Involvement in Organizations						
	Out -Degree (mean = 38.4)	In -Degree (mean = 38,4)	Betweennes (mean 12.3)		Local Farm	Provincial Farm	National Farm	Municipal Office	Local ENGO	Provincial ENGO	Community
01_09	24	35	2.52	Beef	X	X					

01_10	79	43	19.8	Beef	X			X			
01_11	40	33	16.4	Dairy				X	X		X
02_07	131	43	30.0	Beef	X		X	X			
02_08	10	32	0.74	Beef	X	X	X	X		X	
03_13	40	41	43.6	Dairy	X						X
03_15	12	52	4.60	Cash Crop	X						X
04_07	44	29	8.46	Beef	X	X			X		X
04_21	0	31	0	Dairy	X	X					
05_07	11	39	0.67	Pork	X	X					
05_08	48	35	7.84	Horticulture	X	X					
06_12	63	61	52.1	Horticulture	X	X	X		X	X	
06_13	42	27	0.09	Dairy	X				X		X
06_14	49	44	25.7	Beef	X	X					X
07_09	0	27	0	Dairy	X	X					X
09_05	27	43	2.12	Horticulture	X						X
09_09	40	34	6.96	Cash Crop	X	X		X	X		X
09_10	43	28	0.21	Dairy	X		X	X	X		X
10_05	81	29	0.21	Grapes	X	X					X
11_07	36	26	0.21	Market Garden	X			X			X
12_09	11	47	3.25	Beef	X						X
12_10	82	47	36.5	Beef	X	X			X	X	
13_07	53	32	15.4	Cash Crop	X	X					
13_08	12	35	0.4	Dairy	X		X		X		X
13-06	0	35	0	Dairy	X				X		
14_07	6	49	2.67	Beef		X			X		
14_08	13	34	1.37	Beef	X	X			X		
14-09	42	26	26.2	Beef					X		
16_09	46	39	2.17	Dairy	X	X					X
16_10	26	37	3.83	Beef	X	X					
16_11	25	37	0.42	Sheep	X	X	X				
18_09	41	50	5.56	Dairy	X	X	X				
18_10	19	37	1.33	Pork	X						
18_11	46	63	57.3	Pork	X		X				X
19_09	49	35	16.1	Dairy		X					
19_10	65	43	16.1	Beef	X						
19_11	63	41	8.03	Dairy	X						X

[1]Highlighted centrality measure values exceed the mean value

moderate ties create a structure for multiple paths for the movement of knowledge within the sub-group. The third sub-group, formed by 119 strong ties, included all network members, and demonstrated the opinion leaders occupy a central position within the sub-group. Figure 4.1d indicates that the paths for the movement of knowledge was much more limited, and radiated out from several centrally located members (*e.g.*, 02-07, 18-11), who were also connected through numerous weak and moderate ties.

Participant observation and SNA results indicated that the cohesive sub-groups were connected in two ways within the network. First, weak ties formed bridges for connecting members, and for sharing knowledge within the network. This is consistent with current theory and practice which holds that weak ties can bridge and provide a means for accessing and sharing resources between disconnected or diverse parts of the community (Granovetter, 1973; Borgatti and Lopez-Kidwell, 2011). The moderate and strong ties between opinion leaders connected the cohesive sub-groups, albeit through a small number of members (Figure 4.1d), forming an overarching structure that was connected to at least one member of all the sub-groups within the network. This is consistent with the theoretical literature that indicates that networks promote bonding between members who have close relationships, and where there are shared values, within smaller well-integrated and cohesive groups (Blanco *et al.*, 2011), and bridging between diverse groups (Burt, 2005; Blanco *et al.*,, 2011).

Figures 4.1c and 4.1d, and Table 4.2, indicated that the majority (71%) of the opinion leaders were associated with the animal agriculture commodities (beef, dairy or pork production). However, participant observation and the results of the exit surveys indicated that no single sub-group or commodity group dominated discussions within the workshops. This suggested that different perspectives within the network were relatively well represented and balanced during problem-solving discussions. Table 4.2 indicates that all of the agricultural representatives had participated previously in some form of multi-stakeholder problem-solving process, and had had

experience with negotiation and consensus-building activities. The centrality measures results summarized in Table 4.2 supported these qualitative results: 15 of the 16 SPCs (81%) had at least one influential Agricultural Representative; the SPC that did not have an influence leader (07) had only one Agricultural Representative and was geographically isolated from the other subgroups.

Participant observation indicated that the agricultural representatives were highly cohesive concerning some issues, but less cohesive on others. For instance, the agricultural representatives were able to reach consensus on a set of guiding SWP principles within a single afternoon of a workshop. Draft SWP principles were presented by members of the OFEC SWP working group, were discussed in detail, and then modified and accepted with minimal negotiation (OFEC, 2007). In contrast, extended discussion was required to resolve more contentious issues.

One example of extended discussion concerned the relative advantages and disadvantages of using a regulatory versus a voluntary approach for mitigating risks associated with the handling and storage of animal manure. This discussion was contentious because it concerned the development of a position on the management of manures generated by animal agriculture operations – an issue that affected the majority of the opinion leaders who were associated with the animal agriculture commodity sectors. The development of the position played out over several workshops, and involved two groups of agricultural representatives, each group supporting one of two different approaches. One group advocated for the use of a regulatory approach involving the Ontario *Nutrient Management Act, 2002* (Province of Ontario, 2002b), and the mandatory phase-in of affected farms that were not currently subject to the legislation. This group included a prominent Agricultural Representative (14-07) who was highly respected within the broader agricultural community. A second group promoted a voluntary approach, which they described as more flexible and site-specific compared to the regulatory approach, and which would avoid the disadvantages associated with the uniform approach prescribed through

the requirements of the *Nutrient Management Act, 2002*. In the end, the two groups worked to develop a hybrid approach that combined aspects of both the regulatory and voluntary approaches, and which served as a foundation for a farmer-led approach for managing on-farm threats identified by the SPP process (OFEC, 2013).

The centrality measures summarized in Table 4.2, and the patterns formed by the different strength ties shown in Figures 4.1b, 4.1d, and 4.1d, provide insight into the problem-solving process within the network. Despite the high level of prominence indicated by his high in-degree centrality score (49), Agricultural Representative 14-07 had limited influence on the sharing of knowledge and views within the network as reflected in a low out-degree (6) and betweenness (2.67) centrality scores. In contrast, Agricultural Representative 02-07, a proponent of the voluntary approach, had high out-degree (131), high in-degree (43), and high betweenness (30) scores. As a consequence, this person was well connected and better positioned to share knowledge and views within the network. Further, Agricultural Representative 14-07 was positioned on the margin of the sub-groups in Figures 4.1b, 4.1c, 4.1d, and was the recipient of many in-degree ties, but did not have the out-degree ties needed for passing on information or acting as the intermediary for knowledge sharing. In contrast, Agricultural Representative 04-07 occupied a strategic position within all three sub-groups, benefiting from many in-degree and out-degree ties, and by acting as an intermediary for the sharing of knowledge.

The outcome of the discussion was a negotiated compromise. Neither group was successful in getting their position fully adopted and endorsed by the network, reflecting the balanced approach to problem-solving. Deliberation of the two opposing approaches appeared to help both groups to better understand each other's concerns, which provided an opportunity for negotiating and accepting concessions, and enabled the development of a mutually acceptable outcome. These circumstances suggest that the ability of influential members to link sub-groups and promote the sharing of knowledge that helped support a collaborative problem-solving approach.

This was demonstrated by the ability of members to negotiate mutually acceptable outcomes through the problem-solving process. The outcome was the integration of each group's values and beliefs, which were both grounded in a mutual acceptance of agricultural science, to create a vernacular knowledge.

4.5 Conclusions

Stakeholder participation in the creation and sharing of knowledge is necessary for collaborative forms of problem-solving (Yaffee and Wondolleck, 2000; Innes and Booher, 2010). Social networks have been recognized as important ways to involve stakeholders in these processes (Innes, 2005). In this chapter, data collected using different methods were analyzed using a MMR approach to evaluate how effective a provincial farm organization had been in organizing locally-elected farm community representatives to form a cohesive social network, and how the resulting network structure enabled members to participate in the creation and sharing of knowledge in support of a collaborative process.

The results of social network analysis indicated that the efforts of OFEC to organize locally elected agricultural representatives to form a cohesive network were successful. Participant observation indicated that the members were able to negotiate and reach consensus on contentious issues, although the density measure calculated for ties between members suggested that the network was moderately connected. Further, although the calculation of centrality measures indicated the presence of opinion leaders who had the potential to influence the problem-solving process, evaluation of secondary data suggested that no individual or group of members dominated discussions. This balanced approach was attributed to the connection between cohesive sub-groups that were formed through weak, moderate and strong ties, combined with the previous experience of the agricultural representatives with multi-stakeholder problem-solving processes.

The research also demonstrated two benefits of using a MMR approach for evaluating the structure and function of a social network. First, the use of data collected using different methods confirmed that the SNA measures alone can lead to simplistic and inaccurate characterizations of social networks (Prell *et al.*, 2009). In this instance, participant observation determined that the density measure calculated using SNA software underestimated the level of cohesion within the network; this was demonstrated by the ability of the network members to negotiate and reach consensus on contentious issues. This finding prompted the evaluation of centrality measures, which helped to identify opinion leaders who had the potential to influence the creation and sharing of knowledge within the network. Second, the complementary use of participant observation and SNA techniques determined that the social network was much more complex than initially thought, consisting of a series of cohesive sub-groups that were linked by different strength ties. This finding is consistent with research indicating that networks can have structures composed of highly cohesive sub-groups that are connected by a combination of bridging weak and moderate ties and bonding strong ties (Blanco *et al.*, 2011).

The results of this research provide broader insight for theory and practice. First, stakeholder networks can be intentionally organized to participate in creating and sharing of vernacular knowledge. In this instance, the formation of the stakeholder network was facilitated by a working group composed of farm organization and state agricultural agency representatives. This insight is complementary to existing research that has focused on identifying stakeholder networks that can participate in environmental problem-solving (*e.g.*, Prell *et al.*, 2009; Blackstock and Richards, 2007). Given that social networks can make an important contribution to problem-solving (Yaffee and Wondolleck, 2000), it stands to reason that helping stakeholder groups to create or bolster their networks would result in more robust problem-solving processes.

Second, stakeholder networks contain opinion leaders who can quickly influence the creation and sharing of knowledge through a network is an important insight for researchers and

practitioners. This indicates that there may be preferential pathways for the transfer of information into, and within, a network from the outside by identifying and accessing opinion leaders. This may be useful for sharing knowledge concerning alternative agri-environmental management practices with members of farm networks, and may also have broader applications, such as research concerning knowledge sharing in networks in the business (Provan and Kenis, 2007) or health (Currie and White, 2012) sectors. There may also be interest among researchers to explore less resource intensive methods for identifying opinion leaders within networks. This insight is important for practitioners who are interested in sharing knowledge or influencing problem-solving within a stakeholder network, strategically identifying and forming ties with opinion leaders in order to optimize the uptake of knowledge within a stakeholder network.

Finally, this research indicates the benefit of formally recognizing and incorporating the perspectives of the researcher for research involving stakeholder networks. In this case the perspectives were drawn from the author's personal experience as a member of the stakeholder network under study, and knowledge of the factors that have affected the structure and function of a stakeholder network both before and during the period of study. The contribution of the researcher as an insider – in this instance as a member of the entity under study – has become an emerging area of discussion in the social sciences, particularly in the health sector (Lewis and Russell, 2011). Given the importance of internal and external factors that influenced the creation and function of networks (Hay, 1998; Crossley, 2010), knowledge provided by the researcher, who has also been an insider, has the potential to enrich the research process considerably.

Chapter Five

Vernacular Knowledge – Towards the Integration of Expert Science, Local Knowledge and Societal Values

5.1 Introduction

Many environmental problems involve competing financial, institutional, political, social and technical considerations (Wynne, 2002; Turner, 2004). As such, they cannot be solved using expert science alone. An alternative that has been proposed is a collaborative problem-solving approach through which diverse stakeholder interests negotiate solutions (Yaffee and Wondolleck, 2000; Innes and Booher, 2010). Collaborative approaches for managing natural resources involving watershed partnerships have been documented around the world, including in Australia, Europe, and North America (Leach, 2006; Blackstock and Richards, 2007; Taylor *et al.*, 2012). In this paper, the focus is on the involvement of stakeholder networks in multi-stakeholder problem-solving processes.

Collaborative approaches are important because they can serve as a forum in which stakeholders can share information and concerns, both of which are necessary for challenging and changing entrenched positions, and for reaching compromise in order to resolve complex problems (Falkenmark, 2007; Fish *et al.*, 2010; Lemos *et al.*, 2010). Indeed, the reaching of consensus, or at least acceptance, forms a frequently critical requirement for long-term success. An important function of collaborative forums is integrating expert science with local knowledge, and community beliefs and values (Lee, 1993; O'Riordan and Rayner, 1993; Fischer, 2000). It has been argued that deliberative processes facilitate the co-production of vernacular science or knowledge through the discussion of problems and the negotiation of solutions (Orr, 1991; Lach *et al.*, 2005; Bartel, 2013). Evidence from numerous settings suggests that the outcomes of such

collaborative forms of problem-solving are more likely to be accepted and implemented by stakeholders (NRC, 2000; Yaffee and Wondolleck, 2000).

Solutions to complex problems increasingly are being negotiated by members of overlapping stakeholder networks (Crossley, 2010; Fish *et al.*, 2010; Brummel *et al.*, 2012). These networks can be formal or informal, imposed in a top-down fashion or emergent through bottom-up efforts (Yaffee and Wondelleck, 2000; Bogason and Zølner, 2007). In many cases, they promote communication and information-sharing at different scales and across boundaries (Paquet, 2001; Peters and Pierre, 2004; Reed and Bruyneel, 2010). Networks also provide an opportunity for stakeholders to share information and to promote increased understanding about particular circumstances and concerns of their members (Chambers, 1983; Tsouvalis *et al.*, 2000).

Given the important role that stakeholder networks play in collaborative forms of problem-solving, two key questions arise concerning the creation and sharing of vernacular knowledge as part of any multi-stakeholder process. First, what factors influence stakeholder participation during the creation and sharing of vernacular knowledge within multi-stakeholder problem-solving processes? Second, what factors contribute to the success of a stakeholder network sharing its knowledge within a multi-stakeholder problem-solving process? In this paper, these questions are addressed through a case study involving a multi-stakeholder problem-solving process located in the Province of Ontario. The chapter begins with an overview of the theoretical and empirical literature concerning the role of stakeholder networks in collaborative approaches to problem-solving. The background and methods for the case study are then presented. Next, data from the case analysis are brought to bear on the two questions noted above, with findings considered within the context of the literature. The chapter concludes with several selected reflections on the relevance of the method and the findings for research and practice.

5.2 Stakeholder Networks and Collaborative Forms of Problem-solving

Problem-solving involving environmental problems has traditionally relied on a risk-analysis approach using expert (*e.g.*, objective and quantitative) science that has been generated using a process separated from the every-day concerns of the community (Functowicz and Ravetz, 1993; Wynne, 2002; Jasanoff, 2003; Dilling, 2007; Renn, 2007b). There is growing consensus that such a science-driven approach is poorly suited for dealing with complex problems involving the environment and risk, in the context of competing needs and demands. Complex problems often are described as "quasi-scientific" because expert science alone is not enough for making competent decisions (Turner, 2004). As a consequence, complex problems have proven to be challenging to solve because a science-driven approach has difficulty conceptualizing and incorporating local knowledge and societal beliefs and values – which are typically qualitative and subjective in nature (Jasanoff, 1998; Slovic, 1998; Smith, 2004).

Collaborative approaches to problem-solving have been proposed in the literature as an alternative to traditional risk analysis. Collaborative approaches concern the "processes, mechanisms and organizations through which actors influence environmental actions and outcomes" (WRI, 2004; Lemos and Agrawal, 2007). They provide deliberate forums within which scientists, state and non-state actors can engage in problem-solving that incorporates the concerns of stakeholders (Functowicz and Ravetz, 1992; Ravetz, 1999; Wynne, 2002; Nowotny *et al.*, 2003; Renn, 2007a; Renn, 2007b). Such collaborative efforts are beneficial for challenging and changing entrenched stakeholder interests and positions, and for gaining the acceptance of compromises and trade-offs and that are necessary for good problem-solving (Falkenmark, 2007; Fish *et al.*, 2010; Lemos *et al.*, 2010).

An important part of a collaborative approach is integrating expert science and local knowledge with societal beliefs and values as part of the problem-solving process (Lee, 1993;

O'Riordan and Rayner, 1993; Fischer, 2000; Lach *et al.*, 2005). This can allow stakeholders to co-produce what has been termed vernacular knowledge, as problems are deliberated, and solutions are negotiated, by stakeholders (Orr, 1991; Lach *et al.*, 2005; Bartel, 2013). Vernacular knowledge integrates expert science and local knowledge with community beliefs and values, and provides a mutually acceptable foundation for the problem-solving process. This co-production of vernacular knowledge promotes greater involvement by involving the community in the deliberation and negotiation of the knowledge that will be used in developing and implementing solutions for complex problems (Lach *et al.*, 2005; Wagner, 2007). The co-production of vernacular knowledge is important for two reasons. First, the process helps to mitigate power differentials among actors by encouraging reasoned debate and negotiation, and promoting discussion of value-based issues (Innes and Booher, 1999; Paquet, 2001; Schusler *et al.*, 2003; Carr, 2004; Reed and McIlveen, 2004; Lach *et al.*, 2005; Van Wyk *et al.*, 2007). Second, the process encourages the community to participate in a discourse that can generate a mutually acceptable and locally relevant source of knowledge that can form the foundation for the development of solutions to complex problems (Lach *et al.*, 2005; Wagner, 2007).

As a consequence, collaborative approaches require the substantive participation of state and non-state actors in the problem-solving process (WRI, 2004; Lemos and Agrawal, 2006: Ansell and Gash, 2007). This level of participation is well beyond consultation where technical experts provide information to stakeholders. Rather, it requires substantive involvement where actors acknowledge their interdependence, recognize shared goals, and perceive themselves as part of the process for finding and implementing solutions (Yaffee and Wondelleck, 2000). For instance, experience with watershed management demonstrates that land owners who have been involved in a substantive way in the development and implementation of local watershed management plans are more likely to understand the need to take action to protect water resources proactively (NRC, 2000; Lemos *et al.*, 2010). As a consequence, collaborative forms of problem-

solving can provide outcomes that are seen to be fairer, and thus may be more likely to be broadly accepted and implemented by stakeholders (NRC, 2000; Yaffee and Wondelleck, 2000).

Complex problems increasingly are deliberated and negotiated within stakeholder networks composed of state and non-state actors (Fish *et al.*, 2010). These networks overlap and are composed of inter-dependent members who share multiple knowledges (Wellman, 1979; Gladwell, 2000; Crossley, 2010; Brummel *et al.*, 2012). Stakeholder networks can promote communication and encourage co-operation between stakeholders concerning issues that span vertical and horizontal scales and cross administrative, physiographic and political boundaries (Paquet, 2001; Peters and Pierre, 2004; Reed and Bruyneel, 2010). Networks can be created in a top-down fashion through regulation, with a prescribed number and affiliation of members, or they can emerge informally from bottom-up efforts (Yaffee and Wondelleck, 2000; Bogason and Zølner, 2007). An example of the top-down approach includes the creation of river basin councils in Brazil (Lemos *et al.*, 2010), which contrasts with the locally-constituted Landcare groups in Australia (Wilson, 2004). Even where a formal network structure has been prescribed, informal networks can still form around and augment the formal structure (Robins *et al.*, 2011). Further, establishing prescribed procedures for cooperation and collaboration, even within a very detailed plan, will not prevent the emergence of informal relationships around the formal structures (Robins *et al.*, 2011). The formation and participation of stakeholders in formal and informal networks has been promoted as a means to help to achieve "socially-valued outcomes", by encouraging "the development of a network society" involving decentralized organizations (Lockie, 2006, 23) that can contribute to the development of knowledge and expertise.

Stakeholder networks can influence collaborative problem-solving forums in two ways. The first involves supporting the formal goals and objectives of the problem-solving process (Ivey *et al.*, 2006). This is important from the perspective of the agency that is organizing the problem-solving process, particularly where there is a prescribed budget, scope and timeline. The second

involves the development and incorporation of stakeholder interests into the problem-solving process (Yaffee and Wondelleck, 2000; Ivey *et al.*, 2006). Although this latter form may at times be in conflict with the former, particularly from a functional perspective, it exists and is a major reason why stakeholders become involved in collaborative governance (Tsouvalis *et al.*, 2000; Mitchell, 2005; Innes and Booher, 2010). As an example: it is expected that citizens have a right to question scientists and the scientific information they generate, as well as a right to provide alternative sources of information (Susskind *et al.*, 2007). For instance, farmers have contested knowledge that was inconsistent with their own understanding, and have discounted forms of innovation when they believe their concerns and knowledge have not been incorporated (Tsouvalis *et al.*, 2000). However, both roles can be nurtured by building capacity and expertise (Carolan, 2006: Ivey *et al.*, 2006). Encouraging stakeholders to pursue these complementary objectives can transform the problem-solving process, producing outcomes that are more robust because stakeholders have worked collaboratively to achieve them (Haque *et al.*, 2009; Innes and Booher, 2010).

Agricultural networks are an example of a key stakeholder group that is often involved in environmental problem-solving processes (Fish *et al.*, 2010). The main focus of the agricultural community throughout history has been to increase agricultural production to provide food and other products to meet the demands of a growing population (Mazoyer and Roundart, 2006; Tauger, 2011). More recently, farming in Western economies has begun to transition into a post-production phase where agricultural production must be both economically and environmentally sustainable (Jones and Garforth, 1998; Holmes, 2006). Although the theory and practice of sustainable farming and agricultural extension are still evolving (Cleveland and Solari, 2007), farmers and farm organizations increasingly are participating in the production of knowledge as part of environmental problem-solving (Tsouvalis *et al.*, 2000). One aspect of this evolution is what Chambers (1983, 201) calls a “reversal in learning” where the “farmer must educate the

outsiders". Outsiders include environmental scientists and members of environmental non-governmental organizations, who are largely urban-based, and who, like the growing urban majority of the population, are increasingly separated from where their food comes from and how it is produced (Turner, 2011). This disconnect has been identified as a particular problem when practice-oriented individuals such as farmers have interacted with those who Tsouvalis *et al.* (2000, 914) describe as "office type people", individuals who have little or no idea of how a regulation or technological innovation will impact affected communities.

The contribution of agricultural networks to environmental problem-solving processes is particularly important where solutions to complex problems are involved. Examples of this are challenges involving water and agricultural management (Yaffee and Wondelleck, 2000; Fish *et al.*, 2010). However, questions remain concerning the manner in which stakeholder networks contribute to collaborative forms of problem-solving, such as their role in the creation and sharing of knowledge. As Bogasan and Zølner (2007) have observed, it is often not clear from the outside what role(s) actor networks play, and how they interact as part of problem-solving processes. In this chapter the contribution of stakeholder network representatives to the development of vernacular knowledge within a mandated multi-stakeholder problem-solving process involving a complex problem is evaluated.

5.3 Source Water Protection in Ontario and the Role of the Farm Sector

The Walkerton Tragedy in May 2000 is an example of how a complex water management problem can become a catastrophe. Seven persons died, and several thousand became ill, in the Town of Walkerton, Ontario, when a poorly located municipal water supply was engulfed by runoff from an adjacent farm, and contaminated water was distributed throughout the community (O'Connor, 2002a). Justice Dennis O'Connor investigated the causes of the tragedy, and published recommendations to ensure the safety of water supply systems throughout Ontario. The

recommendations were structured around a multi-barrier approach, which included developing watershed-scale source protection plans (SPPs) (O'Connor, 2002a; O'Connor, 2002b).

The Province of Ontario responded by enacting the *Clean Water Act, 2006* (Province of Ontario, 2006), which provides authority for the Source Protection Planning (SPP) process, the form of source water protection (SWP) planning currently being implemented in Ontario through a system of nineteen watershed-based entities. These entities are called Source Protection Areas (SPAs) where one watershed is involved, and Source Protection Regions (SPRs) where two or more watersheds are involved. Each SPA or SPR is overseen by a Source Protection Authority formed by the board of local watershed-based conservation authorities. Conservation authorities are municipally-funded watershed-based organizations that have been contracted by the Ontario Ministry of the Environment (OMOE) to facilitate the development of SPPs within a SPA or SPR through a problem-solving process using multi-stakeholder Source Protection Committee (SPC). Each SPC must prepare a SPP for its watershed(s), in compliance with prescribed requirements concerning the scope, content, timeline, and committee structure (OMOE, 2010). The SPC chairs are appointed by, and are responsible to, the Ontario Minister of the Environment. One-third of the stakeholder members are drawn each from the municipal, business, and public interests, respectively, within the watershed. Additional members are allocated to include First Nations representatives on a SPC where the SPA or SPR contains First Nations reserve lands. Each SPC also has *ex officio* members representing the OMOE, and the Source Protection Authority. Administrative and technical support is provided to the SPC by a project manager and administrative and technical staff associated with one or more local conservation authorities from within the SPA or SPR.

Farmers were identified as a key stakeholder group. Although farmers comprise only 2% of the overall population, they own or manage approximately 33% of the land in southern Ontario (OMAFRA, 2012), the part of the province where most of the population and associated

municipal water systems are located. As a result, one to three member(s) of each SPC were prescribed to represent the agricultural community in areas where agriculture was deemed to be a significant local land use. The agricultural sector expressed support for the concept of SWP from the outset. Provincial farm organizations initiated a process to participate in the SPP process that promoted consistency between the SPP process and existing programs that have encouraged economically and environmentally sustainable farming (Armitage, 2001; Bradshaw, 2006; Legislative Assembly of Ontario, 2006). To coordinate farm sector efforts, the Ontario Farm Environmental Coalition (OFEC), which represents 37 farm and commodity organizations concerning agri-environmental matters (Verkley *et al.*, 1998; Morrison and Fitzgibbon, 2014), established a SWP working group. The working group was composed of staff representing four major farm organizations and the Ontario Ministry of Agriculture and Food (OMAF). OMAF staff members have participated in the working group at the invitation of the farm organizations and with the agreement of their Deputy Minister. The author of this chapter is one of the OMAF program staff members, and has participated in the working group since its inception.

The working group recognized the need for agricultural representatives to have capacity to participate effectively in the multi-stakeholder SPC problem-solving setting, and to be seen as legitimate representatives of their local farm community. This is consistent with a growing sentiment in the farming community that farmers need to educate the broader public (Tsouvalis *et al.*, 2000) and make them more aware about the science and practice of farming. The OFEC SWP working group prepared a list of qualifications that were advertised in provincial and local farm publications. A series of meetings was then organized by OFEC and the County Federations of Agriculture throughout Ontario to bring together members of the local farm community to elect agricultural representatives to participate on SPCs. Each Source Protection Authority had been delegated authority under the *Clean Water Act, 2006* (Province of Ontario, 2006) to select agricultural members for its SPC, and initially opposed appointing locally elected agricultural

representatives. However, most (34 of the 37) agricultural representatives elected by the local farm community were eventually accepted by the local Source Protection Authority and were appointed to the 15 of 16 SPCs with agricultural members (Van Dusen, 2007).

An important role of the Agricultural Representative has been to educate other SPC members and staff about farming by sharing a combination of agricultural science and practice, and local farmer knowledge. It was anticipated that this would help SPC members to recognize that municipal drinking water sources could be protected by promoting economically and environmentally sustainable agriculture (Carter, 2005). To support this objective, OFEC secured funding from farm organizations, and federal and provincial government agencies, and delivered six workshops to provide support to the agricultural representatives. These workshops included a combination of formal and informal learning activities that were facilitated by OFEC SWP working group members. The workshops also included presentations academic, consultant, municipal and provincial government technical experts (OFEC, 2007; OFEC, 2008b; OFEC, 2008d; OFEC, 2010; OFEC, 2011; OFEC, 2012). Each meeting included a facilitated discussion involving the agricultural representatives and MOE senior management staff members. The workshops were supplemented with frequent teleconference and online discussion sessions concerning topics requested by the agricultural representatives.

5.4 Methods

The contribution of agricultural representatives to the creation of vernacular knowledge during SPP process was evaluated using a standardized survey questionnaire. Specifically, data were collected concerning SPC members' attitudes regarding the value and uptake of vernacular knowledge within a collaborative multi-stakeholder problem-solving process that began in early 2008. The questionnaire was developed from a review of the literature concerning the role of knowledge in collaborative forms of problem-solving, and was modified using the results of nine

semi-structured interviews of key informants who represented sectors that had a strategic interest and had contributed to the development of the *Clean Water Act, 2006* (Province of Ontario, 2006) and the SPP process. Informants were selected based on their having served directly as a sector representative, or acted in a supporting role as an agency or NGO staff member, as part of one of the three advisory committees established by the Minister of the Environment during the development of SPP process (OMOE, 2003; OMOE, 2004a; OMOE, 2004b).

A mixed methods research (MMR) approach was used to formally combine data collected from different research methods. MMR is a coordinated, inclusive, pragmatic and systematic approach for analyzing data collected using different research methods as part of the same research question (Johnson and Onwuegbuzie, 2004; Yin, 2009). This conformed with the concurrent triangulation approach to MMR that emphasizes the confirmation, cross-validation and corroboration or research findings using the different methods in a single study (Cresswell, 2003). This approach also provides for data to be collected concurrently and with equal priority, and evaluated and analyzed in an integrative manner during the data interpretation. In this way, data collected using different research methods were triangulated to support the interpretation of data and development of conclusions in a manner that would promote comprehensiveness, credibility, reliability and validity of the research process and its findings (Morse, 2003; Teddlie and Tashakkori, 2009).

The questionnaire included a combination of closed- and open-ended questions. Closed-ended questions used a five-point Likert-type scale (Strongly Disagree, Disagree, Undecided, Agree, Strongly Agree) to collect ordinal-level data measuring SPC members' perceptions concerning the themes. Responses to close-ended questions were coded (Strongly Disagree = 1, Disagree = 2, Undecided = 3, Agree =4, Strongly Agree =5), and then analyzed to generate descriptive and inferential statistics using SPSS Statistics Version 20.0 (IBM, 2011). The statistical tests and associated results are discussed in the Results and Discussion section below.

Open-ended questions interspersed with closed-ended questions provided respondents with an opportunity to provide specific examples or expand upon ideas related to the closed-ended questions. Responses to open-ended questions were interpreted and categorized in order to understand the perspective of respondents (Babbie, 2001) concerning the questions presented in Table 5.1.

Table 5.1: Questions Concerning the Co-Production of Vernacular Knowledge

Question	n	Response Rate
a) SPC members are able to request and receive additional technical information from staff	171	39%
b) SPC members freely discuss the benefits and limitations of technical information	170	39%
c) SPC members are able to collaborate freely to generate locally appropriate solutions (n=170)	170	39%
d) SPC members are encouraged to suggest modifications to technical information	169	39%
e) SPC members encouraged to contribute local knowledge	170	39%
f) The broader community is encouraged to contribute local knowledge	170	39%
g) The problem-solving process incorporates both local and technical knowledge	170	39%
h) Local knowledge is equally valid and important as technical knowledge	169	39%
i) Technical knowledge is modified to reflect local knowledge	169	39%

An internet link to the online questionnaire was delivered in mid-2011 by email to the 405 members of the 19 watershed-based SPCs, either directly where individual email addresses were known, or indirectly through SPC staff where the email addresses were not known. The internet link to the online questionnaire was also delivered to 30 representatives of organizations that had a strategic interest in, or had been involved with, the SPP process. This included non-governmental actor organizations such as provincial-scale environmental, farm, watershed management organizations, and three ministries interested and involved in the SPP process in Ontario.

A total of 211 responses were received, providing an overall response rate of 48.5 %. However, the response rate for individual questions was lower (39%). This response rate compares favourably with the range of experiences reported for other studies using email questionnaires (Kaplowitz *et al.*, 2004; Gigliotti, 2011). The specific response rates for the different questions are summarized in Table 5.1.

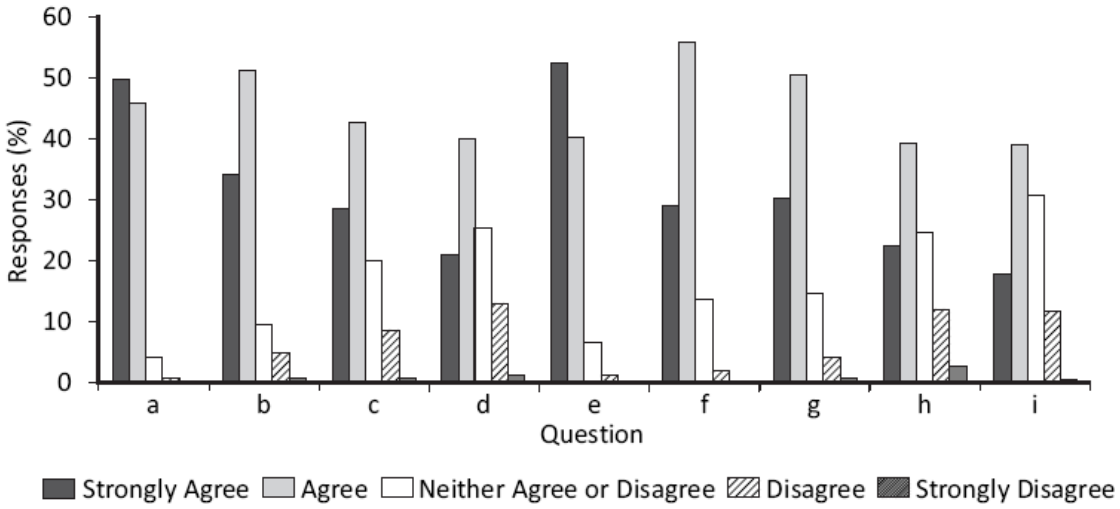
5.5 Results and Discussion

This study concerned the role and contribution of stakeholder networks during the development of vernacular knowledge as part of a multi-stakeholder problem-solving process. In this instance the research involved an evaluation of the participation of agricultural representatives as part of the mandated SPP process in Ontario. This evaluation was carried out by collecting and evaluating data that corresponded to two inter-related themes. The first theme concerned the experience and contribution of SPC members to the creation and sharing of vernacular knowledge as part of the SPC problem-solving process. The second theme concerned the importance of different information sources used by SPC members during the SPC problem-solving process. The results for each theme are presented and discussed separately below.

5.5.1 Involvement in the Creation and Sharing of Vernacular Knowledge

The first theme included the responses to closed and open-ended questions concerning the involvement of SPC members with the use of two key components of vernacular knowledge – technical information and local knowledge – as part of the problem-solving process. Each of these questions was presented as a statement about involvement to which respondents indicated their level of agreement on a five-point Likert scale (Strongly Agree to Strongly Disagree). These statements, along with the number of responses and the associated response rate, are presented in Table 5.1. Figure 5.1 summarizes graphically the distribution of responses for each closed-ended question.

Figure 5.1: Distribution of Responses for Questions



As shown in Figure 5.1, the majority of respondents indicated that they endorsed and participated in the creation and sharing of vernacular knowledge. Indeed, more than 50 % of respondents either strongly agreed or agreed with each of the statements presented. However, a closer examination of responses indicates that there is slight erosion in the strength of support as the questions become increasingly specific concerning an individual member's ability or willingness to participate in the creation in sharing of vernacular knowledge. For example, Question "a" and Question "e" in Figure 5.1, which are relatively general in nature, had strong positive responses (strongly agree and agree) of 95.3 % and 92.4 %, respectively. In contrast, Question "d" and Question "i", which are more specific, had positive responses of 60.3 % and 59.6 %, respectively. This moderation of support suggests that the respondents' endorsement or involvement decreased as there was a shift from principle to practice concerning the creation and sharing of vernacular knowledge.

Open-ended questions asked respondents to share examples of how SPC members have participated in the development or modification of technical information, and to share any examples of local knowledge that were provided by SPC members (*e.g.*, personal knowledge

about groundwater quality in specific areas). Responses to open-ended questions provide insights into why the level of support varied from question to question. More specifically, three technical reasons for the softening of support for the questions concerning the co-production of vernacular knowledge emerged. The first was that the process for conducting technical work was highly constrained by the OMOE Technical Rules concerning the creation and use of knowledge (OMOE, 2009). As a result, SPC staff and consultants perceived little latitude for modifying the technical information based on the comments and concerns of SPC members. One SPC project manager's comments from the survey reflected this challenge:

> at the beginning of the assessment report process SPC members tried to influence the nature of some technical work, but we found that the scope and nature of the technical work was very narrow and that input from the SPC could not be accommodated because of the limitations of the technical rules. The message that I have understood from the province is that the [Source Protection Authority] & SPC have no say in how technical work is done – we must follow the technical rules whether or not they work and whether or not they are relevant to local conditions.

In some cases, this challenge appeared to have been overcome, as indicated by the survey comments of the project manager of another SPC:

> Our Intake Protection Zone studies were not accepted by the SPC when first presented by the consultant because of strong reservations raised by one SPC member about some of the methodologies used. The study was tabled for nearly a year while SPC members [met] informally with MOE technical staff and the consultants to try and sort out the issues with the methodologies. In the end, staff agreed with the SPC that the current results were indefensible and after 14 months a revised approach/methodology was

> reached that was acceptable to staff, the consultants and all but the original SPC member who raised concerns.

A second explanation was related to the often unspoken assumption in technical circles that expert science should not be modified. The underlying rationale is that expert science is generated using a scientific process, and should not be modified based on local knowledge that is perceived to have been generated using a non-scientific process (Innes and Booher, 2010). For instance, one conservation authority representative noted that:

> technical information is technical and it would be contrary to the scientific basis of the process for [SPC members] to suggest modifications to the technical information.

However, the generation of technical information often involved making a number of theoretical assumptions that had to be verified to ensure accuracy and reliability (Slovic, 1998; Renn, 2008). For example, one municipal SPC member noted the great deal of effort that was required by SPC members to understand and discuss the:

> vast array of "assumptions" that the consultants brought to their respective reports. Staff followed up and a meeting was arranged with all of the consultants. Through extensive discussions, a common set of standards/assumptions were conceived."

It is noteworthy that the SPC member who provided this quotation had considerable expertise in the environmental consulting sector. This status as a technical expert, combined with experience and expertise in negotiating with other experts, may have assisted the SPC member to challenge successfully the assumptions put forward by conservation authority staff and technical consultants.

Third, open-ended responses indicated that technical information was privileged over local information because it is collected by experts rather than by local residents. One public representative noted this in their survey response, providing an example where:

> [the SPC's] decisions that are overruled by the technical people in Toronto. An example of this would be the [Municipal Surface Water Intake Protection Zone] for Ramsay Lake. We did not feel that it was inclusive enough. Our technical staff brought this to Toronto and it was turned down.

Also, one SPC Chair observed that "our committee prefers to act on fact rather than opinion." This is consistent with observations in the literature that local knowledge is often perceived to be less robust than expert science (Montpetit, 2003; Innes and Booher, 2010). Also, there appeared to be some lack of trust in local knowledge particularly on the part of technical experts involved in the process. This was reflected in the response of conservation authority staff associated with two different SPCs who stated that "local knowledge is not always correct and recent and must be confirmed, where possible, before it is used", and, that "scientific technical knowledge should outweigh local knowledge as it is the basis for problem-solving." These comments reinforce the perspective in the literature that there can be a bias on the part of experts who believe that other sources of knowledge have less value than expert science (Innes and Booher, 2010).

Three possible non-technical explanations emerged from the evaluation that helped explain this lack of agreement. First, not all stakeholders may understand the importance or need to question technical information (Susskind *et al.*, 2007). In this instance, increasing the technical capacity of SPC members to critically assess the validity of technical information was important to ensure it accurately represented what existed in the watershed. One SPC member with an extensive technical background observed that:

> Our working group held up and required modifications for a report … when not happy with its presentation. We would seldom try to out-technical the experts obviously but when work was not consistent or appeared poorly done we had it changed.

Second, the process had prescribed timelines and other constraints that interfered with the ability of SPC members to adequately and thoroughly review technical information, and to ensure that appropriate changes were made during the problem-solving process. For instance, one public health unit representative observed that the:

> process appears to be too rushed. When issues are brought forward about wording and the intent comments are made [by conservation authority staff] that this is wordsmithing and that time has been set aside at the end of the process. This may create a problem that down the road in the final review that there may be issues over intent and then [there is] not enough time. The process time should be adequate to discuss issues fully.

An agricultural representative also noted concerns with the mandated timelines imposed on the problem-solving process, and the creation and sharing of vernacular knowledge, stating:

> In some cases, because [of] MOE time constraints, local knowledge was not included in the assessment report, not that local knowledge was not sought after and received, just not all used.

Third, in order for stakeholder representatives to be able to understand technical information presented to them by technical experts, they need to be able to internalize and transform that information into knowledge that makes sense within the context of their own beliefs, experiences, and values (Tsouvalis *et al.*, 2000; Michaels *et al.*, 2006). Where stakeholders have knowledge of local conditions, such as farmers who typically have an intimate, and often multi-generational, knowledge of the lands they farm, inconsistencies may be observed between their local knowledge and the technical information that was presented by experts. In this situation, stakeholders will often strive to better understand or modify technical information so that it is consistent with their understanding, to challenge its validity, or ignore it during the

problem-solving process (Tsouvalis *et al.*, 2000). One Agricultural Representative commented that:

> Technical working group [SPC members have] had the opportunity to review and question and have changes made to most areas with the exception of livestock density calculations, resulting in bogus numbers being used and submitted.

This indicated that some stakeholder representatives possessed, or developed capacity and expertise, that helped them to discuss, and in some cases, resolve inconsistencies in information (Ivey *et al.*, 2006; Carolan, 2006). As a consequence, the OFEC SWP working group members were correct when they anticipated that the agricultural representatives needed greater capacity and expertise to be able to participate more effectively and question ideas that were inconsistent with their knowledge of farming and the local farm community.

5.5.2 Relative Importance of Different Information Sources

The second theme dealt with the relative importance of information sources during the problem-solving process. Responses to closed-ended questions indicated which information sources were considered to be important by actors involved in the SPP process. Responses to open-ended questions helped identify specific individuals or organizations that respondents considered to be especially important sources of information.

Survey responses were evaluated to determine which information provided by different organizations or sectors was important to respondents during the problem-solving process. In this instance, non-parametric statistical analysis was used to test for differences between different sector group information sources. The underlying rationale was that different organizations or sectors brought different information to the SPC process, and each would act as a potential information source for SPC members and other interested parties. The premise was that survey respondents would rank information they found important – and were likely to consider and

include in the problem-solving process – higher than information sources that they judged to be less or not important. The responses to the close-ended questions were evaluated using the Kruskal-Wallis test, which compares three or more independent samples based on ranked data (Reaves, 1992; Cramer, 2004). The Kruskal-Wallis test is useful for determining if the difference in the ranked data is significant and indicates that two or more samples come from different populations (Siegel, 1956; Cramer, 1994). In this application, the Kruskal-Wallis test was used to determine which information source (provided by different organizations or sectors) the respondents indicated considered to be significantly different, and considered important, compared to other sources of information.

Table 5.2 summarizes the results of the Kruskal-Wallis test for the information sources that were rated to be important by respondents. These sources were important where they were significantly different – namely where the Kruskal-Wallis value was equal to or less than specific levels of significance (*i.e.*, p =.001, p=.01, p=.05) (Cramer, 1994; Carver and Nash, 2012). The smaller the Kruskal-Wallis value, the greater the statistical difference between the organization or sector and other organizations or sectors. The organizations or sectors are listed in order of decreasing significant difference, with the applicable level of significance (p value) indicated.

Table 5.2: Importance of Different Information Sources

Organization or Sector	**Kruskal-Wallis Value**	**Statistical Significance**
OMOE	.000	There is a significance difference at p<0.001
Conservation Authority	.001	There is a significance difference at p<0.001
Conservation Ontario	.003	There is a significance difference at p<0.01
OMNR	.013	There is a significance difference at p<0.05
Agriculture	.042	There is a significance difference at p<0.05

Overall, the agricultural sector ranked as the only non-government organization or sector that provided information that was identified as different. This indicates that the information provided by the agricultural sector was perceived by respondents to be different, but not as significantly different than the two provincial ministries (OMOE, OMNR), conservation authorities, and Conservation Ontario, a provincial organization that represents all 36 conservation authorities. This suggests that the information provided by agriculture was also statistically different from the information provided by other non-government sectors.

The organizations or sectors that were determined to be significantly different (Table 5.2) were then evaluated to determine their relative importance to respondents during the problem-solving process. Table 5.3 summarizes the mean value of the responses, and associated rank, for each of the organizations or sectors that were significantly different. This ranking indicates the relative importance of the different information sources. Table 5.3 also indicates the top five receptors of information for each organization or sector, based on the median score of responses, which are listed in order of decreasing importance. The median score provides a measure of the value that each of the respondents associated with a specific organization or sector placed on the information from the significantly different sources. Specifically, a score of "1" (Strongly Agree) indicates a greater acceptance of the statement than a score of "5" (Strongly Disagree).

Overall, the agricultural sector ranked as the third-most influential sector based on respondent scores summarized in Table 5.3. The underlying rationale was that the greater the mean score of the survey responses, the greater the importance the respondents placed on the information provided by each organizations or sector. The premise was that the higher an information source was ranked, the greater the likelihood the respondent would consider and include that information in the problem-solving process. This is noteworthy because the importance of agriculture was only surpassed by conservation authorities and OMOE, which are both supported with significant public financial and staff resources for generating and sharing

information among SPC members. It is also noteworthy that the information provided by agriculture was rated higher than the information provided by ~~OMAF,~~ OMNR, and Conservation Ontario. This result is interesting because two of these organizations – OMNR and Conservation – have received public funding for communications and technical staff members to support their involvement in the SPP program.

Table 5.3 Relative Importance of Different Information Sources

Organization or Sector	**Mean Score**	**Rank**	**Key Information Receptors**	
			Sector	Median Score
Conservation Authority	1.48	1	SPC Chair	1
			Conservation Authority	1
			Public Sector	1
			Municipal Sector	1
			Industry Sector	2
OMOE	1.51	2	OMOE	1
			OMAF	1
			First Nations	1
			Conservation Authority	1
			SPC Chairs	1
Agriculture	1.76	3	Agriculture Sector	1
			SPC Chair	2
			Public Sector	2
			Industry Sector	2
			Environment Sector	2
OMNR	1.98	5	OMOE	2
			Environment Sector	2
			Conservation Authority	2
			SPC Chair	2
			Industry Sector	2
Conservation Ontario	2.01	6	First Nations	1
			OMOE	2
			SPC Chairs	2
			Conservation Authority	2
			Environment Sector	2

The open and close-ended responses linked to this theme suggested four reasons why the agricultural network was perceived as a key information source. First, responses to close-ended questions suggested that agricultural representatives were recognized by other sector representatives as knowledgeable people who contributed community-specific local knowledge of farming experiences at the local scale. For example, one public representative stated that:

> Our agricultural [representatives] in particular frequently provide local knowledge on many topics, including correcting information in draft reports (groundwater quality and threats to groundwater, land use practices, livestock density, nutrient management requirements, etc.).

This indicated that agricultural representatives had the capacity and expertise required to share local knowledge about farming practices and related matters. Acknowledgement of this contribution by other sector representatives indicates that the agricultural representatives were able to participate in effectively sharing local knowledge as part of the problem-solving process.

Second, respondents from different sectors noted in the qualitative responses that agricultural representatives had challenged some aspects of the mandated problem-solving process, and had advocated for changes so that local needs were better addressed. One OMOE representative noted that one example where local needs were better addressed involved "Re-delineation of [intake protection zones] based on their local knowledge of overland flow and drainage systems that were unknown to technical staff." This is consistent with a position in the literature that the community has the right to question scientists and the scientific information they generate, as well as a right to provide alternative sources of information (Susskind *et al.*, 2007).

Third, local knowledge provided by the agricultural representatives was reinforced actively by farm organizations that were part of the OFEC SWP working group. These farm organizations

contributed knowledge concerning farming and agricultural science by delivering information through presentations to, and participating in, technical discussions with, SPC members. OFEC SWP working group members also delivered technical information to representatives of networks at the provincial scale (*i.e.*, Conservation Ontario, OMOE), and interacted directly with the SPC Chairs. This was reflected by the identification of the Ontario Federation of Agriculture, the Ontario Cattleman's Association, and the Ontario Farm Animal Council, or their representatives, as key sources of information by respondents.

Fourth, information distributed by OMAF complemented the information concerning agricultural science and practices provided by the agricultural community (OMAF, 2012). For instance, responses to closed- and open-ended questions indicated that OMAF field and program staff provided expertise at both the SPC scale and provincial scale. OMAF program staff also worked to bridge communication gaps between the OFEC SWP working group, Conservation Ontario and OMOE SPP program staff, and the SPC Chairs and Project Managers. These efforts reflected OMAF's interest in demonstrating how agricultural regulatory standards and voluntary agri-environmental management practices, which share a common foundation in agricultural science and practice, support the development and implementation of SPP policies across Ontario (OMAF, 2012).

5.6 Conclusions

Collaborative approaches to problem-solving provide an opportunity for the development of more robust solutions to complex problems, such as the management of water resources (Lach *et al.*, 2005; Lemos *et al.*, 2010). The contribution of stakeholder communities, and the importance of capacity and expertise to enable them to participate effectively in multi-stakeholder problem-solving processes, is an area of emerging interest in the empirical and theoretical literature (Carolan, 2006; Lockie, 2006). The research presented in this chapter contributes to this area of inquiry by providing insight concerning the effectiveness of a particular stakeholder group – the agricultural community – to participate and share its knowledge and perspectives on water management as part of a mandated multi-stakeholder problem-solving process involving nineteen watershed-based source protection committees in Ontario, Canada.

The research revealed that the majority of respondents endorsed and had participated in the co-production of vernacular knowledge during the problem-solving process. Interestingly, respondents indicated stronger support for the creation and sharing of vernacular knowledge in principle, compared with its actual practice. This can be attributed to three factors. First, the problem-solving process was constrained by the time available for deliberation, and the type of knowledge that should guide it; these time lines were mandated by regulation (OMOE, 2009). This constraint reflects the challenges that arise when problem-solving approaches are prescribed for complex environmental problems (Jordan *et al.*, 2005; Lach *et al.*, 2005; Innes and Booher, 2010). Second, there was a prevailing thought on the part of some participants that local knowledge was less robust than technical knowledge, and that modifying expert science to reflect local knowledge was unscientific. This is a concern that others have identified in relation to collaborative processes (e.g., Innes and Booher, 2010). Finally, some of the participants who had adequate capacity and expertise were able to identify inconsistencies in technical information and were effective in challenging and modifying it so that it was consistent with their local

knowledge. This is consistent with experience elsewhere where farmers have contested or challenged information that did not agree with theirs and have provided alternative sources of knowledge (Tsouvalis *et al.*, 2000; Susskind *et al.*, 2007).

The research also indicated that respondents recognized and valued agricultural knowledge as an important information source for the problem-solving process. This was attributed to three factors. First, members of a provincial-scale agricultural network, which included state and non-state representatives, supported the local farm community to elect stakeholder representatives and then helped enhance their capacity and expertise through a series of forums (workshops, email groups, teleconference meetings). Second, the provincial-scale OFEC SWP working group members provided support to the stakeholder representatives by offering technical presentations to groups involved in the problem-solving process at the local and provincial scale that emphasized the role of agricultural science and practice in meeting the objectives of source water protection. Finally, the state agricultural agency informed SPCs, and organizations and agencies interested or involved in the SPP process, that existing regulatory standards and voluntary programs met the objectives of source water protection, which complemented information provided by the agricultural representatives and provincial farm organizations

The results of the research also provided broader insight for research and practice. First, although the problem-solving process was mandated, it exhibited characteristics associated with a collaborative approach. This is consistent with other collaborative processes that have provided a forum within which state and non-state actors participated in problem-solving that incorporated the concerns of stakeholders (Functowicz and Ravetz, 1992; Ravetz, 1999; Wynne, 2002; Nowotny *et al.*, 2003; Renn, 2007a; Renn, 2007b). Also, stakeholders were able to co-produce vernacular knowledge, as noted in the literature as part of the discussion and negotiation of solutions (Orr, 1991; Lach *et al.*, 2005; Bartel, 2013) by integrating expert science and local knowledge (Lee, 1993; O'Riordan and Rayner, 1993; Fischer, 2000; Lach *et al.*, 2005).

Second, it was evident that the agricultural community worked outside of but in contact with the prescribed process. This helped to support coordinated action across watersheds at the local and provincial scales. This is an example of an informal network that operated around, and interacted with, the mandated network (Robins *et al.,* 2011), and shared information between vertical and horizontal scales and across administrative, physiographic and political boundaries (Paquet, 2001; Peters and Pierre, 2004; Reed and Bruyneel, 2010). The agricultural community also supported the creation and sharing of knowledge, both internally and externally. This is consistent with efforts elsewhere where the agricultural community has contributed to the development of knowledge (Lockie, 2006) and educated non-farmer members of the process about farming (Tsouvalis *et al.,* 2000).

Finally, the research provided insight concerning the role that stakeholder networks played in the collaborative problem-solving processes (Bogasan and Zølner 2007). In this instance the agricultural network participated in the co-production of vernacular knowledge. Specifically, the stakeholder network supported the selection, and activities of the sector representatives, during a multi-stakeholder problem-solving process. This provides an example of how the capacity and expertise of participants in a problem-solving process can be increased (Carolan, 2006; Ivey *et al.*, 2006). It is also an example of how agricultural science and practice can be shared, accepted and valued by other sector representatives and integrated during the discussion of problems and negotiations of solutions (Orr, 1991; Lach *et al.*, 2005; Bartel, 2013). Further, enhanced capacity and expertise empowered agricultural representatives to question the prescribed SPP process colleagues. This is an example of how increased capacity and expertise can enable participants to challenge assumptions underlying the prescribed approach to problem-solving (Tsouvalis *et al.*, 2000).

Chapter Six

Conclusions

This chapter presents an overview of the major research findings presented in the preceding chapters, and provides an opportunity to identify and discuss these individual research findings in the broader context of the theoretical framework that guided the research. The chapter is organized into four parts. First, the purpose and objectives of the research are presented. Second, the major research findings of each chapter are summarized. Third, the major academic contributions and recommendations for practice are identified. Finally, the limitations of the research and opportunities for future research are discussed.

6.1 Purpose and Objectives

The purpose of this research was to provide insights concerning the formation and function of a stakeholder network, and its role and contribution in the creation and sharing of vernacular knowledge, within collaborative problem-solving processes. A conceptual framework was developed through a review of the academic literature, and augmented by my experience with multi-stakeholder problem-solving processes over the past 20 years as a groundwater professional at the municipal and provincial level of government. Empirical insight for the research was provided through a case study of a multi-stakeholder problem-solving process that has been structured using a prescribed collaborative approach, involving stakeholder networks at the watershed and provincial scales.

The research had three related research objectives:

1. To develop a conceptual framework for evaluating the formation and function of a stakeholder network, and its role in the creation and sharing of vernacular knowledge by a stakeholder network within collaborative problem-solving processes;

2. To use the conceptual framework to assess if the stakeholder network functions in a collaborative manner, and to evaluate its contribution to the creation and sharing of vernacular knowledge as part of an actual example of a collaborative problem-solving processes; and

3. To develop recommendations for designing a collaborative problem-solving process in order to facilitate the creation and sharing of vernacular knowledge by stakeholder networks.

6.1.1 Major Findings

The research results were organized and presented in three manuscripts. Although the three manuscripts were written as independent documents, they were inter-related and were situated within the overall purpose and objectives of the research. As a consequence, the sequence of the three manuscripts was intentional in two ways. First, the content of the manuscripts moved from the general to the specific. Second, each manuscript built on or complemented the results and insight provided in the preceding chapters.

Chapter Three proposed a conceptual framework developed from a review of the academic literature concerning key attributes of collaborative approaches to problem-solving (Lemos and Agrawal, 2006; de Loë and Kreutzwiser, 2007; Innes and Booher, 2010), and the role of networks in creating and sharing knowledge within environmental problem-solving processes (Peters, 1998; Montpetit, 2003; Innes and Booher, 2010). The development of the conceptual framework was also guided by my personal experience as a water professional in Ontario over the past 20 years. The conceptual framework provided a rubric for systematically evaluating a case study involving an agri-environmental stakeholder network that participated in a multi-stakeholder collaborative problem-solving process. The evaluation demonstrated the validity of the key collaborative attributes summarized in the conceptual framework. These included ensuring that representatives were selected by the local community (Reed, 2008), encouraging representatives to develop workshop agendas and content (Bellamy *et al.*, 1999; Lach *et al.*, 2005), building

leadership and technical capacity (Carr, 2004; van Wyk *et al.*, 2007), providing training opportunities to increase contributory and interactional expertise (Carolan, 2006), promoting processes that reinforce accountability at different scales (Murdoch and Abram, 1998; Stoker, 1998; Blackstock and Richards, 2007), and developing an open and transparent process for selecting stakeholder representatives (Scharpf, 1997; Montpetit, 2003; Blackstock and Richards, 2007; Fawcett and Daugbjerg, 2012).

Chapter Three demonstrated that the key collaborative attributes observed within the network were also applicable for the creation and sharing of vernacular knowledge. This included bridging with different stakeholder groups and networks (Blanco *et al.*, 2011), members making concepts relevant to their individual circumstances and needs (Yaffee and Wondolleck, 2000; Carolan, 2006), building capacity for both action and self-determination (Ivey *et al.*, 2006), using contributory and interactional expertise to share knowledge (Collins, 2004; Carolan, 2006), advocating local and provincial scale knowledge (Stoker, 1998; Carr, 2004; Turner, 2004; Cash *et al.*, 2006; Mitchell and Breen, 2007; van Wyk *et al.*, 2007), and promoting outcomes that could be implemented (Montpetit, 2003; Dreyer Hanson, 2007; Provan and Kenis, 2007; Fawcett and Daugbjerg, 2012).

Chapter Three also determined that the agri-environmental network provided a horizontally and vertically integrated system within which vernacular knowledge was created and shared. Agricultural representatives were encouraged to listen to and work with each other in order to promote the creation and sharing of vernacular knowledge internally. Agricultural representatives were also encouraged to share this knowledge externally with their non-farm colleagues on their respective SPCs. This suggested that the agricultural representatives bonded within the network, were encouraged to connect with stakeholders to engage in sharing and integrating scientific and local knowledge, discuss value-based issues during the creation of vernacular knowledge, and built relationships that promoted trust, common rules, shared values, inclusion and empowerment

by bonding and bridging with colleagues inside and outside the network, respectively. These are all important characteristics of processes that have achieved some success in creating and sharing vernacular knowledge (Falkenmark, 2007; Mitchell and Breen, 2007; van Wyk *et al.*, 2007; Reed *et al.*, 2010; Blanco *et al.*, 2011).

Two questions were raised through the evaluation contained in Chapter Three. First, what structural characteristics of the network contributed to bonding and knowledge sharing between the agricultural representatives? Second, how effective were the agricultural representatives in sharing vernacular knowledge with their non-farm SPC colleagues? Chapter Four focussed on investigating the first question, particularly how the agricultural network was structured and functioned. A combination of participant observation and social network analysis was used to evaluate the structure of the agricultural representative network, and its role in the creation and sharing of vernacular knowledge within the context of a collaborative approach. The evaluation was informed by academic literature concerning collaborative approaches to problem-solving (Lach *et al.*, 2005; Blackstock and Richards, 2007; Paavola, 2007; Holley *et al.*, 2012) and the creation and sharing of knowledge within social networks (Wellman, 1979; Prell *et al.*, 2009; Crossley, 2010).

Analysis involving a combination of participant observation and social network analysis indicated that three important characteristics of the agricultural network contributed to the creation and sharing of vernacular knowledge. First, the agricultural representatives formed a network that was moderately cohesive, allowing it to develop a set of shared beliefs and values. At the same time though, this network also accepted the introduction of external ideas – a key concern (Burt, 2005). Second, the agricultural representatives formed strongly and densely bonded groups at the watershed scale that were bridged at the provincial level by relationships formed between influential opinion leaders. Other studies have emphasized the critical role of these kinds of bonds (Burt, 2005; Blanco *et al.*, 2011). Third, despite the moderately cohesive

nature of the network overall, influential opinion leaders helped increase knowledge sharing within the network by bridging the strongly and densely bonded, but weakly connected, watershed-scale groups. This is an example of how influence leaders can increase the cohesivity and knowledge flow within a network composed of weakly connected sub-groups (Burt, 2005; Currie and White, 2012). This result suggested that influential opinion leaders were instrumental in facilitating the creation of vernacular knowledge within a network by helping to connect and share information between weakly connected parts of a network.

A second question that arose from Chapter Three was how effective were the agricultural representatives in sharing vernacular knowledge with their non-farm SPC colleagues? This question was evaluated in Chapter Five in two ways. First, SPC members were queried on whether or not the problem-solving process supported the creation and sharing of vernacular knowledge. Second, SPC members were asked how effective the agricultural sector had been in contributing to the creation and sharing of vernacular knowledge. The evaluation was informed by academic literature concerning collaborative approaches to problem-solving (Lach *et al.*, 2005; Blackstock and Richards, 2007; Paavola, 2007; Holley *et al.*, 2012).

The first part of the analysis revealed that respondents generally agreed that the problem-solving process provided opportunities for the creation and sharing of vernacular knowledge. However, it was also revealed that support for the creation and sharing of vernacular knowledge decreased when the respondents were asked if they agreed that local knowledge should have an equal status as technical knowledge, or if technical knowledge should be modified to reflect local knowledge. The weakening of support was notably present in comments provided by technical experts, and agency and SPC staff, involved in, or supporting, the problem-solving process. This is consistent with the literature that indicates that technical experts tend to privilege expert science because other sources of information such as local knowledge are perceived to be less robust and have less value (Montpetit, 2003; Innes and Booher, 2010).

The second part of the analysis determined that the agricultural sector was effective in contributing to the creation and sharing of vernacular knowledge. The analysis determined that the agriculture sector was ranked the third most influential sector, following conservation authorities and the OMOE. These results indicated that that information provided by the agriculture sector was valued more by SPC members representing non-state sector stakeholders than that provided by some state sector organizations. This result suggested that the agricultural representatives were successful in contributing their vernacular knowledge to the problem-solving process. The results also suggested that the OFEC workshop process had been effective in preparing the agricultural sector representatives to participate effectively in the creation and sharing of knowledge with their SPC colleagues. This is consistent with the literature that the building of capacity and expertise are important for enabling stakeholders to participate in collaborative problem-solving process, and negotiating both mutually acceptable knowledge and outcomes (O'Riordan and Rayner, 1993; Carolan, 2006).

6.2 Contributions

6.2.1 Academic Contributions

This research concerns the role and contribution of stakeholder networks within collaborative problem-solving approaches (Innes and Booher, 2010; Blanco *et al.*, 2011). The research was guided by a conceptual framework composed of a set of key attributes drawn from a review of the theoretical and empirical literature. The key attributes linked insight from literature involving collaborative approaches to environmental problem-solving (Lemos and Agrawal, 2006; Paavola, 2007) and inter-related fields of research concerning networks (Crossley, 2010; Blanco *et al.*, 2011) and knowledge (O'Riordan and Rayner, 1993; Lach *et al.*, 2005). The focus of the case study was the history and function of a specific stakeholder network in this process, namely a group of locally selected farm community representatives that were supported by a provincial agri-environmental network working group composed of representatives of key farm

organizations and the agricultural ministry. The findings of the case study provided a number of theoretical contributions to the literature concerning the role of stakeholder networks in collaborative environmental problem-solving literature (Torfing, 2007; Bevir and Richards, 2009; Prell *et al.*, 2009) and the creation and sharing of vernacular knowledge (Lach *et al.*, 2005; Bartel, 2013).

First, the research provided insight concerning how stakeholders realized a more substantive participation in problem-solving processes (WRI, 2004; Lemos and Agrawal, 2006: Ansell and Gash, 2007; Reed, 2008). Of particular relevance, was a demonstration of how a problem-solving process evolved from a one-way flow of information, associated with traditional consultation efforts, to a multi-way flow of information, associated with collaborative problem-solving processes (Yaffee and Wondolleck, 2000; Reed, 2008). The research findings indicated that stakeholder networks support this evolution in several ways. First, the agri-environmental network encouraged an improved understanding of different interests within the network, by bringing together network members to discuss specific concerns and negotiate mutually agreeable outcomes. Second, the agri-environmental network built relationships within the network by promoting bonding between network members, and by creating bridges to SPC colleagues through which information was shared. Third, the agri-environmental network promoted the creation and sharing of vernacular knowledge, both within the network and within the SPC problem-solving process. Collectively, these actions resulted in a better connected network that was able to participate in the creation of knowledge, both internally and externally, which enabled it to influence the processes and outcomes of collaborative problem-solving processes.

Second, the research provided insight concerning outstanding questions regarding the formation and function of stakeholder networks (Hay, 1998; Torfing, 2007). Some stakeholder networks have been characterized as “closed” entities, which have actively resisted the entry and influence of peripheral state and non-state actors and organizations, both cognitively and

physically, in order to preserve the process and outcomes of the established problem-solving approach (Daugbjerg, 1998; Sørensen and Torfing, 2007). Agricultural, and more recently agri-environmental, networks have been singled out as a particularly extreme example of closed networks because they have involved close, long-lasting and stable relationships between state and non-state agricultural organizations (Daugbjerg, 1998; Marsh, 1998). The literature has also been critical of agricultural networks because they have traditionally focused on issues related to optimizing agricultural production, despite expanding their scope of interest in the last 30 to 40 years to include environmental issues related to agricultural production (Daugbjerg, 1998; Marsh, 1998; Montpetit, 2003). The research findings indicated that a stakeholder network emerged and evolved in response to address a new concern, adapting existing or developing new knowledge to address this concern. Specifically, the agricultural community formed an agri-environmental network that promoted knowledge concerning agricultural science and practices that they proposed would achieve economically and environmentally sustainable farming practices. These findings also suggested that the evolution of stakeholder networks was internally driven, rather than externally imposed, and that this evolution was facilitated with involvement and support from state and non-state organizations with similar interests.

Third, the research findings provided insight concerning the challenges and opportunities of using an innovative approach for evaluating the structure and function of a stakeholder network. The role of social networks in collaborative approaches to environmental problem-solving has typically been explored using qualitative methods. Conversely, collaborative forms of problem-solving have been studied using social network analysis (SNA) has been undertaken from a quantitative perspective. These research approaches are limiting because the opposing qualitative and quantitative approaches are looking at what Edwards and Crossley (2009, 41) have proposed are “different sides of the same coin”. As a consequence, efforts to evaluate qualitative and quantitative data collected using different research methods, and situated as part of a single

research project, are beginning to emerge (*e.g.*, Prell *et al.*, 2009). Specifically the research demonstrated the benefits of using a Mixed Methods Research (MMR) approach for combining qualitative and quantitative data to answer questions regarding the structure and function of a stakeholder network. In this case, it was demonstrated that using a combination of participant observation and SNA can provide insight concerning the structure of a network, helping to better understand and explain how the network functioned.

6.2.2 Recommendations for Practice

Collaborative approaches are being used increasingly for environmental problem-solving for addressing complex environmental problems such as water management. This is in response to concerns that the traditional problem-solving process, which is founded on an expert-driven approach, is not adequate for complex problems that often require the incorporation of local knowledge and community beliefs and values. An important part of such collaborative approaches is the bringing together of stakeholders with different backgrounds and interests to integrate expert science, local knowledge, and community beliefs and values to create a vernacular knowledge (Lee, 1993; O'Riordan and Rayner, 1993; Fischer, 2000). This vernacular knowledge forms a foundation for problem-solving in a way that incorporates the concerns of the community.

Although the benefits of a collaborative approach are being recognized by practitioners, including government agencies, inclusive approaches are being introduced into government agencies that have been structured around, and have operated, using the traditional problem-solving approach. As a consequence, the introduction of collaborative problem-solving approaches has often been implemented by government agencies using a prescriptive regulatory framework. Prescriptive approaches to source water protection are either in use or under development in other provinces of Canada (Goucher *et al.*, 2007), and in international jurisdictions such as Australia (Taylor *et al.*, 2012) and Germany (Kastens and Newig, 2008). An

example of such a scenario is the SPP program that is being implemented in Ontario through watershed-based Source Protection Committees (SPCs) under the authority of the Clean Water Act, 2006 (Province of Ontario, 2006).

The extent of prescription within source water protection approaches can be pervasive, as exemplified by the Ontario SPP program that has prescribed various aspects of the problem-solving process, including:

- Geographic extent of planning [Ontario Regulation 284/07 (Province of Ontario, 2007a); Ontario Regulation 286/07(Province of Ontario, 2007c)];
- Scope and time limits for planning [Ontario Regulation 284/07 (Province of Ontario, 2007a); Ontario Regulation 285/07(Province of Ontario, 2007b)];
- Formation, selection of members, and operation of planning committees [Ontario Regulation 285/07(Province of Ontario, 2007b); Ontario Regulation 288/07 (Province of Ontario, 2007e)];
- Public engagement and consultation [Ontario Regulation 286/07(Province of Ontario, 2007c)); Ontario Regulation 288/07 (Province of Ontario, 2007e)];
- Plan development process [Ontario Regulation 286/07(Province of Ontario, 2007c); Ontario Regulation 288/07 (Province of Ontario, 2007e)];
- Collection, evaluation and use of technical information [Director's Rules (OMOE, 2009)];
- Risk reduction requirements [Clean Water Act, 2006 (Legislative Assembly of Ontario. 2006); Director's Rules (OMOE, 2009)]; and
- Plan review and approval process by the Minister of the Environment [Clean Water Act, 2006 (Legislative Assembly of Ontario. 2006); Ontario Regulation 285/07(Province of Ontario, 2007b)].

This study has demonstrated that such a prescriptive context can constrain collaborative problem-solving processes. Examples of this included the challenges presented to SPCs and stakeholder networks for appointing representatives who had been selected democratically by their community. Prescribed timelines also constrained or precluded full deliberation on topics of concern, limited the creation and sharing of vernacular knowledge, and affected outcomes of the SPP process.

Government agencies have begun to incorporate collaborative problem-solving approaches for deliberating and addressing complex environmental concerns. Therefore, it is important to share lessons from empirical research that demonstrates how such processes can be structured to mitigate process constraints and promote more successful outcomes. To support these objectives, this research provided insight for improving opportunities for stakeholder networks to contribute to the creation and sharing of vernacular knowledge of collaborative problem-solving processes. Of particular interest are collaborative problem-solving approaches that are implemented within the context of a prescriptive regulatory framework. As a consequence, the recommendations for practices developed from this research have broader relevance.

6.2.2.1 Selection of Community Representatives

A challenge with any public process is selecting appropriate individuals to participate in the problem-solving process who will accurately and effectively represent the concerns and interests of the various stakeholder groups (Blackstock and Richards, 2007; Prell *et al.*, 2009). One aspect of collaborative approaches that has been largely overlooked in the literature is how a stakeholder group selects its own representatives to participate in environmental problem-solving processes. This was a very real challenge in the SPP process, particularly for Source Protection Authorities that were delegated the responsibility for identifying and selecting individuals from within the local community to fill the requisite number of member positions for each sector that was prescribed by regulation under the authority of the *Clean Water Act, 2006* (Province of Ontario,

2006). This challenge was exacerbated by Ontario Regulation 288/07 which also prescribed time limits for the formation of SPCs (Province of Ontario, 2007e).

A process was developed by the farm community to select its representatives to participate on SPCs. This process was implemented by the OFEC SWP working group in collaboration with the County Federations of Agriculture, and with local support by OFA member services representatives. This included organizing a series of meetings at which candidates were elected to serve as SPC members on each of the Source Protection Areas or Regions that were deemed to have significant agricultural activity. In total, 14 open and transparent elections were held in which local farm community members voted for individuals who had expressed interest in participating as a member of the local SPC. Although this process was initially opposed by OMOE, because it was seen to circumvent the authority delegated to the Source Protection Authority through Ontario Regulation 288/07, 34 of the 37 farmers selected through this local democratic process were appointed to serve as agricultural SPC members. The other three agricultural SPC members were appointed by the local Source Protection Authority in accordance with the authority granted under Ontario Regulation 288/07.

Other sectors may have also employed a similar process for selecting their representatives if this option had been presented to them, and resources had been provided by either the Source Protection Authority or the OMOE for its implementation. Although this approach would have been time consuming, and involved the provision of additional resources, it is anticipated that it would have helped to increase awareness of the process within the local community. This may have also increased stakeholder interest and involvement during the development and implementation of the SPP, and contributed to the perception of accountability and legitimacy of the process within the broader community.

6.2.2.2 Promoting the Creation and Sharing of Vernacular Knowledge

A fundamental part of collaborative problem-solving processes is a moving away from an exclusive reliance on expert science, and a moving towards the creation, sharing and use of vernacular knowledge that integrates expert science, local knowledge, and community beliefs and values (Lee, 1993; O'Riordan and Rayner, 1993; Fischer, 2000). Although community beliefs and values can be, and were, shared as part of discussions and deliberations during the problem-solving, discussions with SPC and OMOE staff, indicated that there was no formal mechanism for collecting and incorporating local knowledge with expert science as part of the SPP process. This oversight was reflected in the standards and guidance developed by the OMOE to guide the SPP process. For instance, the Technical Rules (OMOE, 2009) provided detailed technical direction on how to assess and classify the vulnerability of water sources, and the threat posed by land use activities to these sources, but no advice was provided on how local knowledge should be incorporated. Similarly, although the stakeholder engagement reference guide for the SPP process states that local knowledge is important (OMOE, 2007), no suggestions are offered on how this local knowledge should be collected and incorporated into the problem-solving process.

The need for vernacular knowledge has been noted implicitly by technical experts involved in the SPP process. In particular, one SPC struggled with how to deal with uncertainty associated with the groundwater modelling process (West *et al.*, 2011), an issue that was not addressed by the OMOE Technical Rules (OMOE, 2009). Interestingly, uncertainty, as with other forms of risk, is one aspect of environmental problem-solving for which a collaborative approach is suited because this involves the consideration of beliefs and values (*e.g.*, what is an acceptable level of risk). As a consequence, formally incorporating the creation and sharing of vernacular knowledge could have had benefits throughout the problem-solving process.

6.2.2.3 Encouraging Network Involvement

It has been proposed that stakeholder networks can play an important role in collaborative approaches to environmental problem-solving (Blackstock and Richards, 2007; Prell *et al.*, 2009). One role that stakeholder networks can play is supporting the creation and sharing of vernacular knowledge (Yaffee and Wondelleck, 2000). This study determined that locally elected agricultural representative formed a network, with support from the OFEC SWP working group, which provided channels for the flow of knowledge horizontally between local farm organizations and OMAF, and within and between Source Protection Areas or Regions (*i.e.*, SPCs), and vertically between local farm organizations and provincial farm organizations and OMAF. This network enabled the farm community to engage with the SPP process and share vernacular knowledge and OFEC SWP principles in a coordinated manner through local SPCs. This was reinforced through OFEC SWP working group efforts to influence OMOE to align the SPP program with agri-environmental programs such as the Environmental Farm Plan. This approach is now being studied through a research project at the University of Guelph concerning how stakeholder organizations can contribute to Knowledge Translation and Transfer as part of collaborative multi-stakeholder problem-solving processes (Beattie, 2011).

The development and support of such a network approach would benefit other sectors that have an interest in environmental problem-solving processes. For instance, a number of sectors participating in SPCs, such as local business and industry representatives, had little or no support from a sector network such as OFEC. Local environmental non-governmental organization representatives received support through the Ontario Water Guardians Network that was established and supported by the Canadian Environmental Law Association and Environmental Defence (CELA and Environmental Defence, 2007). The Ontario Water Guardians Network provided a web forum with information on water-related issues related to source water protection, and sponsored several workshops at which source water protection issues were discussed (CELA,

2007). However, the Ontario Water Guardians Network did not provide the extensive training and support that the OFEC SWP working group provided to the agricultural representatives. It is anticipated that additional support would have helped the Ontario Water Guardians, and other sector representatives, to form better integrated networks, and prepared them to participate in the problem-solving process and the creation and sharing of knowledge, more consistently and effectively at the SPC and provincial scales.

6.3 Revising the Conceptual Framework

The conceptual framework used in this research was useful for guiding this research in two ways. First, the framework provided meaningful criteria for evaluating the formation and function of the agricultural network in Ontario, generally, and a subsequent and more specialized agri-environmental network, from the perspective of the literature concerning collaborative approaches to environmental problem-solving. Specifically, Chapter Three indicated that the scope of the agricultural network composed of farm community members and OMAF staff evolved starting in the early 20th century, and provided a forum that supported the development of a provincial agri-environmental network led by OFEC. The provincial agri-environmental network has demonstrated behaviour that is consistent with the key collaborative attributes of the framework, involving organizations with different interests to participate in collaborative environmental problem-solving processes to negotiate outcomes such as the Environmental Farm Plan. Second, the applicability of the conceptual framework indicates that the approach that was employed during its development was valid, and that it did not require modification once the study had been completed. Specifically, the framework was developed through a review of the theoretical and empirical literature, and drew on situated knowledge that I acquired through my experience as a water management professional in Ontario over the past 20 years. The framework was also refined by presentations at several academic and professional conferences, and benefitted from discussions with academic and professional colleagues.

6.4 Study Limitations and Ideas for Future Research

The concerns investigated in this study involved an evaluation of the formation and function of a stakeholder network, and its effectiveness in contributing to the creation and sharing of vernacular knowledge within a collaborative approach to problem-solving. A MMR approach was selected in order to evaluate a single case study using data collected using different methods. I recognize that the use of a single case study limits my ability to draw general conclusions from the research findings (Yin, 2009). However, the methodology used does allow me to provide insight to the academic literature, and draw limited conclusions based on the empirical results from the research.

The ability to generalize the findings of this research was limited by its scope, which was focused on the participants of the prescribed SPP process. The key attributes of collaborative approaches summarized in the conceptual framework (Table 3.1) are intended to benefit the full membership of stakeholder networks, not just stakeholder network representatives who are directly involved in problem-solving processes. Several key attributes are of particular interest in the context of the case study presented: stakeholder involvement in problem-solving processes through reciprocal communication between stakeholder network representatives and members of the communities represented (Carr, 2004; Reed, 2008); increased stakeholder capacity and expertise through greater awareness and understanding of the complex problems being deliberated (Carolan, 2006; Ivey *et al.*, 2006); and accountability and legitimacy by supporting the process and outcomes of the problem-solving process (Turner, 2004; Cash *et al.*, 2006). Such complementary research could be initiated by exploring the interactions between the agricultural representatives and the members of the local farm communities they represent, and how beliefs, knowledge and values are shared.

There were also aspects of this research that limited my ability to move beyond exploring and describing the structure and function of the network, and to be able to explain what was being

observed. A number of interesting comments were received in response to open-ended questions in the survey questionnaire that did not relate directly to the research questions and could not be explored in this study. For instance, there was also a trend in the closed-ended responses, presented and discussed in Chapter Five, which indicated that although the majority of respondents supported the incorporation of local knowledge into collaborative problem-solving processes, support decreased as the level of non-scientist involvement and importance of vernacular knowledge increased. Several respondents commented that they felt that vernacular knowledge was not as robust as expert knowledge. Insight as to why these respondents held this opinion could be sought using more intrusive research methods, such as structured interviews and focus groups. For instance, are there one or more underlying factors that affects whether or not stakeholders support the incorporation of local knowledge during problem-solving processes? Insight from this and other questions could be used to develop a better empirical understanding as to why some actors value expert science more than local knowledge, which could in turn provide insight for theory why some individuals are more or less likely to participate in the creation and sharing of vernacular knowledge.

A final consideration for future research concerned the relative importance of relational and geographic factors during the formation of relationships between network members, and the influence of these factors on creation and sharing of knowledge within a network. This research was designed to examine the influence of relational factors in the structure and function of a network, but not the influence of geographic proximity on these processes. Crossley (2010) has proposed that propinquity, or spatial proximity, may play a role in the formation of relational ties within a social network. Although propinquity has not been evaluated using SNA tools, because social network analysis cannot accommodate spatial relationships, the relational data which was collected to construct the social network could also have been used to evaluate the influence of propinquity using other research methods. For example, Segal (1974) evaluated the effect of

propinquity on the formation of friendships between officer candidates based on their spatial proximity of their respective dormitory rooms, and concluded that it had a significant effect on the formation of relationships. However, it would be informative for both theory and empirical research to explore the influence of geographic proximity, possibly using the more intrusive research methods described in combination with spatial research tools such as Geographic Information Systems.

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Appendix A – Survey Questionnaire

SPC Questionnaire

You have been contacted because of your involvement with, or support of, Source Protection Planning in Ontario. The purpose of this survey is to collect information about your experiences related to two key questions concerning Source Protection Planning in Ontario:

1. How are expert science, stakeholder knowledge and community values being integrated within Ontario's source protection planning process?
2. Does Ontario's approach to source protection planning encourage information exchange and knowledge building between experts and stakeholders?

This survey is voluntary. Information you provide will be treated as confidential. Only summary information and statements that are presented anonymously will be reported in publications that result from this research. Leave blank any questions that you do not wish to answer.

You should start the survey when you have 30 to 45 minutes of time to complete it, because you will not be able to stop part way and then return to it.

This study has been reviewed by, and received ethics clearance through, the Office of Research Ethics. If you have any concerns regarding your participation in this study, please contact Dr. Susan Sykes, Director, Office of Research Ethics at ssykes@uwaterloo.ca or 519-888-4567 Ext. 36005.)

Continue

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Section A. Respondent Information

Information you provide will be treated as confidential. Only summary information and statements that are presented anonymously will be reported in publications that result from this research. Leave blank any questions that you do not wish to answer.

1. Are you a source protection committee (SPC) member?

   Yes

Submit

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Section A. Respondent Information (cont)

2. Indicate your SPC role:

- ○ Agriculture representative
- ○ Commercial representative
- ○ Environmental representative
- ○ First Nations representative
- ○ Health representative
- ○ Industrial representative
- ○ Ministry of the Environment
- ○ Municipal government representative
- ○ Public representative
- ○ SPC Chair
- ○ Other (Please explain?)

3. On which SPC are you a member?

Ausable Bayfield Maitland Valley

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Section B. Evaluating the contribution of stakeholders to the Source Water Protection decision making process.

Reminder: Information you provide will be treated as confidential. Only summary information and statements that are presented anonymously will be reported in publications that result from this research. Leave blank any questions that you do not wish to answer.

1. Indicate how strongly you agree or disagree with the following statements about the role of the SPC members when making decisions:

	Strongly Agree	Agree	Neither Agree Nor Disagree	Disagree	Strongly Disagree
a. Input from the SPC members is the basis for determining how the decision making process is undertaken	○	○	○	○	○
b. SPC members influence the scope of decision making that is taken by the SPC	○	○	○	○	○
c. The broader community (e.g., people living in the watershed whose interests may or may not be represented by a SPC member) influences the scope of decision making that is taken by the SPC	○	○	○	○	○
d. SPC members participate actively in the development of technical information	○	○	○	○	○
e. SPC members are able to work with each other and staff to generate locally appropriate solutions	○	○	○	○	○

2. Please provide any suggestions for changing the way the committee operates so that SPC members become more involved in making decisions?

3. Indicate how strongly you agree or disagree with the following statements about the use of technical information:

	Strongly Agree	Agree	Neither Agree Nor Disagree	Disagree	Strongly Disagree
a. SPC members are able to request and receive additional technical information from staff	○	○	○	○	○

b. SPC members freely discuss the benefits and limitations of technical information	○	○	○	○	○
c. SPC members are encouraged to suggest modifications to technical information	○	○	○	○	○
d. SPC members are able to collaborate freely to generate locally appropriate solutions	○	○	○	○	○

4. Please share any example(s) of how SPC members have participated in the development or modification of technical information:

5. Indicate how strongly you agree or disagree with the following statements about the use of local knowledge during the decision making process [local knowledge is defined as knowledge about the watershed that has been gathered by the community through experience, rather than through scientific observation or measurement, over one or more generations].

	Strongly Agree	Agree	Neither Agree Nor Disagree	Disagree	Strongly Disagree
a. SPC members are encouraged to contribute local knowledge	○	○	○	○	○
b. The broader community is encouraged to share local knowledge	○	○	○	○	○
c. The decision making process incorporates both technical and local knowledge	○	○	○	○	○
d. Technical knowledge is modified to reflect local knowledge	○	○	○	○	○
e. Local knowledge is equally valid and important as technical knowledge	○	○	○	○	○

6. Please share any example(s) of local knowledge that were shared by SPC members (e.g., personal knowledge about groundwater quality)?

7. Indicate how strongly you agree or disagree with the following statements about the involvement of SPC members in the decision making process:

	Strongly Agree	Agree	Neither Agree Nor Disagree	Disagree	Strongly Disagree
a. The process builds trust between SPC members	○	○	○	○	○
b. The process encourages SPC members to collaborate with one another in reaching decisions	○	○	○	○	○
c. SPC members are listening more openly to what other SPC members say	○	○	○	○	○
d. The process helps SPC members to achieve a better understanding of the concerns of other SPC members	○	○	○	○	○
e. Collaboration between SPC members and technical staff has improved during the decision making process	○	○	○	○	○

8. Can you provide examples of issues or concerns that cannot be resolved within the decision making process (e.g., restrictions on land use activities)?

9. Indicate how strongly you agree or disagree with the following statement about the role of the SPC Chair:

	Strongly Agree	Agree	Neither Agree Nor Disagree	Disagree	Strongly Disagree
a. The Chair manages diverse views of SPC members effectively	○	○	○	○	○
b. The Chair achieves a balance between allowing SPC members to discuss concerns and meeting desired or mandated timelines	○	○	○	○	○
c. The Chair ensures that all SPC members have an opportunity to contribute to discussion and decision-making	○	○	○	○	○
d. The Chair does not favour one point of view over another	○	○	○	○	○

10. Indicate how strongly you agree or disagree with the following statements about the involvement of SPC members when making decisions:

	Strongly Agree	Agree	Neither Agree Nor Disagree	Disagree	Strongly Disagree
a. The active involvement of SPC members results in better decisions	○	○	○	○	○
b. The active involvement of SPC members creates challenges for the operation of the SPC	○	○	○	○	○
c. The active involvement of SPC members results in conflict between different 'interests' of SPC members	○	○	○	○	○
d. The active involvement of SPC members results in dominance of discussion by a single member or small number of members	○	○	○	○	○

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Section C. Evaluating the role of stakeholder networks in the decision making process

Reminder: Information you provide will be treated as confidential. Only summary information and statements that are presented anonymously will be reported in publications that result from this research. Leave blank any questions that you do not wish to answer.

1. In some cases, SPC members were nominated by local or provincial sector organizations to represent the interests of that sector. Do you think such affiliation with external organizations enhances a member's ability to participate on a local SPC?

   Please Select

   Please explain your answer:

2. Indicate how strongly you agree or disagree with the following statements about the involvement of stakeholder networks:

	Strongly Agree	Agree	Neither Agree Nor Disagree	Disagree	Strongly Disagree
a. Provincial and/or local organizations do interact (e.g., share information) with sector representatives who are also SPC members	○	○	○	○	○
b. Provincial and/or local organizations should interact with sector representatives who are SPC members	○	○	○	○	○
c. The relationship between provincial and/or local organizations and affiliated SPC members is perceived positively by other SPC members	○	○	○	○	○
d. The relationship between SPC members and provincial and/or local organizations is perceived positively by conservation authority staff	○	○	○	○	○
e. SPC members who were nominated by local or provincial organizations are encouraged by other SPC members to maintain relationships with these organizations	○	○	○	○	○

3. Indicate how strongly you agree or disagree with the following statements about the SPC members who have a provincial or local affiliation:

	Strongly Agree	Agree	Neither Agree Nor Disagree	Disagree	Strongly Disagree
a. SPC members who are affiliated with provincial and/or local organizations share knowledge from these organizations with other SPC members	○	○	○	○	○
b. Information provided by provincial and/or local organizations is perceived as beneficial to the decision making process	○	○	○	○	○
c. SPC members affiliated with provincial and/or local organizations are encouraged to share information from provincial and/or local organizations with other SPC members	○	○	○	○	○
d. Information from provincial and/or local organizations is incorporated into the decision making process	○	○	○	○	○
e. Information shared by a SPC member who is affiliated with a provincial and/or local organization has influenced my understanding of a topic that has been discussed by the SPC	○	○	○	○	○
f. The SPC has a formal process to guide the sharing of knowledge between provincial or local organizations and SPC members	○	○	○	○	○

4. Please share any example(s) of external information that has been incorporated into the decision making process:

5. Indicate how strongly you agree or disagree with the following statements about provincial or local organizations that contribute information to SPC members when making decisions:

	Strongly Agree	Agree	Neither Agree Nor Disagree	Disagree	Strongly Disagree
a. There is a role for provincial and local organizations to contribute to local decision making processes, such as local source protection planning	○	○	○	○	○
b. There is value to the SPC decision making process when provincial or local networks provide information to sector representatives who are SPC members	○	○	○	○	○
c. There should be no limitation on the type of information that is shared between provincial or local	○	○	○	○	○

sector organizations and sector representatives who are SPC members					
d. It would be useful to have a formal process to guide the sharing of knowledge between provincial or local organizations and sector representatives who are SPC members	○	○	○	○	○

6. Indicate how strongly you agree or disagree with the following statements about the involvement of the broader community in the decision making process:

	Strongly Agree	Agree	Neither Agree Nor Disagree	Disagree	Strongly Disagree
a. The SPC encourages the formal involvement of persons who are not SPC members to support the decision making process through external venues such as working groups	○	○	○	○	○
b. The SPC provides resources to support these external venues	○	○	○	○	○
c. These external venues are beneficial to the decision making process	○	○	○	○	○
d. Knowledge from these external venues involving persons from the broader community is incorporated into the decision making process	○	○	○	○	○
e. Only SPC members should be involved in the decision making process	○	○	○	○	○

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SPC Questionnaire

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Section D. Mapping Stakeholder Interaction and Information Sharing (cont)

2. Please identify sources of information **within the Ausable Bayfield Maitland Valley SPC** that you use when making decisions, and rate how important they are to you. For each source of information, indicate the importance using the scale shown. Do not rate the individuals that you do not use as a source of information.

Source of Information within the Ausable Bayfield Maitland Valley SPC	Extremely Important	Important	Neither Unimportant nor Important	Unimportant	Extremely Unimportant
Larry Brown	○	○	○	○	○
Marilyn Miltenburg	○	○	○	○	○
Ian Brebner	○	○	○	○	○
Meredith Schneider	○	○	○	○	○
Don Jones	○	○	○	○	○
Jim Nelemans	○	○	○	○	○
Al Hamilton	○	○	○	○	○
Gil Dow	○	○	○	○	○
Keith Black	○	○	○	○	○
John Vander Burgt	○	○	○	○	○
Rowena Wallace	○	○	○	○	○
Matt Pearson	○	○	○	○	○
Bill Rowat	○	○	○	○	○
Mike McElhone	○	○	○	○	○
Karen Galbraith	○	○	○	○	○
Gerry Rupke	○	○	○	○	○
Bob Bressette	○	○	○	○	○
Jim Ginn	○	○	○	○	○
Kennon Johnson	○	○	○	○	○
Bob Worsell	○	○	○	○	○
Cathie Brown	○	○	○	○	○

Tu Van Duong	○	○	○	○	○
Other:	○	○	○	○	○
Other:	○	○	○	○	○
Other:	○	○	○	○	○
Other:	○	○	○	○	○
Other:	○	○	○	○	○
Other:	○	○	○	○	○
Other:	○	○	○	○	○
Other:	○	○	○	○	○
Other:	○	○	○	○	○
Other:	○	○	○	○	○

3. Are there specific individuals **within the Ausable Bayfield Maitland Valley SPC** (e.g., SPC member, staff) who you consider to be an especially important source of information. If so, please provide their name(s), explain their significance, and identify the sector or organization they represent.

4. Please indicate how often you provide information to the following individuals **within the Ausable Bayfield Maitland Valley SPC** using the scale shown:

Information Recipient within the Ausable Bayfield Maitland Valley SPC	**Very Often or Always**	**Often**	**Neither Often nor Seldom**	**Seldom**	**Very Rarely or Never**
Larry Brown	○	○	○	○	○
Marilyn Miltenburg	○	○	○	○	○
Ian Brebner	○	○	○	○	○
Meredith Schneider	○	○	○	○	○
Don Jones	○	○	○	○	○
Jim Nelemans	○	○	○	○	○
Al Hamilton	○	○	○	○	○
Gil Dow	○	○	○	○	○
Keith Black	○	○	○	○	○
John Vander Burgt	○	○	○	○	○

Rowena Wallace	○	○	○	○	○
Matt Pearson	○	○	○	○	○
Bill Rowat	○	○	○	○	○
Mike McElhone	○	○	○	○	○
Karen Galbraith	○	○	○	○	○
Gerry Rupke	○	○	○	○	○
Bob Bressette	○	○	○	○	○
Jim Ginn	○	○	○	○	○
Kennon Johnson	○	○	○	○	○
Bob Worsell	○	○	○	○	○
Cathie Brown	○	○	○	○	○
Tu Van Duong	○	○	○	○	○
Other:	○	○	○	○	○
Other:	○	○	○	○	○
Other:	○	○	○	○	○
Other:	○	○	○	○	○
Other:	○	○	○	○	○
Other:	○	○	○	○	○
Other:	○	○	○	○	○
Other:	○	○	○	○	○
Other:	○	○	○	○	○

Submit Reset

SPC Questionnaire

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Section D. Mapping Stakeholder Interaction and Information Sharing (cont)

5. Please identify sources of information **within the Cataraqui SPC** that you use when making decisions, and rate how important they are to you. For each source of information, indicate the importance using the scale shown. Do not rate the individuals that you do not use as a source of information.

Source of Information within the Cataraqui SPC	Extremely Important	Important	Neither Unimportant nor Important	Unimportant	Extremely Unimportant
John Williamson	○	○	○	○	○
Ric Bresee	○	○	○	○	○
Gary Davidson	○	○	○	○	○
Kevin Riley	○	○	○	○	○
John Conley	○	○	○	○	○
Peter Raabe	○	○	○	○	○
Kim Systema	○	○	○	○	○
Jeff Peters	○	○	○	○	○
Robert Cumming	○	○	○	○	○
Chris Mangan-Greene	○	○	○	○	○
Scott Ewart	○	○	○	○	○
Nona Mariotti	○	○	○	○	○
Rick Lingren	○	○	○	○	○
Kathleen Laird	○	○	○	○	○
Alex Palilionis	○	○	○	○	○
Jacques Labelle	○	○	○	○	○
Allan McPhail	○	○	○	○	○
Joan Green	○	○	○	○	○
Rob McRae	○	○	○	○	○
Wendy Lavender	○	○	○	○	○
Other:	○	○	○	○	○

Other:	○	○	○	○	○
Other:	○	○	○	○	○
Other:	○	○	○	○	○
Other:	○	○	○	○	○
Other:	○	○	○	○	○
Other:	○	○	○	○	○
Other:	○	○	○	○	○
Other:	○	○	○	○	○
Other:	○	○	○	○	○

6. Are there specific individuals **within the Cataraqui SPC** (e.g., SPC member, staff) who you consider to be an especially important source of information. If so, please provide their name (s), explain their significance, and identify the sector or organization they represent.

7. Please indicate how often you provide information to the following individuals **within the Cataraqui SPC** using the scale shown:

Information Recipient within the Cataraqui SPC	**Very Often or Always**	**Often**	**Neither Often nor Seldom**	**Seldom**	**Very Rarely or Never**
John Williamson	○	○	○	○	○
Ric Bresee	○	○	○	○	○
Gary Davidson	○	○	○	○	○
Kevin Riley	○	○	○	○	○
John Conley	○	○	○	○	○
Peter Raabe	○	○	○	○	○
Kim Systema	○	○	○	○	○
Jeff Peters	○	○	○	○	○
Robert Cumming	○	○	○	○	○
Chris Mangan-Greene	○	○	○	○	○
Scott Ewart	○	○	○	○	○
Nona Mariotti	○	○	○	○	○
Rick Lingren	○	○	○	○	○

Kathleen Laird	○	○	○	○	○
Alex Palilionis	○	○	○	○	○
Jacques Labelle	○	○	○	○	○
Allan McPhail	○	○	○	○	○
Joan Green	○	○	○	○	○
Rob McRae	○	○	○	○	○
Wendy Lavender	○	○	○	○	○
Other:	○	○	○	○	○
Other:	○	○	○	○	○
Other:	○	○	○	○	○
Other:	○	○	○	○	○
Other:	○	○	○	○	○
Other:	○	○	○	○	○
Other:	○	○	○	○	○
Other:	○	○	○	○	○
Other:	○	○	○	○	○
Other:	○	○	○	○	○

Submit Reset

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Section D. Mapping Stakeholder Interaction and Information Sharing (cont)

8. Please identify sources of information **within the CTC SPC** that you use when making decisions, and rate how important they are to you. For each source of information, indicate the importance using the scale shown. Do not rate the individuals that you do not use as a source of information.

Source of Information within the CTC SPC	Extremely Important	Important	Neither Unimportant nor Important	Unimportant	Extremely Unimportant
Susan Self	○	○	○	○	○
David Kentner	○	○	○	○	○
Mark Schiller	○	○	○	○	○
Robert Burnside	○	○	○	○	○
Laura McDowell	○	○	○	○	○
Michael D'Andrea	○	○	○	○	○
Howard Shapiro	○	○	○	○	○
John Presta	○	○	○	○	○
Louise Foster	○	○	○	○	○
Andrea Bourrie	○	○	○	○	○
Wendy Burgess	○	○	○	○	○
Doug Brown	○	○	○	○	○
Heather Laidlaw	○	○	○	○	○
Peter Miasek	○	○	○	○	○
Lynne Moore	○	○	○	○	○
Juli Aboucher	○	○	○	○	○
Michael Garret	○	○	○	○	○
Jessica Ginsburg	○	○	○	○	○
Robert Goodings	○	○	○	○	○
Irv Harrell	○	○	○	○	○
Peter Orphanos	○	○	○	○	○

Fred Ruf	○	○	○	○	○
Kate Turner	○	○	○	○	○
Brian Denney	○	○	○	○	○
Norine Schofield	○	○	○	○	○
Bev Thorpe	○	○	○	○	○
Other:	○	○	○	○	○
Other:	○	○	○	○	○
Other:	○	○	○	○	○
Other:	○	○	○	○	○
Other:	○	○	○	○	○
Other:	○	○	○	○	○
Other:	○	○	○	○	○
Other:	○	○	○	○	○
Other:	○	○	○	○	○
Other:	○	○	○	○	○

9. Are there specific individuals **within the CTC SPC** (e.g., SPC member, staff) who you consider to be an especially important source of information. If so, please provide their name (s), explain their significance, and identify the sector or organization they represent.

10. Please indicate how often you provide information to the following individuals **within the CTC SPC** using the scale shown:

Information Recipient within the CTC SPC	**Very Often or Always**	**Often**	**Neither Often nor Seldom**	**Seldom**	**Very Rarely or Never**
Susan Self	○	○	○	○	○
David Kentner	○	○	○	○	○
Mark Schiller	○	○	○	○	○
Robert Burnside	○	○	○	○	○
Laura McDowell	○	○	○	○	○
Michael D'Andrea	○	○	○	○	○
Howard Shapiro	○	○	○	○	○

John Presta	○	○	○	○	○
Louise Foster	○	○	○	○	○
Andrea Bourrie	○	○	○	○	○
Wendy Burgess	○	○	○	○	○
Doug Brown	○	○	○	○	○
Heather Laidlaw	○	○	○	○	○
Peter Miasek	○	○	○	○	○
Lynne Moore	○	○	○	○	○
Juli Aboucher	○	○	○	○	○
Michael Garret	○	○	○	○	○
Jessica Ginsburg	○	○	○	○	○
Robert Goodings	○	○	○	○	○
Irv Harrell	○	○	○	○	○
Peter Orphanos	○	○	○	○	○
Fred Ruf	○	○	○	○	○
Kate Turner	○	○	○	○	○
Brian Denney	○	○	○	○	○
Norine Schofield	○	○	○	○	○
Bev Thorpe	○	○	○	○	○
Other:	○	○	○	○	○
Other:	○	○	○	○	○
Other:	○	○	○	○	○
Other:	○	○	○	○	○
Other:	○	○	○	○	○
Other:	○	○	○	○	○
Other:	○	○	○	○	○
Other:	○	○	○	○	○
Other:	○	○	○	○	○
Other:	○	○	○	○	○

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Section D. Mapping Stakeholder Interaction and Information Sharing (cont)

11. Please identify sources of information **within the Essex SPC** that you use when making decisions, and rate how important they are to you. For each source of information, indicate the importance using the scale shown. Do not rate the individuals that you do not use as a source of information.

Source of Information within the Essex SPC	Extremely Important	Important	Neither Unimportant nor Important	Unimportant	Extremely Unimportant
Tom Fuerth	○	○	○	○	○
Charles McLean	○	○	○	○	○
Thom Hunt	○	○	○	○	○
Gord Queen	○	○	○	○	○
Mario Sonego	○	○	○	○	○
Lou Zarlenga	○	○	○	○	○
John Barnett	○	○	○	○	○
Hans Peter Pfeifer	○	○	○	○	○
Larry Verbeke	○	○	○	○	○
Jim Vincent	○	○	○	○	○
David Watsa	○	○	○	○	○
Robert Auger	○	○	○	○	○
Tim Mousseau	○	○	○	○	○
Andrew Pula	○	○	○	○	○
Ashley Stevenson	○	○	○	○	○
John Stuart	○	○	○	○	○
Stan Taylor	○	○	○	○	○
Teresa McLellan	○	○	○	○	○
Ron Rogers	○	○	○	○	○
Deb Bennett	○	○	○	○	○
Other:	○	○	○	○	○

Other:	○	○	○	○	○
Other:	○	○	○	○	○
Other:	○	○	○	○	○
Other:	○	○	○	○	○
Other:	○	○	○	○	○
Other:	○	○	○	○	○
Other:	○	○	○	○	○
Other:	○	○	○	○	○
Other:	○	○	○	○	○

12. Are there specific individuals **within the Essex SPC** (e.g., SPC member, staff) who you consider to be an especially important source of information. If so, please provide their name (s), explain their significance, and identify the sector or organization they represent.

13. Please indicate how often you provide information to the following individuals **within the Essex SPC** using the scale shown:

Information Recipient within the Essex SPC	**Very Often or Always**	**Often**	**Neither Often nor Seldom**	**Seldom**	**Very Rarely or Never**
Tom Fuerth	○	○	○	○	○
Charles McLean	○	○	○	○	○
Thom Hunt	○	○	○	○	○
Gord Queen	○	○	○	○	○
Mario Sonego	○	○	○	○	○
Lou Zarlenga	○	○	○	○	○
John Barnett	○	○	○	○	○
Hans Peter Pfeifer	○	○	○	○	○
Larry Verbeke	○	○	○	○	○
Jim Vincent	○	○	○	○	○
David Watsa	○	○	○	○	○
Robert Auger	○	○	○	○	○
Tim Mousseau	○	○	○	○	○

Andrew Pula	○	○	○	○	○
Ashley Stevenson	○	○	○	○	○
John Stuart	○	○	○	○	○
Stan Taylor	○	○	○	○	○
Teresa McLellan	○	○	○	○	○
Ron Rogers	○	○	○	○	○
Deb Bennett	○	○	○	○	○
Other:	○	○	○	○	○
Other:	○	○	○	○	○
Other:	○	○	○	○	○
Other:	○	○	○	○	○
Other:	○	○	○	○	○
Other:	○	○	○	○	○
Other:	○	○	○	○	○
Other:	○	○	○	○	○
Other:	○	○	○	○	○
Other:	○	○	○	○	○

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Section D. Mapping Stakeholder Interaction and Information Sharing (cont)

14. Please identify sources of information **within the Halton-Hamilton SPC** that you use when making decisions, and rate how important they are to you. For each source of information, indicate the importance using the scale shown. Do not rate the individuals that you do not use as a source of information.

Source of Information within the Halton-Hamilton SPC	Extremely Important	Important	Neither Unimportant nor Important	Unimportant	Extremely Unimportant
Doug Cuthbert	○	○	○	○	○
Barry Lee	○	○	○	○	○
Jacqueline Weston	○	○	○	○	○
Chris Shrive	○	○	○	○	○
Margaret McCarthy	○	○	○	○	○
Susan Felding	○	○	○	○	○
Nick DiGirolamo	○	○	○	○	○
Gavin Smuk	○	○	○	○	○
Melanie Horton	○	○	○	○	○
Teri Yamada	○	○	○	○	○
Peter Ashenhurst	○	○	○	○	○
Paul Attack	○	○	○	○	○
Turlough Finan	○	○	○	○	○
Dave Braden	○	○	○	○	○
Adam Kuehnbaum	○	○	○	○	○
Glenn Powell	○	○	○	○	○
Dianne Bloomfield	○	○	○	○	○
John Westlake	○	○	○	○	○
Nicole Mathews	○	○	○	○	○
Kathy Menyes	○	○	○	○	○
Other:	○	○	○	○	○

Other:	○	○	○	○	○
Other:	○	○	○	○	○
Other:	○	○	○	○	○
Other:	○	○	○	○	○
Other:	○	○	○	○	○
Other:	○	○	○	○	○
Other:	○	○	○	○	○
Other:	○	○	○	○	○
Other:	○	○	○	○	○

15. Are there specific individuals **within the Halton-Hamilton SPC** (e.g., SPC member, staff) who you consider to be an especially important source of information. If so, please provide their name(s), explain their significance, and identify the sector or organization they represent.

16. Please indicate how often you provide information to the following individuals **within the Halton-Hamilton SPC** using the scale shown:

Information Recipient within the Halton-Hamilton SPC	**Very Often or Always**	**Often**	**Neither Often nor Seldom**	**Seldom**	**Very Rarely or Never**
Doug Cuthbert	○	○	○	○	○
Barry Lee	○	○	○	○	○
Jacqueline Weston	○	○	○	○	○
Chris Shrive	○	○	○	○	○
Margaret McCarthy	○	○	○	○	○
Susan Felding	○	○	○	○	○
Nick DiGirolamo	○	○	○	○	○
Gavin Smuk	○	○	○	○	○
Melanie Horton	○	○	○	○	○
Teri Yamada	○	○	○	○	○
Peter Ashenhurst	○	○	○	○	○
Paul Attack	○	○	○	○	○
Turlough Finan	○	○	○	○	○

Dave Braden	○	○	○	○	○
Adam Kuehnbaum	○	○	○	○	○
Glenn Powell	○	○	○	○	○
Dianne Bloomfield	○	○	○	○	○
John Westlake	○	○	○	○	○
Nicole Mathews	○	○	○	○	○
Kathy Menyes	○	○	○	○	○
Other:	○	○	○	○	○
Other:	○	○	○	○	○
Other:	○	○	○	○	○
Other:	○	○	○	○	○
Other:	○	○	○	○	○
Other:	○	○	○	○	○
Other:	○	○	○	○	○
Other:	○	○	○	○	○
Other:	○	○	○	○	○
Other:	○	○	○	○	○

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17. Please identify sources of information **within the Lake Erie SPC** that you use when making decisions, and rate how important they are to you. For each source of information, indicate the importance using the scale shown. Do not rate the individuals that you do not use as a source of information.

Source of Information within the Lake Erie SPC	Extremely Important	Important	Neither Unimportant nor Important	Unimportant	Extremely Unimportant
Craig Ashbaugh	○	○	○	○	○
Dale Murray	○	○	○	○	○
Janet Laird	○	○	○	○	○
Thomas Schmidt	○	○	○	○	○
Roy Haggart	○	○	○	○	○
Jim Oliver	○	○	○	○	○
Howard Cornwell	○	○	○	○	○
Lloyd Perrin	○	○	○	○	○
Bill Ungar	○	○	○	○	○
Ian MacDonald	○	○	○	○	○
Ralph Krueger	○	○	○	○	○
Mark Wales	○	○	○	○	○
Ken Hunsberger	○	○	○	○	○
David Parker	○	○	○	○	○
Richard Seibel	○	○	○	○	○
Marguerite Ceschi-Smith	○	○	○	○	○
Wendy Wright-Cascaden	○	○	○	○	○
Donald Woolcott	○	○	○	○	○
John Harrison	○	○	○	○	○
Mark Goldberg	○	○	○	○	○
Andrew Henry	○	○	○	○	○

Geoff Rae	○	○	○	○	○
Chief Bryan LaForme	○	○	○	○	○
Paul General	○	○	○	○	○
Christopher Martin	○	○	○	○	○
Lorrie Minshall	○	○	○	○	○
Martin Keller	○	○	○	○	○
Alan Dale	○	○	○	○	○
Tu Van Duong	○	○	○	○	○
Other:	○	○	○	○	○
Other:	○	○	○	○	○
Other:	○	○	○	○	○
Other:	○	○	○	○	○
Other:	○	○	○	○	○
Other:	○	○	○	○	○
Other:	○	○	○	○	○
Other:	○	○	○	○	○
Other:	○	○	○	○	○
Other:	○	○	○	○	○

18. Are there specific individuals **within the Lake Erie SPC** (e.g., SPC member, staff) who you consider to be an especially important source of information. If so, please provide their name (s), explain their significance, and identify the sector or organization they represent.

19. Please indicate how often you provide information to the following individuals **within the Lake Erie SPC** using the scale shown:

Information Recipient within the Lake Erie SPC	**Very Often or Always**	**Often**	**Neither Often nor Seldom**	**Seldom**	**Very Rarely or Never**
Craig Ashbaugh	○	○	○	○	○
Dale Murray	○	○	○	○	○
Janet Laird	○	○	○	○	○
Thomas Schmidt	○	○	○	○	○

Roy Haggart	○	○	○	○	○
Jim Oliver	○	○	○	○	○
Howard Cornwell	○	○	○	○	○
Lloyd Perrin	○	○	○	○	○
Bill Ungar	○	○	○	○	○
Ian MacDonald	○	○	○	○	○
Ralph Krueger	○	○	○	○	○
Mark Wales	○	○	○	○	○
Ken Hunsberger	○	○	○	○	○
David Parker	○	○	○	○	○
Richard Seibel	○	○	○	○	○
Marguerite Ceschi-Smith	○	○	○	○	○
Wendy Wright-Cascaden	○	○	○	○	○
Donald Woolcott	○	○	○	○	○
John Harrison	○	○	○	○	○
Mark Goldberg	○	○	○	○	○
Andrew Henry	○	○	○	○	○
Geoff Rae	○	○	○	○	○
Chief Bryan LaForme	○	○	○	○	○
Paul General	○	○	○	○	○
Christopher Martin	○	○	○	○	○
Lorrie Minshall	○	○	○	○	○
Martin Keller	○	○	○	○	○
Alan Dale	○	○	○	○	○
Tu Van Duong	○	○	○	○	○
Other:	○	○	○	○	○
Other:	○	○	○	○	○
Other:	○	○	○	○	○
Other:	○	○	○	○	○
Other:	○	○	○	○	○
Other:	○	○	○	○	○
Other:	○	○	○	○	○
Other:	○	○	○	○	○
Other:	○	○	○	○	○
Other:	○	○	○	○	○

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Section D. Mapping Stakeholder Interaction and Information Sharing (cont)

20. Please identify sources of information **within the Lakehead SPC** that you use when making decisions, and rate how important they are to you. For each source of information, indicate the importance using the scale shown. Do not rate the individuals that you do not use as a source of information.

Source of Information within the Lakehead SPC	Extremely Important	Important	Neither Unimportant nor Important	Unimportant	Extremely Unimportant
Bob Hartley	○	○	○	○	○
Ken McWhirter	○	○	○	○	○
Guy Jarvis	○	○	○	○	○
Robert Stewart	○	○	○	○	○
James Vukmanich	○	○	○	○	○
Hartley Multamaki	○	○	○	○	○
Paul McAlister	○	○	○	○	○
Veikko Long	○	○	○	○	○
Bernie Kamhof	○	○	○	○	○
Ross Chuchman	○	○	○	○	○
Rowena Wallace	○	○	○	○	○
Tu Van Dong	○	○	○	○	○
Mervi Henttonen	○	○	○	○	○
Chris Beveridge	○	○	○	○	○
Melanie Mathieson	○	○	○	○	○
Other:	○	○	○	○	○
Other:	○	○	○	○	○
Other:	○	○	○	○	○
Other:	○	○	○	○	○
Other:	○	○	○	○	○
Other:	○	○	○	○	○

Other:	○	○	○	○	○
Other:	○	○	○	○	○
Other:	○	○	○	○	○
Other:	○	○	○	○	○

21. Are there specific individuals **within the Lakehead SPC** (e.g., SPC member, staff) who you consider to be an especially important source of information. If so, please provide their name (s), explain their significance, and identify the sector or organization they represent.

22. Please indicate how often you provide information to the following individuals **within the Lakehead SPC** using the scale shown:

Information Recipient within the Lakehead SPC	**Very Often or Always**	**Often**	**Neither Often nor Seldom**	**Seldom**	**Very Rarely or Never**
Bob Hartley	○	○	○	○	○
Ken McWhirter	○	○	○	○	○
Guy Jarvis	○	○	○	○	○
Robert Stewart	○	○	○	○	○
James Vukmanich	○	○	○	○	○
Hartley Multamaki	○	○	○	○	○
Paul McAlister	○	○	○	○	○
Veikko Long	○	○	○	○	○
Bernie Kamhof	○	○	○	○	○
Ross Chuchman	○	○	○	○	○
Rowena Wallace	○	○	○	○	○
Tu Van Dong	○	○	○	○	○
Mervi Henttonen	○	○	○	○	○
Chris Beveridge	○	○	○	○	○
Melanie Mathieson	○	○	○	○	○
Other:	○	○	○	○	○
Other:	○	○	○	○	○
Other:	○	○	○	○	○

Other:	○	○	○	○	○
Other:	○	○	○	○	○
Other:	○	○	○	○	○
Other:	○	○	○	○	○
Other:	○	○	○	○	○
Other:	○	○	○	○	○
Other:	○	○	○	○	○

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Section D. Mapping Stakeholder Interaction and Information Sharing (cont)

23. Please identify sources of information **within the Mattagami SPC** that you use when making decisions, and rate how important they are to you. For each source of information, indicate the importance using the scale shown. Do not rate the individuals that you do not use as a source of information.

Source of Information within the Mattagami SPC	Extremely Important	Important	Neither Unimportant nor Important	Unimportant	Extremely Unimportant
George Hughes	○	○	○	○	○
Luc Duval	○	○	○	○	○
Janet Ronne	○	○	○	○	○
Kenneth Gibson	○	○	○	○	○
Susan Rapin	○	○	○	○	○
Alan Thorne	○	○	○	○	○
Ken Tylee	○	○	○	○	○
Roger Carriere	○	○	○	○	○
Danys Racicot	○	○	○	○	○
Lou Bennett	○	○	○	○	○
Chris Mckay	○	○	○	○	○
John Westlake	○	○	○	○	○
Joe Evers	○	○	○	○	○
Other:	○	○	○	○	○
Other:	○	○	○	○	○
Other:	○	○	○	○	○
Other:	○	○	○	○	○
Other:	○	○	○	○	○
Other:	○	○	○	○	○
Other:	○	○	○	○	○

Other:	○	○	○	○	○
Other:	○	○	○	○	○
Other:	○	○	○	○	○

24. Are there specific individuals **within the Mattagami SPC** (e.g., SPC member, staff) who you consider to be an especially important source of information. If so, please provide their name (s), explain their significance, and identify the sector or organization they represent.

25. Please indicate how often you provide information to the following individuals **within the Mattagami SPC** using the scale shown:

Information Recipient within the Mattagami SPC	Very Often or Always	Often	Neither Often nor Seldom	Seldom	Very Rarely or Never
George Hughes	○	○	○	○	○
Luc Duval	○	○	○	○	○
Janet Ronne	○	○	○	○	○
Kenneth Gibson	○	○	○	○	○
Susan Rapin	○	○	○	○	○
Alan Thorne	○	○	○	○	○
Ken Tylee	○	○	○	○	○
Roger Carriere	○	○	○	○	○
Danys Racicot	○	○	○	○	○
Lou Bennett	○	○	○	○	○
Chris Mckay	○	○	○	○	○
John Westlake	○	○	○	○	○
Joe Evers	○	○	○	○	○
Other:	○	○	○	○	○
Other:	○	○	○	○	○
Other:	○	○	○	○	○
Other:	○	○	○	○	○
Other:	○	○	○	○	○
Other:	○	○	○	○	○

Other:	○	○	○	○	○
Other:	○	○	○	○	○
Other:	○	○	○	○	○
Other:	○	○	○	○	○

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Other:	○	○	○	○	○
Other:	○	○	○	○	○
Other:	○	○	○	○	○
Other:	○	○	○	○	○
Other:	○	○	○	○	○
Other:	○	○	○	○	○
Other:	○	○	○	○	○
Other:	○	○	○	○	○
Other:	○	○	○	○	○
Other:	○	○	○	○	○

27. Are there specific individuals **within the Mississippi-Rideau SPC** (e.g., SPC member, staff) who you consider to be an especially important source of information. If so, please provide their name(s), explain their significance, and identify the sector or organization they represent.

28. Please indicate how often you provide information to the following individuals **within the Mississippi-Rideau SPC** using the scale shown:

Information Recipient within the Mississippi-Rideau SPC	**Very Often or Always**	**Often**	**Neither Often nor Seldom**	**Seldom**	**Very Rarely or Never**
Janet Stavinga	○	○	○	○	○
Scott Bryce	○	○	○	○	○
Paul Knowles	○	○	○	○	○
Christine Leadman	○	○	○	○	○
Eleanor Renaud	○	○	○	○	○
Tammy Rose	○	○	○	○	○
Scott Berquist	○	○	○	○	○
Drew Lampman	○	○	○	○	○
Richard Fraser	○	○	○	○	○
Peter McLaren	○	○	○	○	○
Beverly Millar	○	○	○	○	○
George Braithwaite	○	○	○	○	○

Carole Dillon	○	○	○	○	○
Patricia Larkin	○	○	○	○	○
Randy Malcolm	○	○	○	○	○
Brian Stratton	○	○	○	○	○
Sommer Casgrain-Robertson	○	○	○	○	○
Jean-Guy Albert	○	○	○	○	○
Mary Wooding	○	○	○	○	○
Mark Burnham	○	○	○	○	○
Alan Arbuckle	○	○	○	○	○
Other:	○	○	○	○	○
Other:	○	○	○	○	○
Other:	○	○	○	○	○
Other:	○	○	○	○	○
Other:	○	○	○	○	○
Other:	○	○	○	○	○
Other:	○	○	○	○	○
Other:	○	○	○	○	○
Other:	○	○	○	○	○
Other:	○	○	○	○	○

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29. Please identify sources of information **within the Niagara Peninsula SPC** that you use when making decisions, and rate how important they are to you. For each source of information, indicate the importance using the scale shown. Do not rate the individuals that you do not use as a source of information.

Source of Information within the Niagara Peninsula SPC	Extremely Important	Important	Neither Unimportant nor Important	Unimportant	Extremely Unimportant
Mark Neufeld	○	○	○	○	○
Tim Rigby	○	○	○	○	○
Don Ricker	○	○	○	○	○
Chris Shrive	○	○	○	○	○
Robert Bator	○	○	○	○	○
Maria Bellantino	○	○	○	○	○
Brian Antonsen	○	○	○	○	○
David Renshaw	○	○	○	○	○
Dean Ostryhon	○	○	○	○	○
Erwin Schneider	○	○	○	○	○
Glen Hudgin	○	○	○	○	○
Maeve McHugh	○	○	○	○	○
Brian Baty	○	○	○	○	○
Brian Wright	○	○	○	○	○
Other:	○	○	○	○	○
Other:	○	○	○	○	○
Other:	○	○	○	○	○
Other:	○	○	○	○	○
Other:	○	○	○	○	○
Other:	○	○	○	○	○
Other:	○	○	○	○	○

Other:	○	○	○	○	○
Other:	○	○	○	○	○
Other:	○	○	○	○	○

30. Are there specific individuals **within the Niagara Peninsula SPC** (e.g., SPC member, staff) who you consider to be an especially important source of information. If so, please provide their name(s), explain their significance, and identify the sector or organization they represent.

31. Please indicate how often you provide information to the following individuals **within the Niagara Peninsula SPC** using the scale shown:

Information Recipient within the Niagara Peninsula SPC	**Very Often or Always**	**Often**	**Neither Often nor Seldom**	**Seldom**	**Very Rarely or Never**
Mark Neufeld	○	○	○	○	○
Tim Rigby	○	○	○	○	○
Don Ricker	○	○	○	○	○
Chris Shrive	○	○	○	○	○
Robert Bator	○	○	○	○	○
Maria Bellantino	○	○	○	○	○
Brian Antonsen	○	○	○	○	○
David Renshaw	○	○	○	○	○
Dean Ostryhon	○	○	○	○	○
Erwin Schneider	○	○	○	○	○
Glen Hudgin	○	○	○	○	○
Maeve McHugh	○	○	○	○	○
Brian Baty	○	○	○	○	○
Brian Wright	○	○	○	○	○
Other:	○	○	○	○	○
Other:	○	○	○	○	○
Other:	○	○	○	○	○
Other:	○	○	○	○	○
Other:	○	○	○	○	○

Other:	○	○	○	○	○
Other:	○	○	○	○	○
Other:	○	○	○	○	○
Other:	○	○	○	○	○
Other:	○	○	○	○	○

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Section D. Mapping Stakeholder Interaction and Information Sharing (cont)

32. Please identify sources of information **within the North Bay-Mattawa SPC** that you use when making decisions, and rate how important they are to you. For each source of information, indicate the importance using the scale shown. Do not rate the individuals that you do not use as a source of information.

Source of Information within the North Bay-Mattawa SPC	Extremely Important	Important	Neither Unimportant nor Important	Unimportant	Extremely Unimportant
Barbara Groves	○	○	○	○	○
Lucy Emmott	○	○	○	○	○
Ian Kilgour	○	○	○	○	○
Dennis MacDonald	○	○	○	○	○
John MacLachlan	○	○	○	○	○
George Onley	○	○	○	○	○
Maurice Schlosser	○	○	○	○	○
George Stivrins	○	○	○	○	○
Laura Therrien	○	○	○	○	○
Roy Warriner	○	○	○	○	○
Neil Gervais	○	○	○	○	○
Sue Miller	○	○	○	○	○
Chuck Poltz	○	○	○	○	○
Other:	○	○	○	○	○
Other:	○	○	○	○	○
Other:	○	○	○	○	○
Other:	○	○	○	○	○
Other:	○	○	○	○	○
Other:	○	○	○	○	○
Other:	○	○	○	○	○

Other:	○	○	○	○	○
Other:	○	○	○	○	○
Other:	○	○	○	○	○

33. Are there specific individuals **within the North Bay-Mattawa SPC** (e.g., SPC member, staff) who you consider to be an especially important source of information. If so, please provide their name(s), explain their significance, and identify the sector or organization they represent.

34. Please indicate how often you provide information to the following individuals **within the North Bay-Mattawa SPC** using the scale shown:

Information Recipient within the North Bay-Mattawa SPC	**Very Often or Always**	**Often**	**Neither Often nor Seldom**	**Seldom**	**Very Rarely or Never**
Barbara Groves	○	○	○	○	○
Lucy Emmott	○	○	○	○	○
Ian Kilgour	○	○	○	○	○
Dennis MacDonald	○	○	○	○	○
John MacLachlan	○	○	○	○	○
George Onley	○	○	○	○	○
Maurice Schlosser	○	○	○	○	○
George Stivrins	○	○	○	○	○
Laura Therrien	○	○	○	○	○
Roy Warriner	○	○	○	○	○
Neil Gervais	○	○	○	○	○
Sue Miller	○	○	○	○	○
Chuck Poltz	○	○	○	○	○
Other:	○	○	○	○	○
Other:	○	○	○	○	○
Other:	○	○	○	○	○
Other:	○	○	○	○	○
Other:	○	○	○	○	○
Other:	○	○	○	○	○

Other:	○	○	○	○	○
Other:	○	○	○	○	○
Other:	○	○	○	○	○
Other:	○	○	○	○	○

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Section D. Mapping Stakeholder Interaction and Information Sharing (cont)

35. Please identify sources of information **within the Quinte SPC** that you use when making decisions, and rate how important they are to you. For each source of information, indicate the importance using the scale shown. Do not rate the individuals that you do not use as a source of information.

Source of Information within the Quinte SPC	Extremely Important	Important	Neither Unimportant nor Important	Unimportant	Extremely Unimportant
Max Christie	○	○	○	○	○
Ron Hamilton	○	○	○	○	○
Sandy Latchford	○	○	○	○	○
Garnet Thompson	○	○	○	○	○
Clarence Zieman	○	○	○	○	○
Jo-Anne Albert	○	○	○	○	○
Angela Genereaux	○	○	○	○	○
Rahumathulla Marikkar	○	○	○	○	○
Gary Fox	○	○	○	○	○
Heather Lang	○	○	○	○	○
Terry Shea	○	○	○	○	○
Terry Kennedy	○	○	○	○	○
Mel Plewes	○	○	○	○	○
Doug Parker	○	○	○	○	○
Eric Bauer	○	○	○	○	○
Phillip Norton	○	○	○	○	○
Todd Krig	○	○	○	○	○
Curtis Maracle	○	○	○	○	○
Roger Cole	○	○	○	○	○
Andrew Landy	○	○	○	○	○
Wendy Lavender	○	○	○	○	○

Keith Taylor	○	○	○	○	○
Other:	○	○	○	○	○
Other:	○	○	○	○	○
Other:	○	○	○	○	○
Other:	○	○	○	○	○
Other:	○	○	○	○	○
Other:	○	○	○	○	○
Other:	○	○	○	○	○
Other:	○	○	○	○	○
Other:	○	○	○	○	○
Other:	○	○	○	○	○

36. Are there specific individuals **within the Quinte SPC** (e.g., SPC member, staff) who you consider to be an especially important source of information. If so, please provide their name (s), explain their significance, and identify the sector or organization they represent.

37. Please indicate how often you provide information to the following individuals **within the Quinte SPC** using the scale shown:

Information Recipient within the Quinte SPC	**Very Often or Always**	**Often**	**Neither Often nor Seldom**	**Seldom**	**Very Rarely or Never**
Max Christie	○	○	○	○	○
Ron Hamilton	○	○	○	○	○
Sandy Latchford	○	○	○	○	○
Garnet Thompson	○	○	○	○	○
Clarence Zieman	○	○	○	○	○
Jo-Anne Albert	○	○	○	○	○
Angela Genereaux	○	○	○	○	○
Rahumathulla Marikkar	○	○	○	○	○
Gary Fox	○	○	○	○	○
Heather Lang	○	○	○	○	○
Terry Shea	○	○	○	○	○

Terry Kennedy	○	○	○	○	○
Mel Plewes	○	○	○	○	○
Doug Parker	○	○	○	○	○
Eric Bauer	○	○	○	○	○
Phillip Norton	○	○	○	○	○
Todd Krig	○	○	○	○	○
Curtis Maracle	○	○	○	○	○
Roger Cole	○	○	○	○	○
Andrew Landy	○	○	○	○	○
Wendy Lavender	○	○	○	○	○
Keith Taylor	○	○	○	○	○
Other:	○	○	○	○	○
Other:	○	○	○	○	○
Other:	○	○	○	○	○
Other:	○	○	○	○	○
Other:	○	○	○	○	○
Other:	○	○	○	○	○
Other:	○	○	○	○	○
Other:	○	○	○	○	○
Other:	○	○	○	○	○
Other:	○	○	○	○	○

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Section D. Mapping Stakeholder Interaction and Information Sharing (cont)

38. Please identify sources of information **within the Raisin Region South Nation SPC** that you use when making decisions, and rate how important they are to you. For each source of information, indicate the importance using the scale shown. Do not rate the individuals that you do not use as a source of information.

Source of Information within the Raisin Region South Nation SPC	Extremely Important	Important	Neither Unimportant nor Important	Unimportant	Extremely Unimportant
Claude Cousineau	○	○	○	○	○
Chris McDonell	○	○	○	○	○
Mary McCuaig	○	○	○	○	○
Glenn Mackey	○	○	○	○	○
Norm Levac	○	○	○	○	○
Shawn McRae	○	○	○	○	○
Bill Smirle	○	○	○	○	○
Brian Powell	○	○	○	○	○
Joel Potvin	○	○	○	○	○
Margaret Taylor	○	○	○	○	○
Ray Beauregard	○	○	○	○	○
Walter Oeggerli	○	○	○	○	○
Jacqueline Pemberton	○	○	○	○	○
Don Munro	○	○	○	○	○
Tom Van Dusen	○	○	○	○	○
Robert Sarrazin	○	○	○	○	○
Lawrence Levere	○	○	○	○	○
Mary Wooding	○	○	○	○	○
Richard Pilon	○	○	○	○	○
Other:	○	○	○	○	○
Other:	○	○	○	○	○

Other:	○	○	○	○	○
Other:	○	○	○	○	○
Other:	○	○	○	○	○
Other:	○	○	○	○	○
Other:	○	○	○	○	○
Other:	○	○	○	○	○
Other:	○	○	○	○	○
Other:	○	○	○	○	○

39. Are there specific individuals **within the Raisin Region South Nation SPC** (e.g., SPC member, staff) who you consider to be an especially important source of information. If so, please provide their name(s), explain their significance, and identify the sector or organization they represent.

40. Please indicate how often you provide information to the following individuals **within the Raisin Region South Nation SPC** using the scale shown:

Information Recipient within the Raisin Region South Nation SPC	**Very Often or Always**	**Often**	**Neither Often nor Seldom**	**Seldom**	**Very Rarely or Never**
Claude Cousineau	○	○	○	○	○
Chris McDonell	○	○	○	○	○
Mary McCuaig	○	○	○	○	○
Glenn Mackey	○	○	○	○	○
Norm Levac	○	○	○	○	○
Shawn McRae	○	○	○	○	○
Bill Smirle	○	○	○	○	○
Brian Powell	○	○	○	○	○
Joel Potvin	○	○	○	○	○
Margaret Taylor	○	○	○	○	○
Ray Beauregard	○	○	○	○	○
Walter Oeggerli	○	○	○	○	○
Jacqueline Pemberton	○	○	○	○	○

Don Munro	○	○	○	○	○
Tom Van Dusen	○	○	○	○	○
Robert Sarrazin	○	○	○	○	○
Lawrence Levere	○	○	○	○	○
Mary Wooding	○	○	○	○	○
Richard Pilon	○	○	○	○	○
Other:	○	○	○	○	○
Other:	○	○	○	○	○
Other:	○	○	○	○	○
Other:	○	○	○	○	○
Other:	○	○	○	○	○
Other:	○	○	○	○	○
Other:	○	○	○	○	○
Other:	○	○	○	○	○
Other:	○	○	○	○	○
Other:	○	○	○	○	○

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Section D. Mapping Stakeholder Interaction and Information Sharing (cont)

41. Please identify sources of information **within the Saugeen, Grey Sauble Northern Bruce Peninsula SPC** that you use when making decisions, and rate how important they are to you. For each source of information, indicate the importance using the scale shown. Do not rate the individuals that you do not use as a source of information.

Source of Information within the Saugeen, Grey Sauble Northern Bruce Peninsula SPC	Extremely Important	Important	Neither Unimportant nor Important	Unimportant	Extremely Unimportant
Mike Traynor	○	○	○	○	○
Kathie Hughes	○	○	○	○	○
Mitch Twolan	○	○	○	○	○
Les Nichols	○	○	○	○	○
Ken Furlong	○	○	○	○	○
Bill Twaddle	○	○	○	○	○
David Biesenthal	○	○	○	○	○
Robert Emerson	○	○	○	○	○
Brent Lanktree	○	○	○	○	○
Carolyn Parker	○	○	○	○	○
Mark Kraemer	○	○	○	○	○
Dale Thompson	○	○	○	○	○
Les MacKinnon	○	○	○	○	○
Lou D'Allesandro	○	○	○	○	○
Bruce Davidson	○	○	○	○	○
Carolyn Day	○	○	○	○	○
Robert Reid	○	○	○	○	○
Don Smith	○	○	○	○	○
Jim Coffey	○	○	○	○	○
John Cottrill	○	○	○	○	○
Teresa McLellan	○	○	○	○	○

Other:	○	○	○	○	○
Other:	○	○	○	○	○
Other:	○	○	○	○	○
Other:	○	○	○	○	○
Other:	○	○	○	○	○
Other:	○	○	○	○	○
Other:	○	○	○	○	○
Other:	○	○	○	○	○
Other:	○	○	○	○	○
Other:	○	○	○	○	○

42. Are there specific individuals **within the Saugeen, Grey Sauble Northern Bruce Peninsula SPC** (e.g., SPC member, staff) who you consider to be an especially important source of information. If so, please provide their name(s), explain their significance, and identify the sector or organization they represent.

43. Please indicate how often you provide information to the following individuals **within the Saugeen, Grey Sauble Northern Bruce Peninsula SPC** using the scale shown:

Information Recipient within the Saugeen, Grey Sauble Northern Bruce Peninsula SPC	**Very Often or Always**	**Often**	**Neither Often nor Seldom**	**Seldom**	**Very Rarely or Never**
Mike Traynor	○	○	○	○	○
Kathie Hughes	○	○	○	○	○
Mitch Twolan	○	○	○	○	○
Les Nichols	○	○	○	○	○
Ken Furlong	○	○	○	○	○
Bill Twaddle	○	○	○	○	○
David Biesenthal	○	○	○	○	○
Robert Emerson	○	○	○	○	○
Brent Lanktree	○	○	○	○	○
Carolyn Parker	○	○	○	○	○
Mark Kraemer	○	○	○	○	○

Dale Thompson	○	○	○	○	○
Les MacKinnon	○	○	○	○	○
Lou D'Allesandro	○	○	○	○	○
Bruce Davidson	○	○	○	○	○
Carolyn Day	○	○	○	○	○
Robert Reid	○	○	○	○	○
Don Smith	○	○	○	○	○
Jim Coffey	○	○	○	○	○
John Cottrill	○	○	○	○	○
Teresa McLellan	○	○	○	○	○
Other:	○	○	○	○	○
Other:	○	○	○	○	○
Other:	○	○	○	○	○
Other:	○	○	○	○	○
Other:	○	○	○	○	○
Other:	○	○	○	○	○
Other:	○	○	○	○	○
Other:	○	○	○	○	○
Other:	○	○	○	○	○
Other:	○	○	○	○	○

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Section D. Mapping Stakeholder Interaction and Information Sharing (cont)

44. Please identify sources of information **within the Sault Ste. Marie SPC** that you use when making decisions, and rate how important they are to you. For each source of information, indicate the importance using the scale shown. Do not rate the individuals that you do not use as a source of information.

Source of Information within the Sault Ste. Marie SPC	Extremely Important	Important	Neither Unimportant nor Important	Unimportant	Extremely Unimportant
Subhash Verma	○	○	○	○	○
Susan Hamilton-Beach	○	○	○	○	○
Peter Tonnazo	○	○	○	○	○
Hal McGonigal	○	○	○	○	○
Andrew Hallet	○	○	○	○	○
Roy Bertolo	○	○	○	○	○
Peter McLarty	○	○	○	○	○
Laurence Woolley	○	○	○	○	○
Ralph Yanni	○	○	○	○	○
Rhonda Bateman	○	○	○	○	○
Maeve McHugh	○	○	○	○	○
Gary Nelson	○	○	○	○	○
Virginia MacEachern	○	○	○	○	○
Linda Whalen	○	○	○	○	○
Other:	○	○	○	○	○
Other:	○	○	○	○	○
Other:	○	○	○	○	○
Other:	○	○	○	○	○
Other:	○	○	○	○	○
Other:	○	○	○	○	○
Other:	○	○	○	○	○

Other:	○	○	○	○	○
Other:	○	○	○	○	○
Other:	○	○	○	○	○

45. Are there specific individuals **within the Sault Ste. Marie SPC** (e.g., SPC member, staff) who you consider to be an especially important source of information. If so, please provide their name(s), explain their significance, and identify the sector or organization they represent.

46. Please indicate how often you provide information to the following individuals **within the Sault Ste. Marie SPC** using the scale shown:

Information Recipient within the Sault Ste. Marie SPC	Very Often or Always	Often	Neither Often nor Seldom	Seldom	Very Rarely or Never
Subhash Verma	○	○	○	○	○
Susan Hamilton-Beach	○	○	○	○	○
Peter Tonnazo	○	○	○	○	○
Hal McGonigal	○	○	○	○	○
Andrew Hallet	○	○	○	○	○
Roy Bertolo	○	○	○	○	○
Peter McLarty	○	○	○	○	○
Laurence Woolley	○	○	○	○	○
Ralph Yanni	○	○	○	○	○
Rhonda Bateman	○	○	○	○	○
Maeve McHugh	○	○	○	○	○
Gary Nelson	○	○	○	○	○
Virginia MacEachern	○	○	○	○	○
Linda Whalen	○	○	○	○	○
Other:	○	○	○	○	○
Other:	○	○	○	○	○
Other:	○	○	○	○	○
Other:	○	○	○	○	○
Other:	○	○	○	○	○

Other:	○	○	○	○	○
Other:	○	○	○	○	○
Other:	○	○	○	○	○
Other:	○	○	○	○	○
Other:	○	○	○	○	○

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Section D. Mapping Stakeholder Interaction and Information Sharing (cont)

47. Please identify sources of information **within the South Georgian Bay Lake Simcoe SPC** that you use when making decisions, and rate how important they are to you. For each source of information, indicate the importance using the scale shown. Do not rate the individuals that you do not use as a source of information.

Source of Information within the South Georgian Bay Lake Simcoe SPC	Extremely Important	Important	Neither Unimportant nor Important	Unimportant	Extremely Unimportant
Lynn Dollin	○	○	○	○	○
John Boucher	○	○	○	○	○
Clayton Cameron	○	○	○	○	○
Herb Proudley	○	○	○	○	○
Rick Newlove	○	○	○	○	○
Stan Wells	○	○	○	○	○
David Marquis	○	○	○	○	○
Erin Mahoney	○	○	○	○	○
Colin Elliott	○	○	○	○	○
Chris Galway	○	○	○	○	○
John Helmsted	○	○	○	○	○
Colin Nisbet	○	○	○	○	○
Dave Ritchie	○	○	○	○	○
Gerry Brouwer	○	○	○	○	○
David Ketcheson	○	○	○	○	○
Dianne Corrigan	○	○	○	○	○
Bob Duncanson	○	○	○	○	○
Stephanie Hobbs	○	○	○	○	○
Tom Kurtz	○	○	○	○	○
Alex Millar	○	○	○	○	○
Fred Ruf	○	○	○	○	○

Larry Slomka	○	○	○	○	○
Fred Jahn	○	○	○	○	○
Kate Turner	○	○	○	○	○
Don Goodyear	○	○	○	○	○
Ted Devine	○	○	○	○	○
Gayle Wood	○	○	○	○	○
Other:	○	○	○	○	○
Other:	○	○	○	○	○
Other:	○	○	○	○	○
Other:	○	○	○	○	○
Other:	○	○	○	○	○
Other:	○	○	○	○	○
Other:	○	○	○	○	○
Other:	○	○	○	○	○
Other:	○	○	○	○	○
Other:	○	○	○	○	○
Other:	○	○	○	○	○

48. Are there specific individuals **within the South Georgian Bay Lake Simcoe SPC** (e.g., SPC member, staff) who you consider to be an especially important source of information. If so, please provide their name(s), explain their significance, and identify the sector or organization they represent.

49. Please indicate how often you provide information to the following individuals **within the South Georgian Bay Lake Simcoe SPC** using the scale shown:

Information Recipient within the South Georgian Bay Lake Simcoe SPC	**Very Often or Always**	**Often**	**Neither Often nor Seldom**	**Seldom**	**Very Rarely or Never**
Lynn Dollin	○	○	○	○	○
John Boucher	○	○	○	○	○
Clayton Cameron	○	○	○	○	○
Herb Proudley	○	○	○	○	○
Rick Newlove	○	○	○	○	○

Stan Wells	○	○	○	○	○
David Marquis	○	○	○	○	○
Erin Mahoney	○	○	○	○	○
Colin Elliott	○	○	○	○	○
Chris Galway	○	○	○	○	○
John Helmsted	○	○	○	○	○
Colin Nisbet	○	○	○	○	○
Dave Ritchie	○	○	○	○	○
Gerry Brouwer	○	○	○	○	○
David Ketcheson	○	○	○	○	○
Dianne Corrigan	○	○	○	○	○
Bob Duncanson	○	○	○	○	○
Stephanie Hobbs	○	○	○	○	○
Tom Kurtz	○	○	○	○	○
Alex Millar	○	○	○	○	○
Fred Ruf	○	○	○	○	○
Larry Slomka	○	○	○	○	○
Fred Jahn	○	○	○	○	○
Kate Turner	○	○	○	○	○
Don Goodyear	○	○	○	○	○
Ted Devine	○	○	○	○	○
Gayle Wood	○	○	○	○	○
Other:	○	○	○	○	○
Other:	○	○	○	○	○
Other:	○	○	○	○	○
Other:	○	○	○	○	○
Other:	○	○	○	○	○
Other:	○	○	○	○	○
Other:	○	○	○	○	○
Other:	○	○	○	○	○
Other:	○	○	○	○	○
Other:	○	○	○	○	○

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Section D. Mapping Stakeholder Interaction and Information Sharing (cont)

50. Please identify sources of information **within the Sudbury SPC** that you use when making decisions, and rate how important they are to you. For each source of information, indicate the importance using the scale shown. Do not rate the individuals that you do not use as a source of information.

Source of Information within the Sudbury SPC	Extremely Important	Important	Neither Unimportant nor Important	Unimportant	Extremely Unimportant
Nels Conroy	○	○	○	○	○
Stephen Monet	○	○	○	○	○
Paul Baskcomb	○	○	○	○	○
Nick Benkovich	○	○	○	○	○
Greg Haddad	○	○	○	○	○
Wendy Wisniewski	○	○	○	○	○
Luc Bock	○	○	○	○	○
Tim Worton	○	○	○	○	○
Lilly Noble	○	○	○	○	○
Richard Bois	○	○	○	○	○
Cheryl Recollet	○	○	○	○	○
Vivian Naponse	○	○	○	○	○
Neil Gervais	○	○	○	○	○
Bob Rogers	○	○	○	○	○
Burgess Hawkins	○	○	○	○	○
Melanie Venne	○	○	○	○	○
Other:	○	○	○	○	○
Other:	○	○	○	○	○
Other:	○	○	○	○	○
Other:	○	○	○	○	○
Other:	○	○	○	○	○

Other:	○	○	○	○	○
Other:	○	○	○	○	○
Other:	○	○	○	○	○
Other:	○	○	○	○	○
Other:	○	○	○	○	○

51. Are there specific individuals **within the Sudbury SPC** (e.g., SPC member, staff) who you consider to be an especially important source of information. If so, please provide their name (s), explain their significance, and identify the sector or organization they represent.

52. Please indicate how often you provide information to the following individuals **within the Sudbury SPC** using the scale shown:

Information Recipient within the Sudbury SPC	**Very Often or Always**	**Often**	**Neither Often nor Seldom**	**Seldom**	**Very Rarely or Never**
Nels Conroy	○	○	○	○	○
Stephen Monet	○	○	○	○	○
Paul Baskcomb	○	○	○	○	○
Nick Benkovich	○	○	○	○	○
Greg Haddad	○	○	○	○	○
Wendy Wisniewski	○	○	○	○	○
Luc Bock	○	○	○	○	○
Tim Worton	○	○	○	○	○
Lilly Noble	○	○	○	○	○
Richard Bois	○	○	○	○	○
Cheryl Recollet	○	○	○	○	○
Vivian Naponse	○	○	○	○	○
Neil Gervais	○	○	○	○	○
Bob Rogers	○	○	○	○	○
Burgess Hawkins	○	○	○	○	○
Melanie Venne	○	○	○	○	○
Other:	○	○	○	○	○

Other:	○	○	○	○	○
Other:	○	○	○	○	○
Other:	○	○	○	○	○
Other:	○	○	○	○	○
Other:	○	○	○	○	○
Other:	○	○	○	○	○
Other:	○	○	○	○	○
Other:	○	○	○	○	○
Other:	○	○	○	○	○

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53. Please identify sources of information **within the Thames, Sydenham and Region SPC** that you use when making decisions, and rate how important they are to you. For each source of information, indicate the importance using the scale shown. Do not rate the individuals that you do not use as a source of information.

Source of Information within the Thames, Sydenham and Region SPC	Extremely Important	Important	Neither Unimportant nor Important	Unimportant	Extremely Unimportant
Bob Bedggood	○	○	○	○	○
Sheldon Parsons	○	○	○	○	○
Darrell Randell	○	○	○	○	○
Patrick Donnelly	○	○	○	○	○
James Maudsley	○	○	○	○	○
Brent Clutterbuck	○	○	○	○	○
Pat Sobeski	○	○	○	○	○
Joe Salter	○	○	○	○	○
John van Dorp	○	○	○	○	○
Patrick Feryn	○	○	○	○	○
Don McCabe	○	○	○	○	○
Dean Edwardson	○	○	○	○	○
Earl Morwood	○	○	○	○	○
Paul Hymus	○	○	○	○	○
Joe Van Overberghe	○	○	○	○	○
Richard Philip	○	○	○	○	○
Doug McGee	○	○	○	○	○
Joseph Kerr	○	○	○	○	○
Carl Kennes	○	○	○	○	○
Valerie M'Garry	○	○	○	○	○
Margaret Misek-Evans	○	○	○	○	○

Charles Sharina	○	○	○	○	○
Kennon Johnson	○	○	○	○	○
Augustus Tobias	○	○	○	○	○
Jim Reffle	○	○	○	○	○
Teresa McLellan	○	○	○	○	○
Murray Blackie	○	○	○	○	○
Chris Tasker	○	○	○	○	○
Other:	○	○	○	○	○
Other:	○	○	○	○	○
Other:	○	○	○	○	○
Other:	○	○	○	○	○
Other:	○	○	○	○	○
Other:	○	○	○	○	○
Other:	○	○	○	○	○
Other:	○	○	○	○	○
Other:	○	○	○	○	○
Other:	○	○	○	○	○

54. Are there specific individuals **within the Thames, Sydenham and Region SPC** (e.g., SPC member, staff) who you consider to be an especially important source of information. If so, please provide their name(s), explain their significance, and identify the sector or organization they represent.

55. Please indicate how often you provide information to the following individuals **within the Thames, Sydenham and Region SPC** using the scale shown:

Information Recipient within the Thames, Sydenham and Region SPC	**Very Often or Always**	**Often**	**Neither Often nor Seldom**	**Seldom**	**Very Rarely or Never**
Bob Bedggood	○	○	○	○	○
Sheldon Parsons	○	○	○	○	○
Darrell Randell	○	○	○	○	○
Patrick Donnelly	○	○	○	○	○

James Maudsley	○	○	○	○	○
Brent Clutterbuck	○	○	○	○	○
Pat Sobeski	○	○	○	○	○
Joe Salter	○	○	○	○	○
John van Dorp	○	○	○	○	○
Patrick Feryn	○	○	○	○	○
Don McCabe	○	○	○	○	○
Dean Edwardson	○	○	○	○	○
Earl Morwood	○	○	○	○	○
Paul Hymus	○	○	○	○	○
Joe Van Overberghe	○	○	○	○	○
Richard Philip	○	○	○	○	○
Doug McGee	○	○	○	○	○
Joseph Kerr	○	○	○	○	○
Carl Kennes	○	○	○	○	○
Valerie M'Garry	○	○	○	○	○
Margaret Misek-Evans	○	○	○	○	○
Charles Sharina	○	○	○	○	○
Kennon Johnson	○	○	○	○	○
Augustus Tobias	○	○	○	○	○
Jim Reffle	○	○	○	○	○
Teresa McLellan	○	○	○	○	○
Murray Blackie	○	○	○	○	○
Chris Tasker	○	○	○	○	○
Other:	○	○	○	○	○
Other:	○	○	○	○	○
Other:	○	○	○	○	○
Other:	○	○	○	○	○
Other:	○	○	○	○	○
Other:	○	○	○	○	○
Other:	○	○	○	○	○
Other:	○	○	○	○	○
Other:	○	○	○	○	○
Other:	○	○	○	○	○

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Section D. Mapping Stakeholder Interaction and Information Sharing (cont)

56. Please identify sources of information **within the Trent Conservation Coalition SPC** that you use when making decisions, and rate how important they are to you. For each source of information, indicate the importance using the scale shown. Do not rate the individuals that you do not use as a source of information.

Source of Information within the Trent Conservation Coalition SPC	Extremely Important	Important	Neither Unimportant nor Important	Unimportant	Extremely Unimportant
Jim Hunt	○	○	○	○	○
Dave Golem	○	○	○	○	○
Bruce Craig	○	○	○	○	○
Dave Burton	○	○	○	○	○
Gerald MacGregor	○	○	○	○	○
Rosemary Kelleher-MacLennan	○	○	○	○	○
Mary Smith	○	○	○	○	○
Richard Straka	○	○	○	○	○
Bev Spencer	○	○	○	○	○
Edgar Cornish	○	○	○	○	○
Glenn Milne	○	○	○	○	○
Kerry Doughty	○	○	○	○	○
Monica Berdin	○	○	○	○	○
Rick Johnson	○	○	○	○	○
Robert Lake	○	○	○	○	○
Mary Jane Conboy	○	○	○	○	○
Terry Rees	○	○	○	○	○
Wayne Stiver	○	○	○	○	○
Bill Cornfield	○	○	○	○	○
Alanna Bouton	○	○	○	○	○
Bobbie Drew	○	○	○	○	○

Matt Taft	○	○	○	○	○
Mae Whetung	○	○	○	○	○
Pam Crowe	○	○	○	○	○
Darla Blodgett	○	○	○	○	○
Jim Kelleher	○	○	○	○	○
Anne Alexander	○	○	○	○	○
Glenda Rogers	○	○	○	○	○
Wendy Lavender	○	○	○	○	○
Other:	○	○	○	○	○
Other:	○	○	○	○	○
Other:	○	○	○	○	○
Other:	○	○	○	○	○
Other:	○	○	○	○	○
Other:	○	○	○	○	○
Other:	○	○	○	○	○
Other:	○	○	○	○	○
Other:	○	○	○	○	○

57. Are there specific individuals **within the Trent Conservation Coalition SPC** (e.g., SPC member, staff) who you consider to be an especially important source of information. If so, please provide their name(s), explain their significance, and identify the sector or organization they represent.

58. Please indicate how often you provide information to the following individuals **within the Trent Conservation Coalition SPC** using the scale shown:

Information Recipient within the Trent Conservation Coalition SPC	**Very Often or Always**	**Often**	**Neither Often nor Seldom**	**Seldom**	**Very Rarely or Never**
Jim Hunt	○	○	○	○	○
Dave Golem	○	○	○	○	○
Bruce Craig	○	○	○	○	○

Dave Burton	○	○	○	○	○
Gerald MacGregor	○	○	○	○	○
Rosemary Kelleher-MacLennan	○	○	○	○	○
Mary Smith	○	○	○	○	○
Richard Straka	○	○	○	○	○
Bev Spencer	○	○	○	○	○
Edgar Cornish	○	○	○	○	○
Glenn Milne	○	○	○	○	○
Kerry Doughty	○	○	○	○	○
Monica Berdin	○	○	○	○	○
Rick Johnson	○	○	○	○	○
Robert Lake	○	○	○	○	○
Mary Jane Conboy	○	○	○	○	○
Terry Rees	○	○	○	○	○
Wayne Stiver	○	○	○	○	○
Bill Cornfield	○	○	○	○	○
Alanna Bouton	○	○	○	○	○
Bobbie Drew	○	○	○	○	○
Matt Taft	○	○	○	○	○
Mae Whetung	○	○	○	○	○
Pam Crowe	○	○	○	○	○
Darla Blodgett	○	○	○	○	○
Jim Kelleher	○	○	○	○	○
Anne Alexander	○	○	○	○	○
Glenda Rogers	○	○	○	○	○
Wendy Lavender	○	○	○	○	○
Other:	○	○	○	○	○
Other:	○	○	○	○	○
Other:	○	○	○	○	○
Other:	○	○	○	○	○
Other:	○	○	○	○	○
Other:	○	○	○	○	○
Other:	○	○	○	○	○
Other:	○	○	○	○	○
Other:	○	○	○	○	○

Other:					

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Section E. Mapping Stakeholder Interaction and Information Sharing

Reminder: Information you provide will be treated as confidential. Only summary information and statements that are presented anonymously will be reported in publications that result from this research. Leave blank any questions that you do not wish to answer.

1. Please identify sources of information that you use when making decisions regarding source water protection, and rate how important they are to you using the scale shown:

Source of Information	Name	Extremely Important	Important	Neither Unimportant nor Important	Unimportant	Extremely Unimportant
Agricultural Organization		○	○	○	○	○
Conservation Authority		○	○	○	○	○
Conservation Ontario		○	○	○	○	○
Environmental Organization		○	○	○	○	○
First Nations Organization		○	○	○	○	○
Health Organization		○	○	○	○	○
Industrial Organization		○	○	○	○	○
Ministry of the Environment		○	○	○	○	○
Ministry of Natural Resources		○	○	○	○	○
Ontario Ministry of Agriculture, Food and Rural Affairs		○	○	○	○	○

Other - please indicate name of source:		○	○	○	○	○
Other - please indicate name of source:		○	○	○	○	○
Other - please indicate name of source:		○	○	○	○	○
Other - please indicate name of source:		○	○	○	○	○
Other - please indicate name of source:		○	○	○	○	○

2. Are there specific individuals or organizations who you consider to be especially important sources of information? If so, please provide their name(s), explain their significance, and identify the sector or organization they represent.

3. Indicate which organizations you provide information to. Include the name of each organization you share information with, and rate how often you provide information to each organization using the scale shown.

Recipient Organization	Name	Very Often or Always	Often	Neither Often nor Seldom	Seldom	Very Rarely or Never
Agricultural Organization		○	○	○	○	○
Conservation Authority		○	○	○	○	○
Conservation Ontario		○	○	○	○	○
Environmental Organization		○	○	○	○	○
First Nations Organization		○	○	○	○	○
Health Organization		○	○	○	○	○

Industrial Organization		○	○	○	○	○
Ministry of the Environment		○	○	○	○	○
Ministry of Natural Resources		○	○	○	○	○
Ontario Ministry of Agriculture, Food and Rural Affairs		○	○	○	○	○
Other - please indicate name of source:		○	○	○	○	○
Other - please indicate name of source:		○	○	○	○	○
Other - please indicate name of source:		○	○	○	○	○
Other - please indicate name of source:		○	○	○	○	○
Other - please indicate name of source:		○	○	○	○	○

Submit

SPC Questionnaire

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Section F. Additional Demographic Information

Reminder: Information you provide will be treated as confidential. Only summary information and statements that are presented anonymously will be reported in publications that result from this research. Leave blank any questions that you do not wish to answer.

Your name will be used to map your interaction and sharing of knowledge with other committee members and interested parties in Section E. Your name will not be used to identify your answers in Sections C and D.

In this section please provide some additional information about your background:

1. Name:
2. Gender: Please Select
3. Age: Please Select
4. Highest Level of Education Achieved:
   Please Select
5. What is the main source of the water you use for domestic purposes?
   Please Select

   If Other, please specify:
6. During my life, I have lived mainly in: Please Select
7. I was raised in: Please Select
8. I now live in: Please Select
9. Are you a member of one or more provincial or local organizations that have an interest in source water protection? Please Select

   If Yes, please write down the name of the organization(s):

Submit

SPC Questionnaire

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Section G. Other Thoughts

1. Are there any other thoughts that you would like to share concerning your involvement in the decision making process?

Submit

SPC Questionnaire

Random Draw for Prize

In appreciation of the time you have given to this study, a random draw for cash prizes will be held. Following the close of the survey, 60 respondents will be randomly selected for a prize of $25.00 each. The odds of winning a cash prize are estimated to be 1 in 7. Names and contact information collected for the purpose of selecting winners of the prize draws will be stored separately from other information collected as part of the survey, and destroyed once prizes have been awarded.

Provide your contact information below if you would like to be included in the random draw for a cash prize:

Name:

Mailing Address:

Email Address:

Submit

SPC Questionnaire

Thank you for participating in our survey concerning environmental decision-making at a watershed scale! Your responses are extremely valuable.

If you are interested in obtaining a copy of the results of this survey, please let the research team know by sending us an email (hcsimpso@uwaterloo.ca) and we will send it to you. If you have any general comments or questions related to this study, please contact Dr. Rob de Loe Department of Environment and Resource Studies at rdeloe@uwaterloo.ca, or Hugh Simpson, Department of Geography and Resource Studies at hcsimpso@uwaterloo.ca.

This study has been reviewed by, and received ethics clearance through, the Office of Research Ethics. If you have any concerns regarding your participation in this study, please contact Dr. Susan Sykes, Director, Office of Research Ethics at ssykes@uwaterloo.ca or 519-888-4567 Ext. 36005.)

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Appendix B – Questions for Key Informant Interviews

Theme A: Evaluating the nature of the collaborative problem-solving process

1. How would you describe the role of committee members in shaping the direction and content of local source protection plan documents and policies?

    Follow-up question (a): Have committee members had an active role in the development of technical information?

    Follow-up question (b): Were committee members encouraged to suggest modifications to technical information based on their or others local knowledge (e.g., soils)

    Follow-up question (c): Were the committee members given the opportunity to decide the how the decision-making process would be undertaken?

    Follow-up question (d): Were committee members given the opportunity to influence the scope of decision-making that would be taken by the SPC?

2. What direct and indirect benefits do you see associated with this role?

    Follow-up question (a): Did the process build collaboration and trust between committee members

    Follow-up question (b): Did the process facilitate learning about and result in a better understanding of the concerns of other committee members?

3. What challenges do you see arising from this role for committee members?

    Follow-up question (a): Does the active involvement of committee members create challenges for the operation of the SPC such as drawing out the decision-making process?

Follow-up question (b): Does the active involvement of committee members create conflict between different 'interests' of committee members?

Follow-up question (c): Does the active involvement of committee members result in dominance of discussion by a single member or small number of members?

4. Has local knowledge been incorporated in the decision-making process?

Follow-up question (a): Have members been encouraged to share local knowledge?

Follow-up question (b): Has the broader community been encouraged to share its local knowledge?

Follow-up question (c): How did the process incorporate technical and local knowledge?

Follow-up question (d): Was local knowledge perceived and treated as being equally valid and important as technical knowledge?

Follow-up question (e): Was technical knowledge modified to reflect local knowledge?

Theme B: Evaluating the role of non-state networks in the problem-solving process

1. In some cases members of local source protection committees (SPCs) were nominated by local or provincial sector groups to represent the interests of that sector. Does this role as a sector representative enhance or interfere with the ability of a member to participate on a local SPC?

Follow-up question (a): Were members who were nominated by local or provincial groups encouraged or discouraged from maintaining these relationships?

2. Has the SPC encouraged the formal involvement of local sector representatives who were not members of the SPC through venues such as working groups?

Follow-up question (a): Did the SPC provide any resources to support these venues?

Follow-up question (b): Did these venues contribute to the decision-making process?

Follow-up question (c): How was knowledge from these venues incorporated into the decision-making process?

3. For members who have a provincial sector affiliation, did the members share any knowledge with the SPC members that was provided by these affiliations?

   Follow-up question (a): Was this external information perceived as beneficial or harmful to the decision-making process?

   Follow-up question (b): Were these members encouraged to share this information with other SPC members?

   Follow-up question (c): Was this external information incorporated into the decision-making process?

4. Is there a role for provincial networks to contribute to environmental decision-making at a watershed scale, through efforts such as local source protection planning?

   Follow-up question (a): Would there be any value in provincial networks in providing information on complementary concerns (*e.g.*, economics)?

   Follow-up question (b): What could the formal arrangements for provincial networks to contribute knowledge look like?

Appendix C – List of Documents Reviewed

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