

THE RESILIENCE OF GOVERNANCE NETWORKS:  
WILDLIFE HEALTH MANAGEMENT IN CANADA

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## ABSTRACT

Emerging diseases in Canada threaten the wellbeing of humans, domestic and farmed animals, as well as wildlife. Canada, like many nations, struggles to manage diseases that cross boundaries, both geographically and in species. This has led to a heavy reliance on governance networks to coordinate the knowledge and resources needed to develop management approaches. As governance networks often exist in an informal or ad hoc capacity and at the same time attempt to solve complex or expansive policy problems beyond the ability of any one agency, the issue of network resilience is examined to explore how networks and their membership can mitigate network failure.

Through two case studies of wildlife disease incidents in Canada (Chronic wasting disease and White nose syndrome), I examine how the wildlife health network in Canada developed its disease management approaches as well as recommendations to provincial and federal governments. Using primary sources, I evaluate the network's activities, attitudes and behaviours to assess if characteristics associated with resilience (slack in resources, adaptive capacity and situation awareness) are present and if they contribute to positive outcomes.

Greater presence of resilient characteristics- slack in resources, adaptive capacity and situation awareness-were present in the case with better policy outcomes, however, the analysis reveals that the concept of resilience is limited as a useful tool when examined in the broader context. Governance networks are often limited by the structural constraints of their environment, including scarce resources and a lack of self-determination. In this network, an additional factors exists to complicate analysis: disease type and severity. The relative ease with which an emerging disease can be understood and management appears to contribute significantly to the network's success.

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# TABLE OF CONTENTS

PERMISSION TO USE .....	i
ABSTRACT.....	ii
ACKNOWLEDGEMENTS .....	iii
TABLE OF CONTENTS.....	iv
LIST OF TABLES .....	vi
LIST OF FIGURES .....	vii
LIST OF ABBREVIATIONS.....	viii
CHAPTER 1: INTRODUCTION .....	1
1.1 The Problem.....	4
1.2 The Network .....	5
1.2.1. Authority and Reporting Structure.....	8
1.3 Methodology .....	10
1.3.1 Data Sources .....	12
CHAPTER 2: NETWORKS .....	14
2.1 The Concept.....	14
2.2. Governance networks.....	15
2.3 How do governance networks address the failings of traditional governance? .....	19
2.4 Governance network limitations .....	20
2.5 Evaluating governance networks .....	22
2.5.1 Network failure .....	23
2.6 Improving network activities .....	24
CHAPTER 3: RESILIENCE AND A NETWORK RESILIENCE MODEL .....	26
3.1 Resilience as Positive Adjustment .....	27
3.2 Governance network resilience.....	28
3.2.1 Slack in Resources .....	29
3.2.2 Adaptive Capacity.....	31
3.2.3 Situation Awareness.....	32
CHAPTER 4: THE CHRONIC WASTING DISEASE INTER-AGENCY OVERSIGHT COMMITTEE .....	34
4.1 The Disease.....	34
4.2 The Network in Action .....	35
4.3 Network Resilience .....	44

4.3.1 Slack in Resources .....	45
4.3.2 Adaptive Capacity .....	48
4.3.3 Situation Awareness .....	51
CHAPTER 5: THE INTERAGENCY WHITE NOSE SYNDROME COMMITTEE .....	55
5.1 The Disease .....	55
5.2 The Network in Action .....	57
5.3 Network resilience .....	66
5.3.1 Slack in resources .....	67
5.3.2 Adaptive Capacity .....	69
5.3.3 Situation Awareness .....	72
CHAPTER 6: CONCLUSION .....	76
6.1 Overall ability to manage disease is heavily dependent on disease characteristics .....	79
6.2 Experience increases situation awareness .....	81
6.3 Structural limitations to resilience in governance networks .....	83
REFERENCES .....	87

## LIST OF TABLES

Table 3-1 Governance network resilience model.....	33
Table 6-1 Network resilience by characteristic.....	79

## LIST OF FIGURES

Figure 1-1 The wildlife health network in Canada .....	6
Figure 1-2 Authority structure for wildlife health in Canada .....	9



## LIST OF ABBREVIATIONS

**BSE:** Bovine spongiform encephalopathy is a fatal neurodegenerative disease that affects cattle and can be transmitted to humans as Variant Creutzfeldt-Jakob disease. Also referred to as Mad cow disease.

**CFIA:** Canadian Food Inspection Agency.

**COSEWIC:** Committee on the Status of Endangered Wildlife in Canada is a committee of scientific advisors tasked with evaluating applications for Species at Risk listings for the federal government.

**CWD:** Chronic wasting disease is a fatal transmissible spongiform encephalopathy that affects cervids (members of the family *Cervidae* including deer, elk and moose).

**CWDC:** Canadian Wildlife Directors Committee is an advisory body comprised of federal, provincial and territorial wildlife directors, including Environment Canada, Fisheries and Oceans Canada and Park Canada. They provide leadership for the development and coordination of policies and programs that support wildlife health and biodiversity.

**CWHC:** Canadian Wildlife Health Cooperative is a partnership of Canada's five veterinary colleges committed to generating knowledge, surveillance and policy interventions needed to assess and manage wildlife health in Canada.

**CWS:** Canadian Wildlife Service is an agency of Environment Canada under the Environmental Stewardship branch. They are responsible for federal wildlife management.

**IOC:** Inter-agency Oversight Committee is the official name for the Chronic wasting disease network under the direction of the Canadian Wildlife Directors Committee.

**NWDS:** National Wildlife Disease Strategy is a disease management framework created to fill in the gaps in wildlife disease management in Canada.

**SARA:** Species at Risk Act is a federal law that provides the Minister of Environment with the authority to declare wildlife at risk of extinction. The Act requires that the government provide remedies to mitigate the extinction threat.

**TSE:** Transmissible spongiform encephalopathy is a class of infectious disease that affects the brain and nervous system of animals and humans, resulting in impairment of brain function. Chronic wasting disease and Bovine spongiform encephalopathy are both TSEs. Also referred to as prion diseases.

**WNS:** White Nose Syndrome is a disease that is caused by fungus *Pseudogymnoascus destructans* which affects hibernating bats, causing them to wake from hibernation and expend energy before an adequate food supply has emerged.

## CHAPTER 1: INTRODUCTION

Over the past 75 years, there has been an unprecedented rise in the number of emerging infectious diseases (EIDs) affecting animal and human health, as well as the global economy (Jones et al., 2008). Within Canada, a number of EIDs have affected farmed animals, wildlife and human populations just in the last 15 years. These diseases include Bovine spongiform encephalopathy (or Mad cow disease), Severe acute respiratory syndrome (SARS), Chytridiomycosis, Highly Pathogenic Avian Influenza (known as H5N1), Influenza A (H1N1), Bovine tuberculosis, Avian botulism, White nose syndrome and Chronic wasting disease. Many of these diseases are classified as EIDs because the disease is either entirely new, new to the affected population or area, or a variation on a previously encountered disease. While diseases are considered a natural part of an ecosystem, the threat presented by a foreign or emerging infectious disease can irreparably damage an environment by eradicating a species that is vital to the ecosystem (Canadian Wildlife Health Cooperative, 2004). The introduction of new diseases globally through increased travel, trade and environmental degradation has decimated animal species, caused human health crises and created economic havoc through trade restrictions and travel warnings (Miller, Farnsworth & Malmberg, 2013).

The influx of these diseases has led to concern about the ability of Canadian governments to effectively manage animal health epidemics. In addition to new research, surveillance and treatment options that must be developed and implemented in Canada to ensure the general health of farmed animals and wildlife, there are coordination gaps that need to be addressed between various levels of government. The Canadian legal framework surrounding animal health is divided not only between wildlife and farmed animals, falling under natural resource and agriculture departments respectively, but also by territorial divisions. The federal government has responsibility for migratory birds and aquatic species as well as terrestrial wildlife on federal lands. Provincial and territorial governments have jurisdiction over terrestrial wildlife on their lands. Both levels of government have the ability to declare endangered or threatened species at risk and are then required to address conservation and/or repopulation. Experts in wildlife disease have suggested that these jurisdictional divisions have allowed gaps to emerge where

there is uncertainty about authority and the responsibility to provide appropriate policy responses (Canadian Wildlife Health Cooperative, 2004).

Attempting to address an emerging animal disease epidemic requires a high level of collaboration and coordination, as diseases can often be transmitted between farmed animals and wildlife, and beyond jurisdictional boundaries. Patricia Farnese (2014) has argued that the formal legal and regulatory framework in Canada fails to consider the role of wildlife in emerging diseases and prioritizes animals of consumptive use (such as livestock or farmed game). She further suggests that the public and animal health regimes are not structured to efficiently tackle emerging diseases and that the regulatory silos in which human, animal and wildlife health operate only exacerbate the problem.

There is no centralized governance body for addressing emerging diseases in wildlife in Canada. Instead, there exist two official forums to discuss policy and collaboration. The first is the Joint Ministers Council responsible for Forestry, Wildlife, Endangered Species and Fisheries and Aquaculture which is comprised of the provincial, federal and territorial Ministers responsible for wildlife in their jurisdiction. This group meets sporadically and did not meet in a formal capacity between 2006 and 2015. The second, more active, forum is the Canadian Wildlife Directors Committee (CWDC). It provides accountability, leadership and coordination for policy priorities and collaboration across the country with regards to wildlife and biodiversity. The CWDC consists of the directors of wildlife ministries for all provinces and territories, as well as the regional and national directors of the Canadian Wildlife Service and representatives of Fisheries and Oceans Canada and Parks Canada. The group meets regularly by teleconference as well as biannually in person to discuss pressing developments, formalize policy collaborations and hear from stakeholders and experts on important issues (Technical Working Group, 2005).

Between 2001 and 2002, the CWDC conducted an evaluation of the capacity of Canada's wildlife health infrastructure and concluded that a resource and knowledge gap exists in Canada (Technical Working Group, 2005). The variety of existing and emerging wildlife diseases and the divergent approaches taken in jurisdictions reflecting varying priorities and crises, along with small operating budgets made coordination of policy responses to disease outbreaks challenging. In an attempt to mitigate the challenges facing wildlife health officials, the Joint Ministers

Council agreed that a national wildlife disease strategy should be developed to identify clear procedures for dealing with wildlife disease outbreaks.

In order to address the absence of useful policy and formalize the collaboration needed to effectively address wildlife disease, the Canadian Wildlife Directors Committee (CWDC) proposed a formal strategy that would provide procedures and responsibilities for crucial activities to mitigate disease while being general enough to be applicable to the vast majority of potential disease scenarios. The CWDC commissioned the Canadian Wildlife Health Cooperative, a network of academic researchers from Canada's veterinary colleges, to author a strategy that would bridge the gaps in communication, knowledge, coordination and funding between various jurisdictions by standardizing regulations, strengthening surveillance and facilitating response when the next disease outbreak occurred. (Canadian Wildlife Health Cooperative, 2004) The strategy was approved by both the CWDC and the Joint Ministers Council, as a tool to guide action (Technical Working Group, 2005).

The National wildlife disease strategy is a management framework that seeks to minimize the impact of wildlife disease by identifying and filling critical gaps in the health infrastructure as well as improving response coordination. The Strategy has not been fully implemented across sectors, nor have resources been made available for its implementation. However, the wildlife health community in Canada has used it to build the groundwork for their approach to collaboration on wildlife disease management. One of the key elements of this work has been the development of a governance network that has coordinated the work of government scientists and policy makers, as well as academics and non-governmental organizations facing particular disease threats.

Governance networks have become an increasingly prevalent approach to deal with complex, multijurisdictional policy problems. These problems generally transcend the geographical divisions and/or bureaucratic partitions through which most government departments and agencies are required to work. The network response allows for collaboration and coordination between various levels and areas of government as well as non-governmental organizations and stakeholders in the private or academic sectors. In its basic form the network is a collection of interested and knowledgeable individuals, organizations and/or governments who work together to tackle a policy problem that cannot be dealt with effectively by a single entity (Sørensen & Torfing, 2005). This network, centred around the Canadian Wildlife Health

Cooperative, has worked to collaborate policy responses for Chronic wasting disease, West Nile virus, White nose syndrome, Avian Influenza, and Chytridiomycosis across the country.

## **1.1 The Problem**

While the network approach taken in the Canadian wildlife health sector addresses a portion of the gaps in the wildlife health system it does so in an informal fashion. Those in power at the provincial, territorial and federal levels have allowed this network approach to become the default response to wildlife health crises without having a clear picture of the network's capacity and ability to sustain itself. The absence of legislation and regulations that would formalize the roles and responsibilities of policies like the Canadian Wildlife Disease Strategy, has left what Farnese (2014) calls a regulatory deficit in wildlife health policy that the network struggles to close. The network has no consistent source of funding and no formal source of authority. It is self-organized and often works without official consent from all levels of government. There are often no formal agreements made between governments regarding the work of the network and funding is contract-based and temporary. The network, in addition to its primary mandate of tackling disease threats, has to overcome the barriers of working with insular bureaucratic regimes across jurisdictions and sectors to achieve policy outcomes.

Governance network theorists tend to assume that network participants are able to contend with flexible arrangements and processes requiring high levels of negotiation and fluidity, however there has been little to no work done regarding what kinds of behaviours and attitudes are required by participants to flourish in this environment. It is essential to conduct research that explores what limitations exist for governance networks to achieve their objectives and to identify how successful networks overcome barriers. Ensuring a network is functional and able to produce positive policy outcomes over time should be a key objective of the government entities that are embracing this form of governance. At a minimum, governments should be confident that public expenditures spent on the network's activities contribute to positive solutions.

A question emerges given what this network does and the conditions under which they do it: what enables them to sustain their activities and work towards minimizing the disease threat to wildlife, farmed animals and humans in the face of numerous obstacles? The answer proposed in

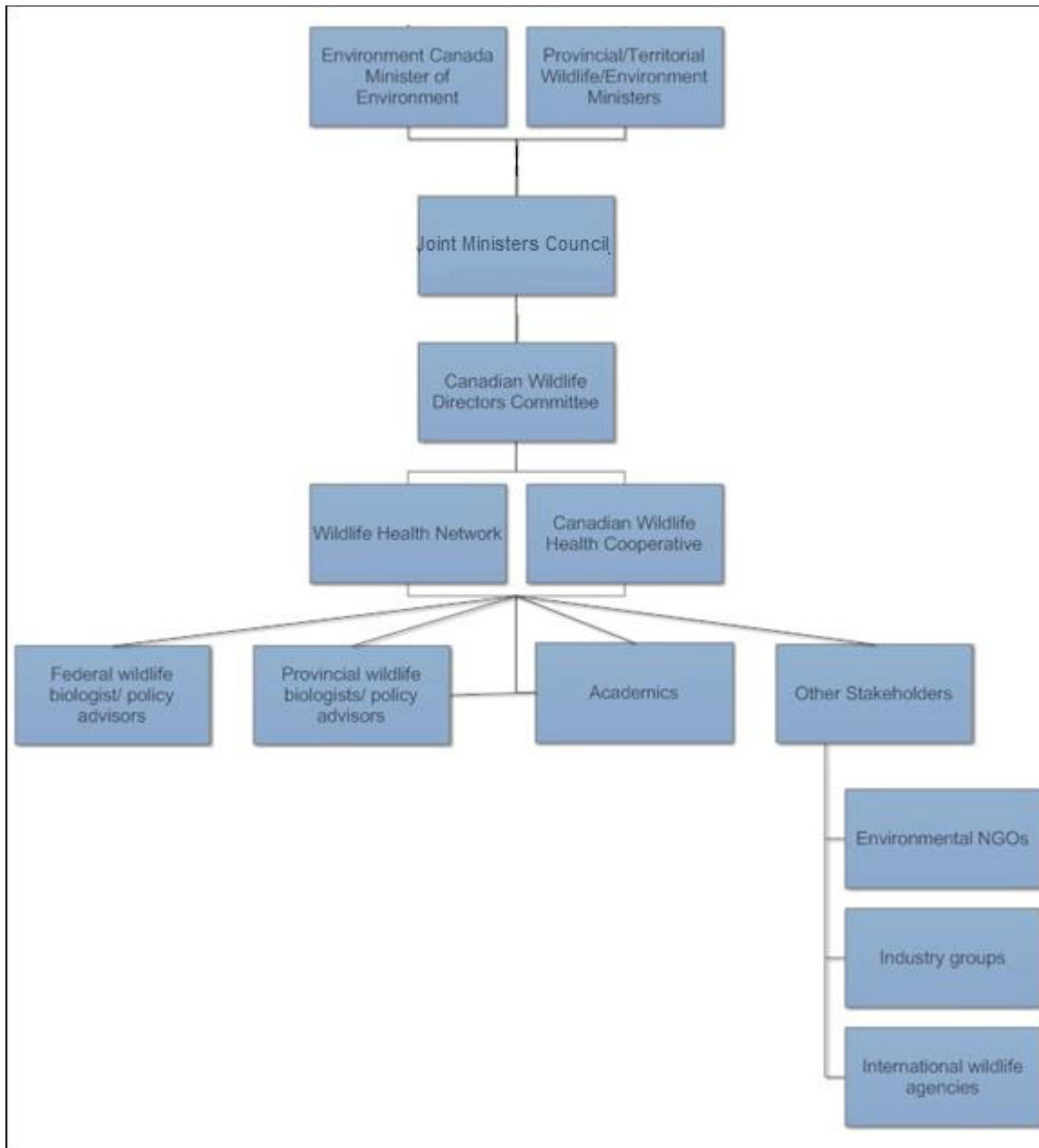
this paper is resilience. Resilience is the ability to continue making positive adjustments in the face of obstacles (Sutcliffe & Vogus, 2003). It is not a binary state but rather a multifaceted characteristic developed and strengthened by awareness and experience.

In this thesis, I will argue that to sustain network activities over time and in the face of stressors governance networks require resilience, which is characterized by adaptive capacity, situation awareness and slack in financial, social and cognitive resources. This thesis is an exploration of how attitudes, behaviours and actions shape the resilience of a governance network and how resilience affects the outcomes of a governance network's activities. By examining two cases in which the Canadian wildlife health network participated- the emergence of Chronic wasting disease in Western Canada and the emergence of White nose syndrome in Eastern Canada-, I will explore how this network uses resilient characteristics to adjust to stressors and how greater resilience facilitates the achievement of policy goals.

## **1.2 The Network**

The wildlife health network in Canada is comprised of individuals employed as wildlife biologists and policy advisors with a number of government departments and agencies, as well as independent academics with expertise in wildlife veterinary biology and pathology, members of environmental interest groups and the aforementioned Canadian Wildlife Health Cooperative (see Figure 1-1).

**Figure 1-1: The wildlife health network in Canada**



Many of the provincial and federal government employees who participate in the network are wildlife biologists who also hold positions with Canadian universities or have research partnerships with the CWHC. Similarly, many of the academics in the network have worked on contracts for provincial, territorial and federal governments. Most of the relationships in the network were formed through collaborative work on wildlife issues. Members working in government have large portfolios in wildlife health which means they can represent their



jurisdiction on a number of topics, allowing the network to have fairly consistent membership over time and when dealing with diverse disease incidents.

The Canadian Wildlife Health Cooperative (CWHC) was created through a memorandum of understanding between Canada's five veterinary colleges and the British Columbia Animal Health Centre. CWHC's mission is to "promote and protect the health of wildlife and Canadians through leadership, partnership, investigation and action" (Canadian Wildlife Health Cooperative, 2016b). With offices across the country and a headquarters at the Western Veterinary College at the University of Saskatchewan, CWHC has used their expertise to develop partnerships and collaborations on wildlife health issues in Canada. They conduct research and field surveillance to identify the emergence and mechanisms of disease and have become a key resource for governments developing wildlife management plans.

The CWHC has taken on the role of secretariat for the wildlife health network, as its staff have expertise in wildlife management and experience in providing policy advice to decision makers. Under the leadership of Dr. Fredrick A. Leighton (now retired), the CWHC acted as the coordinating hub of the network, arranging teleconferences, funding agreements, workshops and authoring management plans in consultation with stakeholders inside and out of the network. An organization of this type is of particular value to a governance network working across jurisdictions. The CWHC has been seen as a neutral non-governmental agency that can be funded in order to support national work (Canadian Wildlife Health Cooperative, 2016a).

The CWHC's role as a broker and coordinator for national and region disease issues has resulted in staff from the organization forming the core of the network with a number of government officials who have been collaborating in varying capacities for many years. This core remains stable as the network addresses different disease management issues. Other participants will join the network for a shorter period due to their role or knowledge regarding a specific disease threat or species, rather than a broader focus on wildlife disease management. On the periphery of the network are other stakeholders who have limited interest or capacity to participate. These participants include environmental organizations and industry organizations (such as game farm associations).

The individuals in the network work together to assess a disease threat and develop a management plan or other forms of policy response that can be implemented by various levels of government affected by the disease. Due to their reputations, their expertise and experience

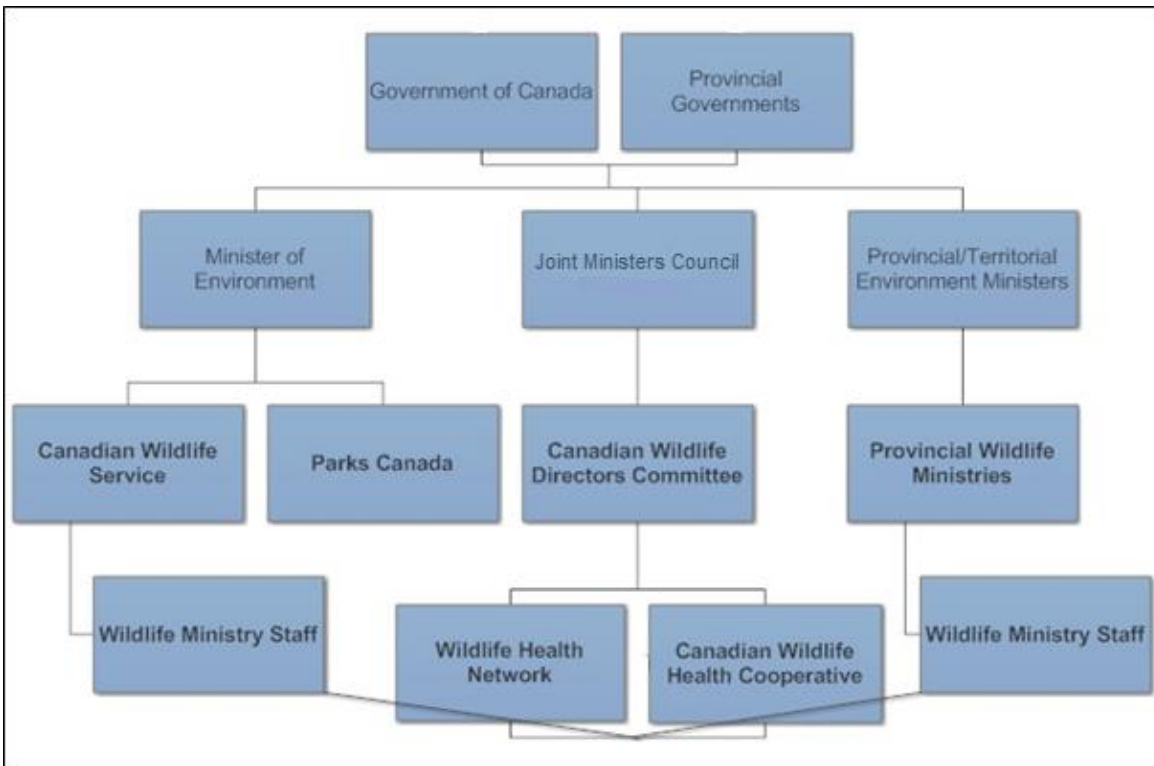
dealing with wildlife health, as well as their willingness to tackle these cases, this network has been entrusted in both formal and informal capacities to provide advice, conduct active surveillance of animals at risk and to coordinate policy approaches to wildlife disease threats for government.

### **1.2.1. Authority and Reporting Structure**

In both cases explored in this thesis, the network began their work on an informal basis. Sharing information is a key function of the network and through that process emerging infectious diseases have been identified as significant threats in need of national or international management plans. In order to formalize their collaboration the network has drafted agreements to stipulate the scope of their authority to develop management plans for provinces and/or the federal government. Figure 1-2 shows the formal authority structure for wildlife disease in Canada.

As there is a division of authority between levels of government responsible for wildlife health, the network has sought approval for its plans from the Canadian Wildlife Directors Committee (CWDC). Members of this committee include directors of wildlife from each province and territory, as well as the director of the Canadian Wildlife Service (the agency responsible for wildlife within Environment Canada) and representatives from Fisheries and Oceans Canada and Parks Canada. The CWDC exists to provide leadership on policy development and coordination across the country.

**Figure 1-2: Authority structure for wildlife health in Canada**



The CWDC does not have power to authorize the implementation of wildlife health management plans; instead it sets direction and seeks to unify the goals of wildlife agencies across the country. The work of the network supports the CWDC’s mandate by both bringing emergent issues to the attention of the senior policy makers on the committee, as well as developing technical expertise required to fulfill the needs of wildlife agencies.

Members of the network who are employed by provincial, territorial or federal government agencies or departments participate in the network as both individuals with expertise and representatives of their jurisdiction. Members are still responsible to their home department or agency and can use their position in government to advocate for the resources to implement specific management plans in their jurisdiction.

As with any government policy or program, ultimate authority rests with provincial, territorial and federal ministers. The network is able to partially fund their activities through the CWHC’s operating funding, contributions from non-governmental organizations (like the environmental advocacy group Canadian Wildlife Federation) or contributions from provinces or the federal government. When the network’s goal is to fully implement a national management

plan aimed at mitigating a wildlife disease threat, an agreement from the Joint Ministers Council or the federal Cabinet is needed, as a significant financial commitment is required to ensure success.

### **1.3 Methodology**

Studies of governance networks have generally taken one of two approaches: social network analysis or case studies. Depending on the nature of the research question, each of these approaches has both benefits and limitations for exploring governance networks.

The apparent novelty of the network approach led social scientists to seek to identify the types of groups and individuals both inside and outside of the state involved in policy solutions. Using a form of mapping called social network analysis (SNA) allowed researchers to understand more fully how social and professional relationships connected groups that developed unprecedented policy solutions. Statistical models have been developed to measure the centrality of particular individuals or groups (known as ‘nodes’) in a social network given the number of connections they have. There are also measures to identify the density of the social network given the relative strength or weakness of the connection of nodes based on the instances of their interactions (Dowding, 1995).

Ideally, transforming the ‘relational data’ of organizations into a graphical representation using SNA would reveal an underlying structure that illuminates how the network interacts. The results of social network analysis allows comparative and evaluative approaches to be used to assess the success of networks that were characterized by varying levels of density, reciprocity or the centrality of specific types of actors (DeLeon & Varda, 2009).

The SNA approach brings to light the importance of structure and form in various types of network environments. However, on its own, the results of social network analyses are relatively incomplete. SNA produces a network map of participants but tells us nothing about the internal workings of the network: how power is distributed, how decisions are made or where the challenges lay. The outcomes of the analysis may overvalue the network structure at the expense of the processes of collaboration and network activities that are not examined through the mapping process.

The other limitation of SNA is that it typically shows the network at a single point in time, or assumes that the network does not change or evolve. Keith Dowding (1995) suggests that the transformation of relationships into units of power in a network model should not be overstated as these relationships are not static nor do they tell us much about the network's behaviour. They only communicate the existence of the relations between nodes. As situations change and new issues are faced, the snapshot of the network may no longer be an accurate picture. Jenny M. Lewis (2011) argues that SNA did not find strong support in the policy world because the results are entirely too specific and tell us little about other policy sub-systems.

The case study approach is the other commonly used methodology in studying governance networks. John Gerring (2004) describes this approach as “an intensive study of a single unit for the purpose of understanding a larger class of (similar) units” (p.342). The case study method provides the opportunity to explore in depth the unit of analysis. The aim of using the case study method is twofold: to identify the practices and history of the network that have led to its current outcomes as well as to extrapolate from the particularities of one network the subject area on a larger scale (Gerring, 2007). The value of a case is that we are presented with details on human behaviour from our subjects and their actions in enough detail that we can estimate how closely theoretical expectations match a real world example. Finding a connection between activities and behaviours occurring in the unit and those theorized in the literature can affirm expectations. However, if the case's realities differ significantly from our expectations that also serves as an interesting outcome, as we can then explore where the theory ceases to account for real world behaviour.

A case study is limited in its ability to permit broad inferences, inasmuch as any testable theories developed from empirical observations need to be examined in a larger sampling to be statistically significant. Gerring (2004) suggests that case studies allow for the identification of causal mechanisms that increase our understanding despite the statistical limitations; the researcher is able to use logic and the knowledge gained from an in-depth study to make a connection between a network, its context, its actions and its ability to sustain itself.

For the purposes of this thesis, I have chosen to use a case study approach to examine how the Canadian wildlife health network dealt with two instances of wildlife health crises. Developing an understanding of the structure of the network, akin to a rudimentary version of social network analysis, was an important jumping off point; however it was apparent early on

that simply mapping the relationships present in the network would not provide any new or previously unexplored information on governance networks. A more detailed analysis that delves into the network's actions when facing disease threats was required to identify and expand upon an under theorized feature of governance networks, namely resilience. Resilience is comprised of a number of practices as well as behavioural traits that in a network may not be present in uniformly making mapping an unsuitable method.

### **1.3.1 Data Sources**

A vast amount of case material on Chronic wasting disease and White nose syndrome was provided by the coordinating agency of the network, the Canadian Wildlife Health Cooperative (CWHC), including drafts of management plans, financial documents, minutes of network meetings, correspondence between network members and an email archive from Dr. Fredrick A. Leighton, the former Executive Director of CWHC. This information was supplemented by public documents such as research reports and press releases from governments and academic studies on management strategies and treatment options for the two diseases. Dr. Leighton was also able to fill in the gaps through personal interviews and communications when necessary.

After an initial examination of the case material, the research question began to emerge more fully. There were gaps in the network's activity on Chronic wasting disease (CWD) due primarily to a change in the political makeup of the federal government in 2006. The work on White Nose Syndrome started later, in late 2010, but the network had to work within the same political environment and was able to navigate roadblocks it had not surpases in the CWD case. To appreciate the differences between the two cases I decided to adapt a model of organizational resilience, developed in the literature on positive organizational scholarship, to the phenomenon of network governance. Resilience recommended itself because the complex policy problems the network deals with do not lend themselves to easy or quick solutions. The work of the network appeared from the outset to be a struggle for answers, responses and resources. Resilience and the capacity to continue working in the face of these struggles appeared to be a fruitful avenue of inquiry.

Secondary sources contain little material that directly address governance network resilience, outside of case studies on disaster management networks operating in post-Hurricane Katrina in Louisiana in 2005 and the 2010 earthquake in Haiti. Positive organizational scholarship literature presented the concept of resilience as the ability to adapt and make positive adjustments in the face of internal and external pressures (Sutcliffe & Vogus, 2003). This provided a useful explanatory tool that seemed as though it could be tested against the findings of the case studies I had already examined. The wildlife health network had made significant inroads into becoming an authority on wildlife health epidemics in Canada without any formal authority. The question of how such a network maintains its activities despite limited funding and political power was of key interest to me.

Using the case study method I was able to delve deeply into the attitudes, behaviours and actions of the network members by examining their correspondence with each other, government officials, their U.S. counterparts and members of non-governmental organizations they occasionally work with. I was able to ensure that features of the resilience model that I judged to be present, such as failure-seeking behaviour or deference to expertise (see Chapter 3 and *passim*), were present in multiple instances. Language used in correspondence between network members was also present in network authored management plans and/or meeting minutes. These patterns allowed me to be relatively certain that the attitudes or behaviours I observed were not subjective assumptions on my part, but rather consistently observed themes. Whenever possible I have cited a publicly available document that contains the same language or action that I observed in unpublished material.

The next chapter will present an overview of the relevant research on governance networks, the following on resilience and the governance network resilience model. Chapters four and five contain the narrative of each of the cases reconstructed from my research on the network's activities. Each case is then evaluated against criteria laid out in the governance network resilience model. The thesis concludes with a brief discussion of my findings.

## CHAPTER 2: NETWORKS

### 2.1 The Concept

The ‘network’ concept has captured the imagination of theorists across disciplines. What is it about this model that makes it so useful for understanding social, technical and biological systems? Guido Caldarelli and Michele Catazaro (2012) suggest that the network concept allows us to make sense of the seeming randomness and disorder that appears on the surface of complex systems. When we search through a seemingly random or disordered grouping of complex elements there is often an underlying network structure that illuminates the behaviour of the larger group (or network). Unpredictable or unexpected phenomena or behaviour in a system can also often be attributed to the underlying network and the interaction of network elements. In both created and natural systems, there is self-organization that has occurred as the outcome of relationships, mechanisms and tendencies iterated along thousands of interactions. This self-organization is fundamental to network governance and represents the most conspicuous difference between a network and various forms of hierarchy.

The key to the network concept, in Caldarelli and Catazaro’s estimation, is that a network is more than just the sum of the individual elements that comprise the network. A network should be thought of as the product of three components: the individual elements (i.e. people, organizations, parts of an ecosystem), the sum of all these individual elements and, most importantly, the kinetic interactions in the relationships among the different elements (Caldarelli & Catazaro, 2012, p. 4). In a governance network we can see this interaction at play in complex policy problems such as a public health epidemic or the aftermath of a nature disaster. The collective knowledge, skill and resources of participant governments, NGOs and individuals could result in ‘enough’ to solve the problem; however, no one participant has the means and knowledge to implement a solution on their own. It is the collective and collaborative response that can, theoretically, ultimately provide the best course of action to implement a solution.

Another reason the network concept has captured the imagination of many researchers is that network structures emerge partially through an element of randomness and chance that is



unlike many purpose-created structures and institutions. Isolated elements are transformed through a pattern of interactions into groups and communities. Network structures appear not as grids but as webs of relationships as a result of the presence of some disorder. Mark Granovetter's (1983) work on information diffusion and communication across networks points to the presence of network hubs that connect unexpected elements to create the 'small world' of a network. Individuals or organizations acting as hubs span group boundaries and connect individuals and groups that would most likely never interact otherwise (Berry et al., 2004).

The Canadian Wildlife Health Cooperative (CWHC) can be thought of as a hub for the wildlife health network, as the knowledge and experience of its staff gives it standing with a variety of organizations, individuals and governments that would never have been connected otherwise. This bridging role allows for a variety of perspectives, experiences and frames of reference to be present in the development of management plans or policy responses in a way that is not possible in traditional governance models. Provan and Kenis (2007) frame the role played by organizations like the CWHC as 'Lead Organization-Governed Networks'. The knowledge, experience and connections that provide the authority to be a 'hub' is conceived of as legitimacy to broker relationships and perform a coordinating function for a network. Provan and Kenis (2007, p. 237) suggest that decreasing levels of trust and goal consensus due to greater numbers of participants (particularly participants who do not have a history working together) will require more brokered forms of governance for effective network interactions.

## **2.2. Governance networks**

Networks in government are a form of social coordination that attempts to address government and market failures that have emerged as well as tackle seemingly new, complex problems that require a collaborative, multi-level response from government and civil society (Bell & Hindmoor, 2012). In its basic form networks in government are comprised of individuals and organizations from civil society (such as non-governmental organizations, universities and interested citizens), various levels of government and the private sector that collaboratively co-produce policy solutions, knowledge and/or program adjustments in a given policy sphere. These groups vary in their membership, their administrative structure and activities but are generally

organized in a collaborative structure, with a horizontal power distribution and non-mandatory participation.

Early work on networks identified three broad forms. The first was the policy network (also known as an issue network or policy community) which identified a coalition of interested parties that together affect the agenda of government and the legislative process (Atkinson & Coleman, 1989; Wilkinson, Lowe & Donaldson, 2010). The second was the intergovernmental network, which attempt to coordinate government action and response between central and local governments (in unitary systems) and between national, provincial/state and local governments (in federal systems) (Rhodes & Marsh, 1992). The third network type is the public management or governance network. The governance network is a group of individuals and organizations (including government) who are attempting to solve policy problems from inception to implementation that can not be adequately addressed by a single party. Robert Agranoff (2006) suggests the term ‘collaborative management’ for these activities and describe it as follows: “the process of facilitating and operating in multi organizational arrangements to solve problems that cannot be solved, or solved easily, by single organizations” (p. 1).

Governance networks, the network form of key interest in this thesis, have been in existence in various forms most likely as long as there has been government (Goldsmith & Eggers, 2004). In the past 30 years, the use and study of governance networks has expanded significantly. The overarching reason for this interest and expansion is that traditional governance centred on the instruments of the modern state has struggled to keep pace with emergent public problems. The solutions needed to address economic, social and environmental problems facing citizens and communities require coordination beyond the capacity of discrete units of government at the municipal, provincial and federal levels.

The development of governance since the 19<sup>th</sup> century has primarily focused on the creation of stable institutions that provide a model for consistent legislative and public administration outcomes through a democratically-elected officials and an independent public service. Stephen Goldsmith and William D. Eggers (2004) suggest that this traditional organizational thinking cannot cope with the realities of what bureaucrats are required to do to provide solutions through policies and programs: “rigid bureaucratic systems that operate with command-and-control procedures, narrow work restrictions, and inward-looking cultures and

operational models are particularly ill-suited to addressing problems that often transcend organizational boundaries” (p. 7).

The ideal governance arrangement in the Westminster tradition has at its core a civil service that is strictly divided along department lines, is separated from overt political interference and has a vertical hierarchical structure for both control and accountability. Departments and agencies report ultimately to their Minister who is accountable in Parliament to the citizenry. It is difficult to assimilate networks into this formula, with the result that, as Kettl (2002) argues, public administration theory has remained static in the face of complex problems spanning policy areas and geographic boundaries as well as increased demands on the bureaucracy. As a result, practitioners of government and governance have been obliged to fend for themselves both practically and theoretically as they develop collaborative methods to solve problems.

The separation between theory and practice is not only an issue for practitioners in government and academia but has also nurtured a distrust and scepticism both inside and outside of government institutions. The growth of services provided, contracted out or collaborated on by government has challenged the traditional convention of ministerial oversight, which cannot be readily stretched to accommodate these different organizational forms. It is unreasonable to assume that the minister of a modern government department can be made aware of the details of all the programs under her remit and that leaves gaps in accountability (Roy, 2008). Beyond ministerial oversight, there are also challenges in communication and coordination between government departments that share or overlap on areas of responsibility but have to rely on formal methods of reporting through a chain of authority.

An illustration of the potential for failure of this governance structure, with its strict division by department and jurisdiction, its absence of day-to-day contact with ministers and its vulnerability to miscommunication, is the case of Bovine Spongiform Encephalopathy (BSE) in the United Kingdom. The BSE crisis spanned a decade from mid-1980s to mid-1990s and saw thousands of animals destroyed, millions of dollars lost to the UK’s economy and most significantly dozens of lives lost to the human variant of the fatal neurodegenerative disorder.

The BSE Inquiry, commissioned by the UK Parliament in the wake of the crisis, found that it took two years for the initial discovery of the disease in livestock by the Ministry of Agriculture, Fisheries and Food (MAFF) to be disclosed to the Department of Health (DH). They

also suggested that had the departmental divide between MAFF and DH not been so great, action would have occurred months before it ultimately did (Gerodimos, 2004). The Inquiry revealed that the decision by MAFF public servants to downplay the threat posed by BSE was influenced heavily by a desire to calm public fears and appease their professional connections in the beef industry (Gerodimos, 2004, p. 918). The decisions made at MAFF appear to be entirely devoid of a concern for the broader impact of BSE and shows a worst-case scenario for silo thinking on the part of government departments reacting to crisis situations.

The inability of governments to adequately address complex public policy problems is not just a problem of institutional structure but is also due to the increasing speed at which new problems are emerging. Traditional governance is based on a series of institutions embedded in the stability of legislative and administrative procedure. The new problems faced by society and government are different in kind and complexity than the problems that confronted the relatively stable institutions of the 19th century (Jones et al., 2008). The appearances of new diseases, record population growth, devastating natural disasters, among other problems challenge the most knowledgeable public servants, academics and legislators.

The SARS coronavirus is the textbook example of an epidemic for the modern world. From its origin in Guangdong Province, China in 2002 the virus spread to 37 countries in less than a year, killing almost 500 people (Smith, 2006). While the outcome could have been much more severe, the economic impacts and loss of lives illustrates how an interconnected world has set the stage for unprecedented policy problems. The development of new treatments and approaches to tackle these diseases and the environmental processes encouraging them is essential. Rethinking how governments tackle crisis scenarios and mitigate high risk situations is also critical to preventing the loss of human and animal lives as well as environmental and economic damage.

The governance network approach can be seen in this light as a redress of the structural problems in traditional governance as well as a coping mechanism to deal with unprecedented and complex problems. The lack of capacity of government to properly address policy problems was one of the catalysts of the development of the governance network model (Isett, Mergel, LeRoux, Mischen, & Rethemeyer, 2011). Bell and Hindmoor (2012) argue that networks were the natural response to the acknowledgment that government is no longer in a position to act unilaterally to achieve policy solutions, while Donald Kettl (2002) suggests that responsibility

must be shared as no one government or organization “can completely encompass, manage, or control any problem that really matters” (p. 6).

### **2.3 How do governance networks address the failings of traditional governance?**

Donald Kettl (2002) argues that the network approach is a mechanism that enables governments to bridge their traditional forms of governance with the realities of the ‘knowledge-driven information society’ as governance networks are driven by situation and need as opposed to hierarchy and legislative procedure. Jenny M. Lewis (2011) summarizes the use of governance networks as a changed relationship between society and state:

In short, network governance rests on a recognition that policy is the result of governing processes that are not fully controlled by governments. Policy-making occurs through interactive forms of governing that involve many actors from different spheres. It relies on negotiation between various actors whose interactions give rise to a relatively stable pattern of policy-making that constitutes a mode of coordination... A form of governance that rests on interdependency [*sic*], negotiation and trust is required to cope with changes in how governments and societies interact. (p.122)

This transition in thinking from a bureaucratic silo to a collaborative relationship provides the opportunity to overcome the lack of communication between various departments or levels of government that is often at play in crisis scenarios (like the BSE situation in the UK). A governance network also requires that stakeholders participate in collaborative decision making, which suggests that a broader scope of interests can be taken into account. Robert Agranoff’s (2006) work on interorganizational governance networks found that the concept of decision making is often replaced by ‘reaching an agreement’. As it is unlikely any one element of the network would have the financial or legal resources to contend with a problem on its own, authority is shared and there are partnerships in lieu of lines of authority. ‘Reaching an agreement’ then becomes an opportunity for mutual learning, as the process of collaboration requires understanding varying viewpoints and sharing of knowledge: “joint learning that leads to brokered consensus” (Agranoff, 2006, p. 60).

The collaborative problem solving seen in governance networks also allows governments to access crucial knowledge and communicate it as part of the problem solving activities seen in many governance networks. One activity that is vital for networks - particularly those addressing problems that are new, complex or full of uncertainty - is knowledge management. Policy problems with newly emerged or uncertain elements require new knowledge and new answers.

Agranoff (2006) suggests that knowledge is a commodity to be sought out and managed in the network world. Networks that wrestle with problems that contain layers of complexity and uncertainty across jurisdictional boundaries have to develop and manage distributed knowledge systems, as the expertise and knowledge to solve problems seldom rests with one organization.

The practice of knowledge management is to join both the explicit and implicit knowledge of the policy problem together and communicate it to the broader network for the purposes of engaging in an informed collaborative problem solving process (Agranoff, 2006). A successful collaborative problem solving process requires broadening the horizontal relationships inside and outside of government. Among the key benefits is the (often temporary) destruction of the departmental silo and the communication barrier between portfolios, as long as all sides can engage as active and willing participants. Engaging in a governance network requires an acknowledgement of the complexity of the policy problems because a network must seek to find a substantive solution, not a simple solution that only satisfies one stakeholder. Mark Imperial's (2005) work on watershed management networks shows that collaborative activities were beneficial to network members from varying sectors and political positions. The opportunities to work in a collaborative capacity "are important because they help network members find ways to work together, generate new ideas, share knowledge, solve problems, build relationships, and develop trust" (p. 296).

#### **2.4 Governance network limitations**

Governance networks are not a panacea for all policy problems, nor are they the sole mechanism for collaboration within the policy sphere. Collaboration can take a variety of forms including formal funding agreements, multilevel projects, contracts and the creation of interagency organizations. Both bureaucratic institutions and governance networks use many of these arrangements in their work when formal mechanisms of accountability are required. In fact, the increase of these types of arrangements seems to be normalizing collaboration in bureaucratic government organizations (Agranoff, 2006).

A chief criticism of governance networks has been the lack of democratic accountability in networks and network arrangements (Sørensen & Torfing, 2007; Sørensen, 2002). Sørensen and Torfing (2005) suggest that proponents of governance networks have often

failed to focus on the democratic implications of the ‘de-governmentalized’ state. The inclusion of non-state actors in the policy arena is not novel by any means, however, the potential devolution of authority to governance networks that have closed membership raises concerns about the democratic accountability of decision making that affects the public or the government’s resources.

Differing arguments have surfaced to address these apparent accountability deficiencies. The role of expertise as a form of legitimacy, the inclusion of ‘low politics’ and the use of metagovernance are discussed below as methods to bridge the accountability gap. In a discussion of highly technical and complex areas of service provision, for example energy regulation in the European Union, Hérítier and Lehmkuhl (2011) argue that governments do not have the knowledge or capacity required to have proper oversight. They suggest that networks comprised of technical experts are better equipped to act for the good of the citizenry and the energy sector, as their distance from government and knowledge of the subject area lends legitimacy and credibility. A formal mechanism of democratic oversight for technical experts is recommended to ensure public interest is maintained (Hérítier and Lehmkuhl, 2011). This perspective suggests that subject matter experts can contribute to the creation of legitimacy for the governance network.

While examining community environmental projects in the Netherlands, Thomas Hahn (2011) expands the notion of democratic accountability beyond the traditional realm of ‘high’ democracy. Hahn suggests that the inclusion of individuals and groups who have traditionally been excluded from policy decisions complements representative democracy. These participants have limited access to lawmakers and through collaboration in the network environment, ‘low’ democracy is in action through deliberative discussion and problem solving. Hahn (2011) argues that ‘low’ democracy is not a replacement for traditional representative democracy but rather supports it to increase the legitimacy of the decisions made in consultation with environmental networks. As each network was ‘nested’ within the larger context of traditional bureaucratic and democratic decision making, the networks were able to maintain their flexibility and adaptability while having traditional democratic accountability through elected officials.

Hahn’s concept of nested governance networks supports Sørensen and Torfing’s (2005) concept of ensuring that governance networks are themselves democratic through meta-governance. “Meta-governance designates the endeavour to regulate self-regulating governance

networks by shaping the conditions under which they operate. It involves the attempts of politicians, administrators or other governance networks to construct, structure and influence the game-like interaction within particular governance networks” (Sørensen & Torfing, 2005, p. 202). Meta-governance can take the form of shaping the membership, scope, power and reporting requirements of the network. These authors all suggest that governance networks require increased democratic accountability to ensure that the decisions they are making legitimate and responsible decisions.

There are a number of fronts on which governance networks can potentially improve or hinder policy outcomes. In order to maintain a sense of proportion about the value and potential of governance networks, evaluative tools need to be developed to understand the full impact of the interactions and contributions made by governance networks to the policy making process and policy outcomes.

## **2.5 Evaluating governance networks**

Being able to accurately assess the outcomes produced by governance networks has been a challenge for academics and practitioners. As governance networks often seek to address complex or multifaceted policy problems, these types of problems that do not have straightforward or easily achieved solutions, evaluative tools that can appropriately assess the network’s impact are of key interest.

The question of how to evaluate governance network performance or effectiveness has been addressed in a number of ways. One school of thought suggests that governance networks should be evaluated like their component parts (organizations) adapting to the network environment by multiplying the number of stakeholder communities the network is attempting to satisfy (Provan & Milward, 2001). This involves measuring network outcomes at three levels: network-wide, community and participant organizations. A second school of thought suggests that ex ante goals and standards are detrimental to achieving the necessary exploration, learning and innovation that is required to successfully address complex policy problems. The model attempts to resolve this problem by using ex post goals and measurements to determine how successfully the solutions relate to objectives and whether there is a net improvement from the perspective of all participants (Koppenjan, 2008).



A third school of thought argues that outcomes themselves are entirely too limiting for measuring the success of a governance network. Complex policy problems will often take years to be resolved, which is problematic for governments that are focused on shorter-term progress to secure elections and to respond to opposition. Brian W. Head (2008), among others, suggests that the tendency to mitigate the complexity of evaluation in these situations leads to assessing outputs rather than outcomes, which is problematic. Head's suggestion is to instead assess the processes of collaboration (as the success of the network is vital to the success of the policy solutions it is implementing) as well as the outcomes produced by the network and ultimately address whether the collaboration is adding-value (2008, p. 741). While the approach acknowledges the complexity of certain problems governance networks engage with, this is also a limited approach, as the success of the collaboration may not translate to successful policy action.

### **2.5.1 Network failure**

From that brief examination, it is apparently that evaluation is a challenging issue and the concept of successful governance networks is often problematic. The other side of network evaluation and effectiveness is the development of a theory of network failure. This approach seeks to develop a theory similar to the concepts of market failure and organizational failure that address the social conditions that lead to network failure. Shrank and Whitford (2011) suggest that network failures are caused by either environmental factors, like transactional uncertainty or participant limitations, such as the limits imposed by bounded rationality and individual or organizational opportunism. The two forms of 'absolute' network failure take the form of network devolution (the collapse of an existing network relationship) and the nonappearance of a potentially useful network. The two forms of 'relative' failure are due to lack of competence (an underdeveloped network) and opportunism (a contested network). In other words, relative failure occurs when problematic networks continue to exist and absolute failure occurs when a network ceases existing or does not come into being.

Shrank and Whitford's theory of network failure identifies a gap in the governance network literature that requires further exploration. An exploration of which features have led to failure and which features have assisted networks in avoiding failure would provide a valuable

resource to understand how to mitigate failure. Literature of this nature has focused primarily on how structural features of networks (such as centrality of relationships or the presence of coordinating agencies) improve outcomes (Provan & Milward, 2001; Isett, et al., 2011). What has been neglected is how a network's actions are affected by financial, informational and organizational barriers and how networks cope when faced with barriers to their objectives. When a network has formed in an effort to address a policy problem, like an emerging wildlife health epidemic, which has no viable treatment options, the ability to continue operating by cultivating and maintaining a resilient network is essential.

## **2.6 Improving network activities**

A perspective that focuses on strengthening the positive assets present in the wildlife health network is needed. Identifying the benefits of the governance network form and the skills of the network's members that can contribute to improving outcomes finds its grounding in a form of organizational theory that derived from positive psychology.

Positive psychology as a field of study was introduced by Martin Seligman as an attempt to balance psychology's focus on pathology and behavioural traits that led to negative outcomes (Kelloway, 2011). Seligman's desire to identify positive attitudes and actions that enhance mental well-being and relationships was adapted to organizations and organizational behaviour by Fred Luthans. The resulting field of positive organizational behaviour (sometimes referred to as positive organizational scholarship), was defined by Luthans (2002) as "the study and application of positively oriented human resource strengths and psychological capacities that can be measured, developed, and effectively managed for performance improvement in today's workplace" (p. 59). Traditional organizational behaviour seeks to understand the motivating factors of employee behaviour, whereas positive organizational behaviour focuses primarily on psychology traits that engender positive attitudes and seeks to operationalize these traits (Kelloway, 2011). The psychological traits identified as important for development and/or management to improve performance include hope, optimism, resiliency and efficacy (Norman, Luthans & Luthans, 2005).

This chapter has outlined policy problems that have spurred changes in governance mechanisms from traditional government institutions towards governance networks. Governance

networks provide opportunities to address policy problems that span across jurisdictions. They are theorized to provide policy solutions developed in a collaborative capacity such that the structural disadvantages of traditional governance arrangements can be minimized. Theoretical work on governance network evaluation has provided a variety of frameworks for evaluating success but is limited in how it has conceptualized failure and the mitigation of failure. One approach developed in positive organizational scholarship has been to identify and strengthen processes that promote resilience in organizations in order to reduce failure when a network is faced with threats and adversity.

## CHAPTER 3: RESILIENCE AND A NETWORK RESILIENCE MODEL

The concept of resilience initially emerged from material and engineering sciences where it was used to denote the ability of a substance to regain its original properties and form after undergoing stress. This concept finds practical purposes in the natural and mechanical sciences but it is also an elegant linguistic metaphor that has captured the imagination of social scientists. A variety of understandings and definitions of resilience have emerged. The ability to withstand damage, as in a military situation, where resilience emerges from a redundancy in staff and equipment is a common understanding. Resilience can also be thought of as system adaptation, where a network or organization maintains the ability to adapt to changing circumstances through iterative adaptations. A return to the status quo or the ability to withstand exogenous or endogenous shocks and return to ‘normal’ such as in an economic system post-financial crash is also a potential interpretation of the term (Scheinert & Comfort, 2014).

The definition of resilience most appropriate for my purposes comes from positive organizational scholarship where organizational resilience is defined as “maintenance of positive adjustment under challenging conditions” (Sutcliffe & Vogus, 2003, p. 95). This definition is similar to system adaptation and acknowledges that resilience is more akin to a process than a stable state or binary concept.

Organizational resilience arose as a topic of study as a reaction to the common assertion that a process called ‘threat-rigidity’ is the chief response of organizations to emerging threats. Threat-rigidity is a process wherein significant stress in an organization results in a series of deterministic responses including narrowing of cognitive processes, centralization of control and resource conservation. This type of behaviour in the face of threats can be problematic as threat-rigidity suggests that an individual or an organization while under heightened stress loses the capacity to consider all possible solutions and retains only the capacity to rely on prior knowledge regardless of its applicability to the current situation (Sutcliffe & Vogus, 2003). Threat-rigidity results in organizations that fail to explore options; rather they concentrate decision making and limit the output of resources. Organizations that become rigid in the face of threats may survive, but the inference is that the adaptation is not a value or recognized quality in

the organization as the pressure for adjustment (the threat) is exogenous. Organizational resilience as both a topic of study and an approach to leadership in organizations implies that it is possible to broaden the knowledge base and the skill set of members of the organization in order to limit rigid or automatic behaviours when facing challenges or stressors.

### **3.1 Resilience as Positive Adjustment**

The concept of resilience as positive adjustment under challenging conditions originated in child psychology where the processes and mechanisms of resilience have been studied in individuals who have dealt with both severe trauma and ongoing stress. Resilience has been theorized as being the result of a number of cognitive and physiological functions, including both inherent characteristics and learned traits (Dongxia & Kan, 2011). According to Sutcliffe and Vogus (2003), psychological resilience is now widely (but not wholly) accepted as a dynamic process, rather than the product of inherent biological characteristics. They portray resilience as a self-reinforcing process:

Resilience from a developmental perspective does not merely emerge in response to specific interruptions or jolts, but rather develops over time from continually handling risks, stresses, and strains. Positively adjusting in the face of challenging conditions is thought to add both to the strength of the current entity and also to the strength of the future entity, in that resilience is the continuing ability to use internal and external resources successfully to resolve issues... What this means is that early experience shapes later experience such that the way in which an entity (i.e., organization, unit, individual) interprets and responds to new challenges depends on attitudes, expectations, feelings, and response possibilities derived from a history of prior experience (e.g., adaptation). (p. 98-99)

Conceptualizing resilience as the ability to make positive adjustments, as the result of learning, coping and integrating experiences into a skill set suggests that resilience is not a binary state, it is developed over time. There are two potential responses to a threat: either a defense mechanism is thrown up when a threat is unknown, or accommodative and assimilative processes emerge if a threat is recognized as a stressor. The former response can be thought of as a response of threat-rigidity, where an individual or organization reverts to its most basic nature of fight or flight (reacting in a subconscious manner). The latter response can be seen as a resilient response where the subject pulls from past experience, education or other resources to either reassess their own actions or goals to counter the threat or minimize the impact the threat has on their life or organization (Dongxia & Kan, 2011).

In order to have the capacity to develop resilient behaviours and make productive choices to reduce threats or risk, rather than deferring to passive defense mechanisms, there are certain necessities. Individuals require an adequate level of physical, mental and material resources (or security) as well as suitable levels of cognitive competence that would engage functions like self-regulation, problem solving, planning and working memory for appropriate adaptive behaviour (Masten, 2011).

Developmental psychologists have attempted to develop a scalable model of resilience that can be applied broadly, be it to children, ecological environments, organizations or large scale populations, in an effort to find ways to promote resilience. Measuring resilience capacity relies on judging the total risk or adversity facing the subject versus total assets the subject has in their metaphorical cognitive, physical and material toolbox. When looking at the factors that influence outcomes in children, a typical risk may be a low socioeconomic status, a single parent household or a learning disability. The presence of resources that could help mitigate the risk would include intervention from therapists, educational assistance, food security, or the proximity of a supportive extended family. Acquiring the necessary levels of cognitive competence is a particular challenge for children, as they are in the developmental stage; the literature cites effective parenting as the key protective factor for resiliency over threats (Masten, 2011, p. 498). The interplay of these risks and assets create a variety of educational and behavioural outcomes: where a child with a developmental disability may thrive because of the opportunities provided in a high socioeconomic upbringing, while a child with average intelligence in a low socioeconomic household may lack the ability to cope. These differences can be traced to chronic poverty, which leads to absentee parenting, which deprives the child of functional role models and emotional support, undermining overall competence.

### **3.2 Governance network resilience**

As much as resilience may be a valuable psychological quality, is it equally valuable for organizations and networks? Organizational resilience emerges as a subject of interest from a desire to understand why some firms fail and other adjust rapidly and successfully to threats (Sutcliffe & Vogus, 2003). Can the concept of resilience be used to evaluate networks as effectively as it has been used to evaluate organizations?

Traditional bureaucracies have sufficient legal standing and stability to infer that they will exist over time; non-governmental organizations often exist on less solid ground but none the less have legal standing and support year after year in part because individuals carry their knowledge and experience with them. Networks, however, exist as relationships between these groups, often with little certainty regarding their continuity, save for a short term government contract or an ongoing desire on the part of members to participate in problem solving. The network flourishes often because this lack of structural arrangements provides the flexibility needed to tackle problems in a way that governments cannot. If we accept that networks like the wildlife health network in Canada are tackling problems that cannot be successfully addressed by traditional means, and if governments are willing to invest in partnerships or financial commitments to networks: it stands to reason that we should concern ourselves with both if and how networks are able to be resilient in the face of the uncertainty of their ongoing existence.

In developing a model to explore the way resilience aids the ongoing work of the wildlife health network, it is valuable to explore how organizational resilience scholars operationalize beliefs, processes and actions to identify resilience. The organizational resilience literature contains a consensus regarding how resilient organizations think, act and organize. Resilient organizations are successful, forward-looking, sceptical and have proactive organizational culture (Sutcliffe & Vogus, 2003, p. 106). Resilient organizations enlarge information inputs, loosening control and reconfiguring resources when facing threats; all of which results in a positive feedback loop into that strengthens organizational capabilities, essentially the opposite of threat-rigidity (Vogus & Sutcliffe, 2007).

Based on the organizational resilience literature, I have adapted a number of qualities, behaviours and beliefs into a model that will be used to assess the resilience of the wildlife health network in Canada for two cases. The three features of resiliency that are applicable to the network environment are: slack in resources; adaptive capacity; and situation awareness. These features will each be set out in terms of their relationship to resilience, followed by an exploration of how they will be identified in the case studies (see Table 3-1).

### **3.2.1 Slack in Resources**

The concept of organizational slack emerged from Herbert Simon's assertion that firms often do not seek to completely maximize their profits through optimal efficiency. The excess amount paid to individuals, above what was strictly necessary to maintain their participation in the organization, was seen as slack (Bourgeois, 1981). His colleagues, James March and Richard Cyert further developed the concept of slack, arguing that slack was not simply an inefficiency but rather spare resources that are necessary to maintain organizational flexibility (Cyert & March, 1992). Bourgeois (1981) suggests that organizational slack is a means of safeguarding actual or potential resources which serves to protect the organization when it faces internal or external pressures for change. It also allows breathing room when the organization seeks to make strategic changes of its own volition.

For the purposes of the network resilience model, slack in resources comes in three broad categories: financial, social and cognitive. Financial resources are obviously an important feature of the capacity of any government, organization or network to function effectively. As in Cyert and March's conception of organizational slack, the presence of enough financial resources to make strategic changes or to respond to external pressures is crucial. In the case of the wildlife disease network, a minimum set of financial resources is required to detect a wildlife disease in a new province and to subsequently deploy surveillance or engage wildlife veterinarians in a treatment program. Cognitive resources, such as the ability to gain additional knowledge when facing a new threat or problem, and social resources, like additional contacts with industry, academia, non-governmental organizations or government, are also relevant to understanding levels of resiliency.

The research done by Vogus and Sutcliffe (2007) indicates that the timely deployment of the various resources can make the difference between resilience and rigidity, as organizations with greater resilience are willing and able to expend resources to tackle emerging threats. Along with the willingness to expend resources at crucial times comes the need to have them in the bank. Organizations and networks cannot be perpetually overdrawn. Slack in resources, which means having an adequate margin, is necessary in order to reconfigure resources and draw on them when unexpected issues arise.

Evidence of slack in resources in the wildlife health case studies will come from an examination of the financial arrangements, to determine if the network is overstretched financially, as well as an assessment of whether the network can access social and cognitive



resources when stresses occur. In particular, we will identify the presence of slack in financial resources by whether or not the network members plan for contingency funds, if they are able to access additional finances through recombination or the formation of new partnerships and if there are latent financial resources available. Cognitive slack will be identified by the ability of the network to access new information and perspectives for problem solving (Sutcliffe & Vogus, 2003). Relational slack will be identified by evidence of support from political decision makers and authorities (who were not previously active in the case) and the participation of new network members as a suggestion that the network is not overstretched in terms of human resources.

### **3.2.2 Adaptive Capacity**

The second feature of the model is adaptive capacity. The importance of adaptability in an individual's psychological processes, as we have seen, is the difference between throwing up defense mechanisms and being able to cope. Organizations and networks that display adaptive capacity are in a stronger position to cope with uncertainty and stresses if they are able to adjust their behaviours and practices to meet new challenges. McManus, Seville, Vargo, & Brunson (2008) suggest that adaptive capacity is "the ability of an enterprise to alter its strategy, operations, management systems, governance structure, and decision-support capabilities to withstand perturbations and disruptions" (p. 86).

Adaptive capacity allows the network to adjust its approach to policy implementation, knowledge acquisition, resource management or any number of fundamental activities in a timely manner so that their work is still relevant and their actions are still in line with their objectives. The literature suggests that adaptive capacity is the result of the dynamics and culture of an organization or network that allow it to make decisions in a timely and appropriate manner. It is a function of a flexible organizational culture, receptive leadership, timely information gathering and sharing, as well as an ongoing belief that the group can deal with stressors and grow to meet challenges (McManus et al., 2008).

Evidence of adaptive capacity will come from examining the network's attempts at altering strategy and operations, embracing new information and effectively communicating with network partners when potential stressors occur. The perspective of network members will be explored with regard to their views of crises. The literature suggests both an opportunistic and

positive disposition is valuable to tackling problems. Increased communication and information inputs when problems occur will suggest adaptive capacity, as will the loosening of decision making control and attempts to solve problems using an “organic and innovative approach” (McManus et al., 2008, p. 84). The opposite approach—deferring to authority within a command and control structure—will suggest a lack of adaptive capacity, as McManus et al. suggest command and control management relies on automation and rigor which in turn reduce positive performance and situation awareness in a crisis or ‘out of the ordinary’ situation.

### **3.2.3 Situation Awareness**

The final feature of the model is situation awareness which is defined as the organization (or network)’s awareness of its operating context, by identifying potential threats and opportunities and their consequences. Situation awareness also includes knowledge of the needs, expectations and limitations of stakeholders; of the ramification of potential actions; of potential triggers for stressors and of organizational operating requirements (McManus et al., 2008). Discussing a similar concept termed ‘mindful organizing’, Vogus and Sutcliffe (2007) suggest a number of related beliefs and actions that drive the type of self-awareness and proactive planning resilient organizations require:

engaging in proactive and preemptive analysis of possible vulnerabilities (preoccupation with failure), questioning assumptions and received wisdom to create a more complete picture (reluctance to simplify interpretations), discussing the human and organizational capabilities that enable safe performance (sensitivity to operations), attempting to collectively learn from errors that have occurred (commitment to resilience), migrating decisions to the person or people with the greatest expertise with the problem at hand regardless of rank (deference to expertise). (p. 3420)

Evidence of situation awareness in this analysis will come from the network’s members’ communication and coordination with regard to potential problems, capacity building, and stakeholder expectations. If the network is blindsided by stakeholder activities, this will be evidence of a lack of situation awareness. Identification of situation awareness will include recognition by network members of potential problems in their planning (such as developing contingency plans), whether they view problems as opportunities (as opposed to threats), and if the network is reliant on limited sources of information or willing to search out new perspectives, as it is suggested in the literature that brittle organizations assume they will be successful while resilience organizations plan to struggle (Vogus & Sutcliffe, 2007).

**Table 3-1. Governance network resilience model**

Feature	Definition	Measurement	Source
Slack in Resources	Reserves of financial, social, structural and/or behavioural resources	Evidence that the network is not overstretched in resource allocation; ability to tap into new sources of funding, partnerships, support when necessary.	Vogus & Sutcliffe.
Adaptive Capacity	Culture and dynamics that allow participants to make decisions in a timely and appropriate manner (including flexibility)	Evidence of attempts/success at altering strategy, operations, structure, decision-making capabilities to support positive adjustment	McManus et al; Sutcliffe & Vogus (Efficacy)
Situation Awareness	Perception of operating environment; acknowledgement of threats and opportunities; awareness of limitations and stakeholder expectations.	Evidence of communication, coordination in the network with regards to anticipation of potential problems, obligations to stakeholders, deference to expertise, capacity building.	McManus et al; Vogus & Sutcliffe (Mindful organizing)

The features laid out in this network resilience model will be explored and evaluated through interviews with key informants who participated in the cases and in the network as well as through reviews of primary sources including reports, minutes of meetings, annual reports and correspondence of individuals and organizations involved in the wildlife health network. An evaluation then follows of actions and attitudes supporting (or refuting) the necessary qualities for a resilient network.

Through this analysis, we will be able to begin to assess how networks use their flexible and collaborative arrangements to tackle emergent problems and determine if the beneficial features of governance networks translate into resilient practices or if it instead places networks in a vulnerable position. A comparative assessment of the two cases will then provide insight into the necessity of resilience for successful policy outcomes.

## CHAPTER 4: THE CHRONIC WASTING DISEASE INTER-AGENCY OVERSIGHT COMMITTEE

### 4.1 The Disease

Chronic wasting disease (CWD) is a transmissible spongiform encephalopathy (TSE) that affects cervids (hoofed mammals of the family *Cervidae*): including mule deer, white-tailed deer, elk and moose. TSEs are a class of degenerative illnesses caused by misfolded prions (a proteinaceous infectious particle) in the brain and nervous system (Cashman, 1997). Other TSEs include Scrapie, Bovine spongiform encephalopathy (BSE, often referred to as ‘Mad cow disease’) and variant Creutzfeldt–Jakob disease (the human variation of BSE). CWD is a fatal disease that is currently untreatable; it is associated with behavioural changes and severe weight loss. It has a long incubation period and is therefore difficult to detect until an advanced stage when further transmission has already likely occurred. The exact methods and rate of transmission are still being determined; however, it is known that transmission can occur laterally- between animals- as well as through contaminated environmental material (Wasserberg, 2009).

The first identifiable cases of CWD presented in Colorado in the 1960s and it is commonly assumed that infected animals moved from a South Dakota game farm introduced the disease to Canada. In 1996, CWD was first detected in elk on a game farm in Saskatchewan; six years later it was diagnosed in deer on a game farm in Alberta (Kahn et al., 2004). While CWD affects livestock, it is also found in wild animals. The first identification of the disease in wildlife was an elk in Saskatchewan in 2000 (Canadian Wildlife Health Cooperative, 2015b), since that time it has spread to wild deer and moose in both Saskatchewan and Alberta.

Prior to Chronic wasting disease being found in wildlife, TSEs in Canada were primarily contained in livestock, in the form of Scrapie (affecting sheep) or BSE (affecting cows). Any presence of TSEs in Canada was mainly an economic concern due to trade sanctions imposed on countries with confirmed cases of BSE in livestock. BSE has not been found in wild animals and the effects of Scrapie on wild sheep has been minimal. The fallout of one confirmed case of BSE

in Alberta in 2003 included border closures for Canadian beef to the U.S. for several months, herd reductions of over one million head of cattle and a drop in beef prices by 75% (Petigara, Dridi & Unterschultz, 2011). While the farmed cervid industry, consisting of animals like elk, deer, moose and caribou, is not nearly as large as the beef industry, estimates from Petigara et al. (2011) suggest that over \$40 million a year is contributed to the Canadian economy from cervid game farms. The researchers suggest that a large scale outbreak of CWD would have a number of economic and social costs including diminishing consumer demand for cervid livestock, international trade restrictions, and negative impacts to communities reliant on cervid hunting or the hunting trade (Petigara et al., 2011, p. 1612). The broader economic implications of a CWD outbreak would not be as widespread as the BSE outbreak in Canada and the UK, however, it would still be catastrophic for the cervid game industry in Western Canada.

The ability to detect CWD in the wild is a principle challenge in the attempt to eradicate the disease. There is a long incubation period between infection and the clinic onset of the disease, thought to be at least 16 months, during which the disease is undetected (U.S. Geological Survey National Wildlife Health Centre, 2013). During this time, wildlife can migrate across large distances, shedding infectious prions and exposing the infection to new herds. While a vaccine has been developed and is being tested, there is, as of yet, no treatment for the disease, culling the entire herd where an infected animal is found is the primary means to prevent the spread of disease.

The presence of CWD in domestic elk and deer being raised on game farms in Alberta and Saskatchewan led to a Chronic wasting disease eradication program and the 'Chronic wasting disease Voluntary Herd Certification Program', both regulated and administered by the Canadian Food Inspection Agency. The eradication program began on a voluntary basis in January 2001 but was upgraded to mandatory surveillance and eradication of suspected infected cervids by December of that year for farmed herds in Manitoba, Saskatchewan, Alberta and Yukon (Canadian Food Inspection Agency, 2012). It is estimated that government and industry spent upwards of \$40 million attempting to eradicate the disease on farms in Alberta and Saskatchewan between 2000 and 2005, yet CWD has proven challenging to fully eradicate and has even spread to new species in the wild (Technical Working Group, 2005).

## **4.2 The Network in Action**

There is a clear regulatory regime for reporting diseases in livestock at both the provincial and federal levels. The discovery of CWD in wild animals presented a new challenge, as the disease management framework for wildlife had not been as thoroughly developed. The National Wildlife Disease Strategy had been written and approved in theory, but had not, as of yet been operationalized. The governance implications of CWD's spread to wildlife meant that the number of stakeholders involved grew beyond agricultural and food safety regulatory agencies to include wildlife and natural resource departments from the Saskatchewan, Alberta and Canadian governments (including the Canadian Wildlife Service, Environment Canada, Alberta's Department of Environment and Sustainable Resource Development and Saskatchewan's Ministry of Environment).

In order to tackle the threat of CWD in Western Canada, members of the wildlife health community of public servants, researchers, academics and NGOs in Canada began coordinating efforts and formed an inter-agency, cross jurisdictional network. Acknowledging the absence of federal standards for assessing and managing wildlife health crises, the network dedicated their efforts to working on a management plan for CWD in wild cervids. Research by a number of the network members suggested that if CWD were left unchecked in the wild, the disease could potentially decimate the population of cervids in Canada, both in the wild and raised as livestock (Bollinger et al., 2004). Key members of this network included provincial biologists and Ministry staff from Alberta, Saskatchewan, Ontario and Manitoba as well as researchers from the Canadian Wildlife Health Cooperative.

One of the network's first tasks was to gather some of the world's foremost experts on prion diseases to assess the Canadian situation from a scientific perspective. The group, which included academics and scientists from Canada, Australia, Belgium and the U.S., gathered with government representatives and other stakeholders for two days in Saskatoon in June 2004 to discuss the state of CWD in Canada. The panel was tasked with assessing the threat CWD posed to Canadian wildlife and to identify the knowledge gaps that could potentially be filled by policy intervention.

Eight weeks later the panel released a report entitled 'Chronic wasting disease in Canadian wildlife: An expert opinion on the epidemiology and risks to wild deer' in which they advocated "aggressive regional and national management and research response to prevent further spread of CWD and to control or eliminate the disease in wild cervids" (Bollinger et al.,

2004, p. 3). There was, the panel suggested, a unique opportunity to eliminate the disease as it had only recently taken hold in Canada and is known to be highly resilient once endemic to a population (Bollinger et al., 2004, p. 15). The chief recommendation, given the lack of detection and treatment options available for CWD, was a strategy of surveillance and population reduction coordinated nationally for the greatest coverage and impact. Based on the latest science at the time, the suggestion was made to keep cervid populations down to a density of one per km<sup>2</sup> for between five to ten years in order to allow the possibility of both environmental and lateral transmission to reduce in wildlife management zones home to the disease (Bollinger et al., 2004, p. 14).

The release of the panel's report generated moderate levels of media attention, including articles in the Globe and Mail and coverage in industry-specific publications. (Smith, 2004; Raine, 2004). Raising the profile of CWD as a problem in Canada is exactly what the organizers of the panel intended. In an email from April 26, 2004 to a potential funder, one of the panel organizers suggested that the panel would be a source of highly credible scientific information on the disease and would likely pressure the federal and provincial governments to allocate resources to its eradication. The assumption of the organizers was that the experts would acknowledge the potentially devastating impact CWD could have on Canadian wildlife and would highlight the current lack of capacity to undertake any of the proposed strategies without significant investment:

Thus, we anticipate that the panel's report can be used to catalyze a new inter-jurisdictional dialogue about CWD in wild deer in Canada that might cause provinces to pool some resources to fill essential knowledge gaps about the disease in wild deer. In our view, if provinces, with or without federal partnership, do not take this disease seriously and finance the surveillance and subsequent management actions to control or eradicate it in wildlife, CWD will soon expand its range sufficiently that few management options will remain. It will be beyond control. Thus, either action is taken soon, or not at all... It certainly also is true that the panel and its report can simply be ignored by responsible agencies. However, this will be no different from the current state of affairs (Personal communication, April, 26, 2004).

Within a month of the Chronic wasting disease (CWD) expert panel's report being released the Joint Ministers Council instructed the Canadian Wildlife Directors Committee (CWDC) to develop a national CWD control strategy as the first attempt to operationalize the National Wildlife Disease Strategy (Technical Working Group, 2005). The network was formalized as the 'Inter-agency Oversight Committee' (IOC) by the CWDC. A core group of network members were designated as the Technical Working Group who would author the

control strategy. Two additional subgroups were designated to provide input: a stakeholder committee and a science advisory group. Given the location of the outbreak, a senior representative from Saskatchewan's Ministry of Environment would act as chair to both the IOC and the Technical Working Group. The Canadian Wildlife Health Cooperative (headquartered at the University of Saskatchewan) would act as secretariat for the IOC. Members of the existing network who were already collaborating on the issue participated in the IOC.

All members of the IOC were still responsible to their home jurisdiction but were also responsible to the Canadian Wildlife Directors Committee to "assure the integration and collaboration among the programs and policies of all relevant jurisdictions and legislated authorities that are required for successful implementation of the Chronic Wasting Disease Control Strategy and achievement of its goals" (Canadian Wildlife Directors Committee, 2005). In an attempt to gain support beyond the wildlife health community, the Chair of the IOC invited staff from the Canadian Food Inspection Agency (CFIA), the Public Health Agency of Canada and Saskatchewan's ministries of Health and Agriculture to be part of the committee (Inter-Agency Oversight Committee for Chronic Wasting Disease, 2005d).

By fall 2005 a national Chronic wasting disease Control Strategy had been developed with input from staff of agriculture and wildlife departments of Alberta, Saskatchewan and Manitoba, the CFIA, Parks Canada, Ontario Ministry of Natural resources and as well as CWHC. The goal of the strategy was to eradicate or control as much as possible the transmission of the disease in both wildlife and farmed animals in order to reduce the impact on wildlife, the environment and the economy (Technical Working Group, 2005). The plan was intended to be seen as a complementary process that integrated new programs and policies with those that already existed at the provincial and federal levels into a coordinated national policy. The overarching principles for both the creation and implementation of the strategy were described as: 1) "full and open collaboration; 2) use of the best available science; 3) close vertical and horizontal integration among jurisdictions; 4) careful, strategic investment of new resources; and 5) adaptive management, such that cycles evaluation and revision of program actions are integral components of all policies and programs." (Technical Working Group, 2005, p. 1).

The control strategy covered the full spectrum of management issues. The six goals of the strategy were: prevention of further spread of the disease; early detection through surveillance; a planned response to various outbreak scenarios; effective management through use of an



‘adaptive risk assessment and response framework’; education and training for those who would be involved in implementing the plan and communication to achieve the collaboration necessary to put the plan into action (Technical Working Group, 2005). The document laid out the broad strokes of approaches that should be taken to achieve each goal but did not speak to the specifics of achieving goals nor who would be responsible for funding the work or implementing it.

Additional documents were later authored as action plans for each of the six goals once the plan was approved by the Joint Ministers Council. The action plans were the detailed documents laying out the tasks that needed to be completed to achieve each of the goals, as well as which network member(s) would be responsible for the tasks over the 5 to 10 years of the plan’s lifespan. The guidelines for the action plans specifically stated that cost estimation was not to be part of the discussion at this point: “The TWG has been given a clear mandate to develop a Strategy and Action Plans that are based in science and CWD control objectives and that are developed independent from cost considerations” (Technical Working Group, 2004, p. 2).

With each version of the control strategy and action plan documents, plans were increasingly refined and cost estimates and timelines were eventually added. The control strategy and action plan documents were seen by the IOC and other members of the network as another attempt to sell the importance of the problem and find a place on the agenda of those with the means to provide financial support for this work. In an email dated September 1, 2004 one provincial staffer on the IOC indicated that “[we] see this as a means to engage senior officials and solicit the political support needed to secure the resources essential to immediate and long term action”.

After the release of the panel’s report and throughout 2005, the network was actively searching for the best ways to find political and financial support for their plan. The Canadian Wildlife Directors Committee, while a valuable resource for legitimacy and support for cross-jurisdictional policies, has little internal funding to support the programs they champion. Attention turned to eliciting support from Ministers and their deputies in charge of wildlife, natural resources and environment at the provincial, territorial and federal levels. In an email to the other members of the IOC on September 7, 2004, one Alberta provincial staffer advocated focusing on national political support and funding in order to make the largest impact and have

the greatest chance of success at eradicating Chronic wasting disease, other members agreed with this direction.

Building support with bureaucrats and politicians with responsibility for wildlife health was seen as a crucial step; however, having a control strategy that was primarily authored by wildlife experts and focused on wildlife health was seen as a limitation to the control strategy's political legitimacy. There was some concern from agriculture representatives in the Inter-agency Oversight Committee that early drafts of the control strategy would give a Minister responsible for wildlife final authority on programs that involved the jurisdiction of Agriculture ministries, such as regulations for game farm disease eradication. (Inter-Agency Oversight Committee for Chronic Wasting Disease, 2005b). The consensus from the IOC was that more explicit inclusion of Agriculture's authority and participation in the creation of the plan would be preferable to having a control strategy that only dealt with wildlife. Similarly, the inclusion of the Stakeholder's Committee was seen as an important step to having both environmental groups and the cervid industry embrace the plan they have 'consulted' on (Inter-Agency Oversight Committee for Chronic Wasting Disease, 2005b).

In June 2005 at a meeting of the Deputy Ministers responsible for wildlife, the control strategy was reviewed and approved 'in theory' with the intention to present the plan to the next formal meeting of the Joint Ministers Council in October. An email from the IOC Chairman on June 13, 2005 to the rest of the committee stated that staff from Environment Canada suggested that if the provincial Ministers approved the plan, they would have enough support to request \$85 million for the control strategy from the federal government. The Joint Ministers responsible for Forestry, Wildlife, Endangered Species and Fisheries and Aquaculture did formally approve the strategy on October 5, 2005 which led the IOC to begin planning how to move forward.

The network's discussions were primarily focused on how to fully engage all levels of federal, provincial and territorial government. Gathering the formal support of Ministers of Agriculture and Health, which had not been achieved to this point, in order to strengthen the case for funding was of concern according to the record of the IOC meeting, as was the need to ensure adequate representation of various levels of government with interest in wildlife health issues. One member of the IOC had identified a Minister who held a dual portfolio of Natural Resources and Health who was willing to present the case to federal, provincial and territorial Health

Ministers and the group were tasked with finding someone on the Agriculture side with similar influence (Inter-Agency Oversight Committee for Chronic Wasting Disease, 2005d).

Despite the encouraging progress in developing a large scale disease control strategy, Alberta and Saskatchewan continued to be affected by the presence of CWD in their cervid populations. Targeted culling- as advocated in the control strategy- was put in place in both provinces, as well as surveillance and eased restrictions on deer and elk hunters (MacArthur, 2009). The network began coordinating data management between jurisdictions and collecting data about cervid density and population to help research and program planning (Inter-Agency Oversight Committee for Chronic Wasting Disease, 2005d). In addition, a November 2005 investment from the Network Centres of Excellence project created PrioNet, a prion research centre. PrioNet was mandated to devote a portion of their research expenditure towards Chronic wasting disease. PrioNet's researchers committed to assisting with the CWD control strategy by helping close knowledge gaps (Wong et al., 2011).

#### **4.2.2 The 2006 Federal Election**

A federal election was held on January 23, 2006 in which the governing Liberal party was replaced by a Conservative minority government. This change seemingly shuttered hopes of receiving any significant investment towards a national wildlife disease strategy from the federal government. The network received notice that Environment Canada would not have any direct funding available for the control strategy (such as the \$85 million Environment Canada staffers were planning to request) but that there could be some opportunity for smaller funding through existing grant schemes like the Invasive Alien Species Partnership Program. The average contribution through this program was just over \$25,000, while the Chronic wasting disease control strategy budget was estimated at \$50 million over 5 years (Environment Canada, 2012a). This was an obvious blow to the network as their work had focused on acquiring support and leadership from the federal government. In light of this change and the finalization of the control strategy and action plans, IOC activity on CWD was minimal for the next two years. Both Alberta and Saskatchewan continued their surveillance and culling activities in line with the CWD control strategy at the limited levels they were able to fund through their own provincial budgets.

In the fall of 2008 there was some renewed interest in discussing the progression of Chronic wasting disease within Alberta and Saskatchewan by the Canadian Wildlife Directors Committee (Inter-Agency Oversight Committee for Chronic Wasting Disease, 2008). This allowed an opportunity for various provincial wildlife and agriculture staffers who represented many of the agencies in the CWD Inter-agency Oversight Committee (IOC) to communicate to a national forum the challenges of implementing a disease control strategy with limited support.

Provincial staffers and academics in the affected areas wanted to once again bring attention to the ongoing threat of CWD, to identify what components of the control strategy were helping to mitigate the disease threat and to develop a way to build the needed support from the rest of the country. Key critiques and observations from members of the IOC communicated through emails in October 2008 included the sense that a lack of federal funds was ‘stifling’ the success of the control strategy and that centralized leadership and accountability would be valuable to ensure adequate political support and funding. The lack of centralized leadership and support resulted in funding being available in jurisdictions without CWD cases. This funding was unavailable to those conducting research, surveillance or implementing the management plan in areas with CWD cases, like Saskatchewan and Alberta. The Wildlife Directors provided no official feedback or plan of action to the network when presented with this update on CWD challenges.

Two years later PrioNet and the Alberta Prion Research Institute (APRI), with the assistance of the Canadian Wildlife Health Cooperative (CWHC), sponsored two workshops to assess the progress made in CWD management over the five years since the first control strategy was written. The first workshop attempted to identify what tools were most needed to combat the disease as well as what management objectives were achievable given the current state of affairs. Canadian and U.S. experts briefed the participants on scientific advances made since 2005 as well as challenges that had arisen in attempting to execute the original strategy. Key challenges articulated during the workshop by wildlife and animal health managers included the lack of public support for culling strategies, the high expense of controlling CWD on game farms and “the lack of political will to provide long-term funding support” which undermines the idea that CWD is a serious problem (Alberta Prion Research Institute et al., 2011b, p. 7).

The second workshop began a revision of the Chronic wasting disease control strategy based on the results of the consultations with wildlife and animal health managers. According to

an early draft, it appears as though the focus of many of the changes made to the strategy were meant to temper expectations given the ongoing struggle to manage CWD outbreaks. For example, goals were now stated as disease management and containment, whereas previous documents often included the overall goal of CWD eradication. Eradication did not seem feasible any longer. This new draft also changed the language used to reflect the fact that certain elements of the control strategy are underway and not simply a plan the participants are waiting to enact, as waiting was not an option (Alberta Prion Research Institute et al., 2011a). The ultimate result of the second workshop was a new version of the control strategy published by PrioNet, APRI and CWHC which was then disseminated to the Canadian Wildlife Directors Committee, the Council of Chief Veterinary Officers and the Council of Chief Medical Officers of Health.

The question of how to move the strategy into a formal policy was primarily advanced by the Executive Director of CWHC and a network member who was both a former Environment Canada and Canadian Food Inspection Agency staffer. Framing CWD as an environmental contaminant (as prions are shed into nature and do not degrade for long periods), they shifted from working with Canadian Wildlife Services (which exists as a subsection of Environment Canada) and approached staff within Environment Canada's department of Legislative and Regulatory Affairs. According to an April 19, 2011 email from the director of the CWHC, the hope was to secure either financial or regulatory authority within the federal government (specifically under the Canadian Environmental Protection Act) so that there could be partnership and coordination with the provinces to address CWD. The communications between network members suggest that Environment Canada's budget made it impossible to address new endeavours as the department had been subject to several rounds of cutbacks (Lui, 2011).

Six months later, a further development appeared to signal the end of the collaborative efforts to develop a national control strategy. The Canadian Food Inspection Agency provided wildlife and agricultural stakeholders, including the Canadian Wildlife Directors Committee, with a report on their proposal to change CFIA's approach from eradication to minimizing the geographic spread of CWD (Canadian Food Inspection Agency, 2011). Communications between network members indicate that this move was seen as CFIA relinquishing their responsibility for actively manage the disease in Alberta and Saskatchewan, as all cervids from both provinces would be assumed to have the disease and not be used for commercial purposes.

An email dated November 11, 2011 between the Executive Director of CWHC and the former Environment Canada and CFIA staffer suggests a disappointment with the lack of engagement from the regulatory side of Environment Canada and the developments with CFIA. They acknowledge that using their connections to federal policy makers remains an ongoing option but that on their own the network does not have the influence, authority or knowledge to initiate the needed policy action regardless of how they frame the disease threat.

### **4.3 Network Resilience**

According to the Canadian Food Inspection Agency, Chronic wasting disease is now endemic to Saskatchewan and parts of Alberta (Canadian Food Inspection Agency, 2011). One reading of the above narrative suggests that the wildlife health network had not been particularly successful at attacking and eradicating CWD before it was considered endemic and therefore unable to be easily eradicated. Given the challenges facing wildlife disease experts and the lack of resources available to them, this hardly seems surprising or unexpected.

Despite the lack of financial resources and formal political support, the network did valuable work by engaging experts and decision makers in the development of the initial national CWD Control Strategy in 2005 and an updated strategy in 2011. The control strategy was put into practice at the provincial level by Alberta and Saskatchewan as a guide for action in dealing with CWD in captive and wild animals. As well, the control strategy and the National Wildlife Disease Strategy still exists as a template to deal with wildlife disease outbreaks (Environment Canada, 2005).

Part of the network's lobbying efforts also resulted in Chronic wasting disease being added to PrioNet's research agenda and funding allocation, according to an email from a CWHC staffer to the network on October 24, 2008. Also, and potentially most importantly, this interagency collaboration appears to have been a model for collaboration on future issues, such as West Nile Virus and strains of Highly Pathogenic Avian Influenza. These outcomes suggest there had been value in the network's work on CWD, despite its limited impact on controlling the disease.

In assessing how the network operated, the event that appears to be the most significant stumbling block was the change of federal government in 2006. The timing of the election and

change of government was particularly challenging as the control strategy proposal was about to be presented to the federal cabinet. The proposal never reached cabinet, let alone secured a commitment prior to the election. In addition, significant cutbacks and reorganization occurred within Environment Canada and the Canadian Food Inspection Agency (CFIA) in both 2006 and 2011 (Lui, 2011). The change of federal government and the organizational restructuring ostensibly undermined months of negotiations network members engaged in with deputy ministers at the federal, provincial and territorial levels. The budget cut backs not only meant that there was less possibility of funding a CWD control strategy but also that other departments, like the CFIA, were having to relinquish their existing disease management protocols to meet with the government's new priorities. In order to meet budget targets, the CFIA committed 'streamlining regulatory requirements', one of which was removing regulations for the mandatory eradication of livestock herds found with CWD in Saskatchewan and Alberta (Canadian Food Inspection Agency, 2013). This act compromised the health of wild cervids in Saskatchewan and Alberta, as transmission between captive and wild animals was common when dealing with CWD.

There is no doubt that the network's success was stymied by the loss of momentum after the 2006 election. What is worth noting is that the network persisted for more than five years after the change of government. This would suggest that the network was not solely reliant on this one opportunity to secure funding and leadership for the CWD control strategy. The organizational resilience model set out in chapter three can provide insight into why the network persisted over time despite this setback; as well, it can explain which factors ultimately lead to intractable obstacles the network was unable to overcome.

#### **4.3.1 Slack in Resources**

The first essential quality in the organizational resilience model is slack in resources. Slack in resources indicates that the organization or network is not overextended in its financial, cognitive or social commitments. As explained in chapter three, an organization or network that does not have slack in resources often finds itself strained and is unable to meet new or unexpected challenges because its resources are already committed elsewhere. Evidence of slack in resources can take a number of forms including the ability to attract new partners to the

network, to find and use new information, to have contingency funds or the ability to reallocate funds to new opportunities or challenges as well as having political support to move the network's agenda forward.

We can see evidence of all of these attributes early on in the network's work on Chronic wasting disease, however over time various forms of support were exhausted. The financial resources of the network were an overarching issue throughout, as the bulk of the problem of putting the CWD control strategy into action was framed as a lack of financial support (and leadership) from the federal authorities. The network itself has no operating budget that it can draw from but is rather reliant on the support of the employers of its members and its ability to attract new funding.

The network was able to use its partnerships to secure support for essential meetings and conferences such as the 2004 Expert Panel and the sessions to author both versions of the control strategy. The Expert Panel was supported not only by the Canadian Wildlife Health Cooperative (through its operating funds from Canada's veterinary colleges) and by the Canadian Wildlife Directors Committee but also through the support of the environmental group the Canadian Wildlife Federation, which was approached by the network for funding in the planning stages. The provinces that participated in the control strategy planning sessions (Alberta, Saskatchewan and Manitoba) also contributed by sending their network members to meetings across Canada at various points and both of the prion research institutes in Canada (PrioNet and APRI) were funders and hosts of the 2011 updated controls strategy meetings in Edmonton and Saskatoon.

The lack of funding for the actual implementation of the control strategy from the federal government was particularly problematic for the network as its goal was that federal wildlife, agriculture and animal health leadership would rally the provinces towards executing the CWD control strategy (Inter-Agency Oversight Committee for Chronic Wasting Disease, 2008). In an email exchange to members of the forum on October 23, 2008, members of the network also lamented the fact that provinces with funding and political support for CWD control such as Manitoba and Ontario were not willing or able to contribute to research or control strategies undertaken in Saskatchewan and Alberta. The financial requirements of implementing the control strategy, estimated at \$10 million per year, were large enough that there were limited options for who would fund the program to a satisfactory point. Alberta and Saskatchewan both suspended their culling programs by 2012, indicating a lack of funds to reduce wild herds



(MacArthur, 2012). Emails by network members in November 2011 indicate that the programs, agencies or departments that would normally be avenues of financial support were undergoing budget cuts, therefore support from bureaucrats would be limited.

In terms of social resources, two observations are worth noting. The first is that the network appears to be well connected and is able to gain the attention and assistance of a variety of policy makers and academics. We see evidence of this in the group of researchers who comprised the initial panel of CWD experts, as well as in the membership of the Interagency Oversight Committee involved with the control strategy in 2005. There are two types of participants, the first being individuals who are participating due to the nature of their employment, such as provincial wildlife staffers from Alberta and Saskatchewan who are assigned to work on Chronic wasting disease and can use all the support at their disposal. The second group of participants are those who are experts or experienced in the wildlife policy realm and have a desire to assist their peers (or have been convinced to assist the network). This includes the members of the Canadian Wildlife Health Cooperative, who work on wildlife health issues in their capacities as academics and veterinary researchers, and individuals who are outside experts in prion diseases or wildlife health who all appear to have a sense of duty regarding mitigating CWD. The network was also able to secure the support of various deputy ministers and ministers from Environment, Natural Resources and Agriculture ministries as well as the Canadian Wildlife Directors who approved and supported the CWD control strategy.

The second observation on social resources is that bureaucratic support does not necessarily translate to action. While the Canadian Wildlife Directors Committee and other high level government officials agreed that Chronic wasting disease was a serious issue facing Canadian wildlife, there was little action to fund the control strategy or lead the charge for implementation of the plan. It has been established that Canada's wildlife disease infrastructure is strained beyond capacity and without strong political support or a public sense of urgency; there is little likelihood of securing the kind of funds that would make a difference in eradicating CWD.

An additional area in which slack is advantageous according to the organizational resilience theory is in cognitive resources. Cognitive resources include new individuals (such as the aforementioned expert panel) as well as new perspectives and information resources to assist in decision and policymaking. As we will see below, the network is well placed to support new

discoveries and information inputs as the majority of participants are research scientists working on closing the knowledge gaps in CWD. What appears to have been a major stumbling block is how new and unknown Chronic wasting disease was when the network first attempted to get government support for its eradication. It can be argued that while the network made an ongoing effort to include the latest information on the disease in their planning, there was little to no cognitive slack as they were at the forefront of CWD management strategies and there was little new information. Given the emerging nature of the disease, the network was presented with few options.

In 2015 testing began on a Chronic wasting disease vaccine that appears to be an alternative to wide-scale deer and elk culling (Goñi et al., 2015). When dealing with the initial outbreak in 2004, the methods and rates of transmission were still unconfirmed and there was no way to confirm the disease in a live subject (Bollinger et al., 2004). As a result, the network was limited in what approaches it could offer to government and in turn, the offer of a comprehensive plan to survey, contain and cull animals affected by the disease was deemed either too expensive or too invasive or the problem remained of little concern. The fact that Chronic wasting disease was an emerging disease of significant complexity should not be overlooked as a key challenge to adapting the scientific advice to government on how to control the threat of CWD in a feasible way.

#### **4.3.2 Adaptive Capacity**

The second element of the organizational resilience model is adaptive capacity. Organizations or networks that are seemingly able to cope with challenges are those that have the ability to adjust their operations to fit their new reality. Adaptive capacity is seen as the result of a culture and/or leadership that is willing and able to embrace change as well as being information-seeking and deferring to expertise (rather than authority) (McManus et al., 2008). What appears to be present in this case is a network mindset that embraces adaptive capacity but that does not always have the opportunity or knowledge to put into practice different approaches that would improve their position. The network appears to have been entirely too reliant on the possibility that the federal government would provide financial resources and leadership. Rather than accepting that no significant funds or leadership support would be coming from the Harper

government and developing collaborative plans with the affected provinces, the network continued to hold out hope and return to a seemingly dry well looking for water.

The failure to adapt approaches, which appears to be due to not having a clear understanding of how to move forward with a national disease strategy without federal involvement, can be seen as a limitation of both adaptive capacity and situation awareness. Not having an understanding of how to change approaches, and not fully understanding the severity of the regime change at Environment Canada, suggests the network was limited in its understanding of the operating environment, which is a requirement for successful situation awareness. Without an understanding of how to proceed, the network deferred to experience and employed the standard practice of providing solid evidence-based advice to government then waiting for a response. There is overlap in the processes that contribute to resilience, as they are not discrete characteristics. It also appears that despite the failure to adapt approaches for securing political support, they actively pursued adaptive and information-seeking behaviour around the disease management plan for Chronic wasting disease.

The wildlife health network, throughout their work on Chronic wasting disease, consistently prioritized adaptability as one of the guiding principles in the development of the control strategy plans. While that could be considered lip service, as there was no fundamental change in the approach taken to garner support over time, it appears to be genuine as one of the key practices in wildlife disease is adaptive management. The adaptive management approach allows practitioners to ensure continual improvement and refinement in their plans or programs in the face of limited knowledge. By integrating monitoring and evaluation into the program development process, adaptive management allows researchers to develop hypotheses and test them in the real world environment. If they are successful, they can be incorporated into the program; if not, a better alternative will be found (Wassenberg, 2009).

Other indications of the network being information seeking include starting the development of both versions of the control strategy (in 2005 and then in 2011) with a search for both the most up to date knowledge on the disease and an overview of the key knowledge gaps (Bollinger et al., 2004, p. 18-19; Alberta Prion Research Institute et al., 2011a, p. 11-12). As well, the practice of updating the control strategy after five years is another method of ensuring the programs are being evaluated and renewed with the newest available information. Beyond

this, members of the network were involved in primary research to better understand the disease to better manage its outbreak (PrioNet, 2011).

The network's commitment to being information-seeking and deferring to expertise is implicit in its commitment to scientific inquiry. The other indicators of adaptive capacity, however, such as a cultural or leadership commitment to embracing change in the face of a challenge and increased communication in crisis times are less apparent. If we identify the challenge in this case as the inability to secure funding and leadership from the federal government for a control or eradication program for Chronic wasting disease, then it appears that in the face of setbacks (be they changes in government or indications that no funding is available) the network only committed to revamping and reselling the control strategy. What did not happen was an evaluation of how to approach the federal government with a different plan or how to translate the existing provincial support into a multi-jurisdictional coordinated control strategy without federal support. Another telling indicator of limited adaptive capacity is the distinct lack of communication that occurs after setbacks. Once the control strategy was written and the proposal to the federal cabinet fell through in early 2006, there are no records of any committees or forums meeting until 2008 when the Canadian Wildlife Directors specifically requested an update on CWD management. In addition, between 2008 and 2010 when planning began for the second draft of the control strategy, the only activities on record consisted of members of the network who work directly for Alberta and Saskatchewan wildlife programs implementing those provinces' management plan.

There appears to be some inconsistency between in the network's commitment to evaluate and adapt their policies for CWD and its inability to adapt its approach to decision makers given new developments. One possible explanation lies in the composition of the network: it is primarily composed of biologists and veterinarians not politicians or policy makers. Repeatedly, members of the network express the view that the facts of the situation (the spread and fatal nature of the disease) should spark a bureaucratic or political response (Leighton, 2004; Alberta Prion Research Institute et al., 2011a). This stimulus-response view of the policy process would explain why the network focused on developing a control strategy containing the best available science and the best management practices and pressed this strategy on governments for more than seven years. This is not to suggest that the network members are naïve about how government works, rather that they are experts in wildlife health, not the policy

process or in lobbying. According to an email from the director of the Canadian Wildlife Health Cooperative to a former Environment Canada staffer on October 24, 2011, the traditional protocol for getting a wildlife health issue on a government's agenda is to provide a proposal or recommendation to the appropriate authority and wait for their response. This deference to the existing bureaucratic structure suggests a limitation of both the interest and ability of the network to work outside of traditional policy channels.

### **4.3.3 Situation Awareness**

The third feature of the network resilience model is situation awareness, or the network's awareness of the context in which it operates. The concept of situation awareness encompasses both self-awareness of its membership and capacity as well as insight into the external challenges it could possibly face. Situation awareness becomes relevant to resilience when the network uses its assessments to neutralize threats by proactively addressing them in their work or planning. Vogus and Sutcliffe (2007) argue that organizations that assume their work will always result in success are fragile because, unlike resilient organizations, they do not engage in the challenging work of identifying potential avenues of internal or external threats and possible failure.

Evidence of situation awareness in the network comes primarily from network members' acknowledgement of potential challenges or obstacles in their planning, their willingness to expose themselves to new perspectives as well as the awareness of stakeholder expectations or developments that would lead to problems. In addition to the network's actions, situation awareness can be judged partially by the attitude that network members have towards problems and challenges. A view of problems as opportunities as opposed to threats suggests network members are more resilient and better equipped to overcome minor struggles.

The wildlife health network has shown a strong awareness of potential challenges and failure from the earliest discussions of tackling Chronic wasting disease. This perspective appears to come from experiences working on wildlife health issues or issues that cross wildlife/livestock boundaries with provincial and federal governments in the past. Records of meetings of the network indicate that members were actively aware of the interjurisdictional challenges of developing and implementing a CWD management plan. They were fully aware of the particular challenge of infected animals on and around game farms where the Canadian Food

Inspection Agency (CFIA) would regulate the treatment of the livestock on the farm but not the wildlife likely infected by the livestock (Inter-agency Oversight Committee for Chronic Wasting Disease, 2005c).

The network also showed foresight when it sought to include provincial and federal Agriculture and Health officials in their work in order to have a broad base of support for the CWD control strategy and buy-in from a number of fronts. Representatives from provincial Agriculture departments in Saskatchewan and Manitoba helped author the 2005 control strategy as part of the Technical Working Group, while federal representatives from the CFIA and Public Health Agency were given active roles on the IOC. While the majority of the Technical Working Group members were wildlife biologists, the IOC looked to its Agriculture and Health representatives to sell the plan to various provincial Deputy Ministers who could push support for the plan upwards (Inter-Agency Oversight Committee for Chronic Wasting Disease, 2005b).

The process of evaluating and rewriting the control strategy, along with holding workshops with provincial and federal wildlife managers, Aboriginal leaders and academics in 2011 can also be seen as a reflection of situation awareness as the network attempted to seek out new information, perspectives and input on the control strategy. There seemed to be awareness that the traditional strategy of securing support through the chain of authority in provincial wildlife departments, receiving commitments of support from the Canadian Wildlife Directors Committee and then getting the issue on the agenda of a federal/provincial/territorial ministers meeting for a national agreement was no longer feasible and that adjustments need to be made.

The intention of these workshops was to re-evaluate the feasibility of both attempting to eradicate CWD and attempt to adjust the original plan to something that was both feasible in the current climate and could as much as possible ensure the original plan's success (Alberta Prion Research Institute et al., 2011b). Along with the original expert panel in 2004, these collaborative gatherings show a desire and willingness to fully understand the operating context in which wildlife disease and disease management exist. The 2011 plan also recognized and articulated the obstacles facing those working to implement the control strategy. The new version of the strategy showed awareness of the political context by acknowledging that current disease management programs and objectives exceed the capacity of the jurisdictions attempting to implement them. The plan strongly suggests that approaches need to be developed that are within the resource and capacity limits of those agencies (Alberta Prion Research Institute et al., 2011b,

p. 6). In attempting to mitigate these problems, the control strategy contains management best practices and standards that allow one province to conduct their own surveillance and eradication without the development of a coordinated national program.

The wildlife network was aware of the challenges facing their efforts from the network's earliest meetings, the members chose to act in the hopes of eliciting some response from decision makers, rather than do nothing and face certain failure. One of the indicators of situation awareness is whether setbacks are seen as insurmountable or opportunities to improve. There is no indication that members of the network were overconfident in their ability to eradicate the disease, rather they were muted in their expectations of success. While soliciting funding from environmental groups, the Executive Director of the Canadian Wildlife Health Cooperative states that it is entirely possible governments could ignore the forthcoming report from the panel of prion experts and that their work may do nothing to change the status quo. What makes this awareness less fatalistic and more productive is that in an email, dated April 26, 2004, the Executive Director also describes the progress being made on the National Wildlife Disease Strategy in months previous as an reassuring development: "[t]he current advanced state of this initiative gives me faith that it is possible to turn seemingly intractable situations around and that agencies are willing and eager to work together to achieve mutual goals. It seems then that determined confrontation of CWD in wild deer in Canada also may be possible. I think it is worth a good hard try".

Throughout the network's communications there exists a cautious but hopeful attitude towards success. The chair of the Inter-agency Oversight Committee, in an email dated October 7, 2005, informing the committee that the control strategy had been approved by the Federal-Provincial-Territorial Resource Ministers Council, suggests that now that the control strategy and five year action plans have been approved: "the real work begins, in terms of finding funding, identifying lead agencies etc [sic] and bring [sic] the strategy to life!" The status quo of wildlife health services in Canada prior to the collaboration of the wildlife network was limited to what each individual province could manage on their own, limited budget. Provincial departments responsible for wildlife, like many other bureaucrats, are overwhelmed with the number of priorities vying for the scarce resources they have been allocated. When facing a crisis event, like Chronic wasting disease, the ability to work within a network to potentially bring additional resources and political support to help mitigate the disease appears to be a boon enough that the

network members are willing to weather potential challenges. Any positive action in their favour from government decision makers appears to provide encouragement to continue.

The wildlife health network's work on Chronic wasting disease was met with barriers at nearly every step of the way. The loss of momentum due to the change in federal government in 2006 was something from which the network did not recover and as such the network's attempt to mitigate the spread of Chronic wasting disease had little success. The network had a strong sense of situation awareness and realism about their prospects but did not have the needed financial or relational resources to implement its management plan. Most significantly, the network members did not have much experience in navigating political and regulatory barriers that are essential when facing conflicting priorities from a number of stakeholders in different jurisdictions.



## CHAPTER 5: THE INTERAGENCY WHITE NOSE SYNDROME COMMITTEE

### 5.1 The Disease

Workers from the New York State Department of Environmental Conservation made a startling discovery while surveying hibernacula (hibernation sites, in this instance caves) of local bats in March and April 2007. Hundreds, and in some instances thousands, of bat carcasses were found in the immediate area of four caves in Schoharie and Albany counties in northern New York. There were also unprecedented numbers of sightings of daytime flying bats and a record number of specimens submitted to the New York State Department of Health (Hicks et al., 2007). Wildlife biologists were confounded at this unprecedented event and began the search for a reason for this mass mortality. This was the first point of contact biologists in North America had with a disease that would spread rapidly across the eastern seaboard bringing bat populations nearly to extinction, requiring significant international intervention to slow the spread of this mysterious illness.

The cause of the mass mortality of bats in New York was soon discovered to be a fungus called *Pseudogymnoascus destructans*<sup>1</sup>, colloquially referred to as White nose syndrome (WNS) after the white substance found on the muzzles and wings of infected bats. *P. destructans* had never before been found in North America, despite being present in caves in Europe where bats are seemingly immune to the fungus (Foley, Clifford, Castle, Cryan & Ostfeld, 2011). WNS develops as a skin infection while the animal is hibernating, as the fungus thrives in the cold and humid conditions found in caves. It causes the animals to wake more often than normal from hibernation, resulting in an increased expenditure of the bat's built up fat storage. The increased arousal and lack of food supply lead to starvation (Cryan, Meteyer, Boyles, & Blehert, 2013).

Research is ongoing to discover the mechanism by which the disease disturbs the physiology of bats. However, a leading theory from Warnecke et al. suggests there is a connection between the skin infection on the wings of the bat and the physiological processes

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<sup>1</sup> Prior to 2013 the fungus was misidentified as '*Geomyces destructans*' in the literature due to a classification error; it has since been reclassified (Minnis & Linder, 2013).

that alert the animal to search for food and water. The fungus results in severe lesions on bats' wings (as well as less drastic lesions on the face, muzzle and body), which are crucial to regulating temperature, water and carbon dioxide supplies and immune functions while hibernating. The damage to skin allows for fluid loss and the reduction of sodium levels in the blood. As well, the damage to connective tissue in the wing further increases fluid loss through increased vascular permeability. The seemingly superficial damage caused by the fungus triggers a series of complications that leads to increased respiratory rates and/or torpor arousal in conditions where food supplies are scarce resulting in death (Warnecke et al., 2013).

Two primary factors have caused White nose syndrome to sound a North American-wide alarm for the wellbeing of bats: the high mortality rate of bats infected with the disease and the disease's ability to spread over wide areas in short periods of time. Reports from the U.S. Fish and Wildlife Service indicate that WNS can result in a 95% mortality rate for hibernacula groupings over only two to three years. Coupled with the low birth rate of bats (1 per year), the threat of extinction is strong and imminent (U.S. Fish and Wildlife Service, 2011). From its initial discovery near Albany, New York during the winter of 2007, WNS has spread as far west as the Washington state<sup>2</sup>, south to Georgia and north to Prince Edward Island in eight years. In Canada, five provinces have confirmed the presence of WNS since the winter of 2009-10: Ontario, Quebec, New Brunswick, Nova Scotia and Prince Edward Island (Canadian Wildlife Health Cooperative, 2015a).

While it is suspected that the fungus was transported to the U.S. from Europe by a caver and human transmission remains a concern for wildlife protection agencies, the migratory nature of bats between their maternal roosting habitats and hibernacula present a greater challenge for those trying to limit the transmission of the fungus. In addition to concerns about the fast spread and high mortality rates, the unknowns of the disease early on included the uncertainty of WNS' effect on humans as well as its means of transmission (Foley et al., 2011). It is now understood that WNS does not affect humans.

The public in North America generally considers bats a nuisance, however; they perform a crucial function in their ecosystems. Bats consume large numbers of pests every day, allowing them to act as a natural pest suppressor for agriculture. Areas with decreased populations of bats

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<sup>2</sup> White Nose Syndrome has been confirmed in Washington State as of 2016; this is more than 2,000 kilometres west of the previous western area of infection (U.S. Geological Survey, 2016).

can see a greater population of insects and therefore a greater need for chemical insecticides. In certain areas, bats also act as seed distributors and nocturnal pollinators (U.S. Fish and Wildlife Service, 2011). The economic value of bats' contribution to agriculture has not been determined beyond the value of one species of bat on one particular crop in eastern Texas (Boyles, Sole, Cryan, & McCracken, 2013). Boyles et al. suggest that bats may well be the most economically valuable wild mammals in the world and that a lack of firm understanding of their value (both economically and ecologically) allows the public and policy makers to underestimate the need to tackle threats like WNS.

## **5.2 The Network in Action**

The discovery of the mass mortality in hibernating bats in Canada led to provincial and federal biologists along with wildlife researchers at Canadian universities to work together to understand and tackle the problem of WNS in Canada. Like the Chronic wasting disease problem, government officials and non-governmental organizations (including the Canadian Wildlife Health Cooperation) made the decision to convene periodic teleconferences to share surveillance data and research that was taking place regarding both slowing the spread of the disease and understanding how to treat or vaccinate bats. Unlike Chronic wasting disease, however, only the scale and speed of mortality were known when the disease was identified on Canadian soil (Daszak, 2010). The lack of information on the type of illness, methods of transmission and pathology added a level of difficulty to formulating a coherent policy response given the significant knowledge gaps present.

The Canadian WNS network began meeting in May 2010. The members of this group included provincial and territorial wildlife staff from across the country, with heavy participation from the affected provinces - Quebec and Ontario. University researchers from Manitoba, Saskatchewan, Alberta and New Brunswick were also involved, along with the Canadian Wildlife Health Cooperative's national office in Saskatoon and the Ontario/Northwest branch (who were conducting surveillance of bats under contract for the province of Ontario). The coordinator of the United States Fish and Wildlife Services' (USFWS) WNS program also attended many of the meetings (Interagency White Nose Syndrome Committee, 2010a). The membership of the group evolved as additional researchers became aware of the problem and as WNS spread eastward in Canada with researchers from New Brunswick and the CWHC's Atlantic office becoming heavily active in leading network activities.

Prior to the discovery of WNS in Canada, the wildlife health network collaborated not only on a Chronic wasting disease mitigation strategy but also on management plans for Avian Influenza and West Nile virus in Canada. There was significant overlap between the membership of the individuals working on WNS and the Chronic wasting disease Inter-agency Oversight Committee. Most of the provincial and federal wildlife biologists active in the network participated in both cases, with the exception of those in the Atlantic provinces, as Chronic wasting disease was not seen to be a significant threat on the east coast of Canada. The Canadian Wildlife Health Cooperative (CWHC) was again acting as the coordinating agency for the group. The CWHC's Executive Director had an active role in all of the network's collaborative activities until his retirement in 2015. There have been some temporary members of the network, including individuals transferred within their agency away from the wildlife health portfolio. The most frequent change in membership are disease-specific pathologists and biologists who have in-depth knowledge of one species or disease. These individuals participate to share their knowledge and expertise for one type of disease without an ongoing commitment to the broader arena of wildlife health.

The initial interactions of the WNS network focused on assessing the knowledge gap facing the network. In addition to determining how far WNS had spread in Canada, there were also discussions about the uncertainty of the numbers of bats, maternal colonies and hibernacula present in each province or territory. University researchers participating in the group were able to assist in providing some knowledge of bat habitat and newer surveillance techniques (Interagency White Nose Syndrome Committee, 2010a). By June 2010, the Canadian Wildlife Directors Committee, the group of wildlife directors for various federal, provincial and territorial governments who set national priorities aimed to coordinate wildlife policy across the country, had set three priorities for the management of WNS in Canada. The priorities were to develop a coordinated inter-governmental group to tackle WNS management in a consistent manner across Canada; to encourage the participation of the federal government in WNS management; and to evaluate the impact of WNS on bat populations (Interagency White Nose Syndrome Committee, 2010b).

As the wildlife health network had previously been asked by the CWDC to act as an inter-agency committee responsible for developing disease management plans for Chronic wasting disease and other diseases, and they were already sharing information on a regular basis,

formalizing the network's actions was logical. In September of 2010 a formalized 'White nose syndrome Management Group' was formed under the authority of the CWDC and individual provinces represented by their wildlife staff. It essentially sanctioned the activities the network was already undertaking. The WNS Management Group's initial goals were to author a policy response to the introduction of the disease in Canada as well as prepare for and attempt to mitigate the spread of the disease to new areas (Interagency White Nose Syndrome Committee, 2010c).

At this point in 2010, government staffers from the Canadian Wildlife Service (CWS) who were involved in the WNS Management Group informed the network members that budget cuts and reorganization within Environment Canada meant that there would likely be little to no federal government funding available to assist with the implementation of a national WNS management plan. CWS was able to provide assistance only on matters related to federal lands and animals designated 'species at risk' by the federal Species at Risk Act (SARA). It was noted that without the implementation and integration of the National Wildlife Disease Strategy (NWDS) at the federal level there was neither the political nor financial support for federal agencies to be actively engaged in wildlife disease management outside of federal lands (Interagency White Nose Syndrome Committee, 2010c).

The chair of the early WNS meetings, a provincial biologist from Quebec, emailed the members of the WNS Management Group on September 13, 2010 noting the importance of having a nation-wide strategy. He requested all members ensure their minister or representative from the CWDC would be informed that the previously approved model of disease management (NWDS) could be used for a WNS plan, suggesting that the more wildlife directors that support the NWDS would mean it would be more likely to be on the agenda with provincial and federal decision makers. Federal support was also seen as being critical because representatives from the U.S. Fish and Wildlife Service (USFWS) who were coordinating the American WNS management plan informed the group of their organization's desire for a Canadian federal counterpart with whom they could harmonize international approaches to WNS management (Interagency White Nose Syndrome Committee, 2010c). It should be noted that research biologists on staff at Canadian Wildlife Services and Environment Canada did continue to participate in the WNS Management Group despite the limited resources the department was able to provide.

Upon receiving a draft version of the U.S. WNS management plan in late 2010, the Canadian WNS Management Group felt it was best to model their own efforts on their American colleagues' work and develop a Canadian version of the plan (Interagency White Nose Syndrome Committee, 2011). The U.S. network had been developing policy responses and conducting research since 2008; as such, they were a valuable resource for the Canadian network. The U.S. plan also nodded towards the challenge of engaging stakeholders in a federal structure of wildlife disease management. The USFWS only has jurisdiction on federal lands but included a number of state and tribal representatives in its management plan working group (U.S. Fish and Wildlife Service, 2011). The plan authors acknowledge that states are under no requirement to follow this plan but state that "highly coordinated effort is required to effectively manage WNS and conserve species of bats" (U.S. Fish and Wildlife Service, 2011, p. 4).

The Canadian WNS Management Group requested the authority to develop the White nose syndrome management plan under the authority of the Canadian Wildlife Directors Committee. The CWDC agreed to this arrangement (contingent on the content of the final draft), and required adequate representation on the management plan working group from the four affected provinces: Quebec, Ontario, New Brunswick and Nova Scotia (by 2011 WNS had spread to New Brunswick and Nova Scotia). The CWDC also formally approved the Canadian Wildlife Health Cooperative as the coordinating agency (to give administrative and organizational support to the network) (Interagency White Nose Syndrome Committee, 2011). According to the meeting minutes the immediate goal was to alter the U.S. plan to "cover the full spectrum of management concerns in Canada" by December 2011 (Interagency White Nose Syndrome Committee, 2011, p. 2). The initial draft was written by September 2011 and submitted to the full WNS management group for comment.

The WNS Management Plan laid out six areas of concern including Communications and Outreach; Data and Technical Information Management; Diagnostics; Disease Surveillance; Epidemiology and Ecology Research; and Conservation and Recovery of Affected Species. Each area contained several goals and under each goal a number of action items to complete in order to achieve these goals (Management Plan Drafting Subcommittee, 2012). These areas of concern would then form the basis of an action plan developed in consultation with WNS U.S. counterparts. According to an email from the CWHC's Executive Director dated December 7,

2011, the action plans would assign tasks; indicate potential funding sources and responsibility to working groups to achieve the management plan's goals for each area of concern.

The majority of the goals of the management plan focused on capacity-building, information-sharing and closing the knowledge gap associated with containing the threat of White nose syndrome. The plan covered both the technical side including: developing standardized practices for diagnostic and decontamination and coordinating research efforts; as well as the communication side: including informing the public of both the value of bats and the threat of disease, raising awareness within the environmental community, media and government as well as developing productive working relationships with the recreational caver communities across Canada (Management Plan Drafting Subcommittee, 2012). What the Canadian plan did not include was a section on 'Disease Management'. The U.S. WNS management plan did contain one but the Canadian counterparts suggested that there was a limitation to what would be achievable in this area and they prioritized prevention given their resource limitations. It was noted that any potential avenues that were developed to help mitigate the disease would be included in the action plans for achieving the plan's objectives as they were developed (Management Plan Drafting Subcommittee, 2012, p. 2).

A section of the WNS management plan on the legal framework of the network's collaborative work suggests that there were a variety of factors, including the migratory nature of bats, the toxic nature of the *P. destructans* fungus and potential change in bats' conservation status that could shift jurisdiction for bats and WNS entirely to the federal government. There was also an acknowledgement in the plan that there were limited funds available, particularly no existing federal funding, to coordinate and undertake a serious policy response to the disease (Management Plan Drafting Subcommittee, 2012).

Given the experience of the wildlife health network's interaction with the federal government dealing with Chronic wasting disease and other diseases, the network was seemingly aware of a significant barrier: their need for federal support (both financial and legal) and the lack of forthcoming support from Environment Canada. The response of the network was twofold: they sought to develop capacity and knowledge through the provincial and non-governmental partners already committed to the project and they approached existing federal government programs to gain either financial or legal support for the WNS management plan.

The Canadian Wildlife Health Cooperative, on behalf of the network, made applications to the federal Invasive Alien Species Partnership Program (IASPP) and Environment Canada to fund research and network coordination. As well, requests were made to the Committee on the Status of Endangered Wildlife in Canada (COSEWIC) to conduct an emergency status assessment on the three species of bats most threatened by WNS in Canada. An assessment must be conducted by COSEWIC prior to making a recommendation for listing a species on the Species-at-Risk registry. The federal Minister of Environment has final approval on the listing. If approved, a Species-at-Risk designation requires a federally funded and implemented recovery plan to rehabilitate the ailing species and possibly the compromised lands or waters threatening the species. Having bats designated as ‘Endangered’ could open opportunities for federal support, however; there are limitations if a species is not listed as migratory: only animals on federal lands/water would be covered (Species at Risk Public Registry, 2015).

By early 2012, the Canadian Wildlife Directors Committee had received the final draft of the White nose syndrome management plan from the WNS Management Plan Drafting subcommittee of the network and formally endorsed it as an appropriate course of action. They were unable to offer any finances to assist with coordination or implementation of the management plan, noting that funding “will have to come from the usual channel [sic] of agency budgets and priorities” (Interagency White Nose Syndrome Committee, 2012a, p. 3). The CWDC also indicated that a decision to place bats on the Species at Risk registry could bring a change of funding priorities within their committee.

Attempts to engage the federal government in the WNS management plan were met with a number of roadblocks. Within months of submitting an application to the IASPP, Environment Canada announced the program was being discontinued as part of a budget reduction strategy within the government (Environment Canada, 2012b). After receiving requests in October 2011, COSEWIC conducted an emergency assessment of little brown myotis, tri-colored bat and northern myotis, the three bats affected by WNS in Canada (Committee on the Status of Endangered Wildlife in Canada, 2012). In February 2012, COSEWIC recommended to the federal government that the bats should be listed as ‘Endangered’ on the Species-at-Risk registry (Committee on the Status of Endangered Wildlife in Canada, 2014). Despite this recommendation, no response was received from the Minister of Environment until three years later, when the bats were finally listed as endangered (Species at Risk Public Registry, 2015).



This delay created uncertainty for the network and the CWDC and allowed the disease to continue to spread to new areas in eastern Canada without significant intervention. A small contribution was made by Environment Canada in late 2012 of \$50,000 for the CWHC to conduct surveillance on the spread of the disease (Environment Canada, 2013).

In order to move forward with the WNS management plan and the attempt to engage decision makers in various levels of government, a decision was made to hold a national workshop on WNS in Ottawa in conjunction with the Canadian Wildlife Directors Committee's fall meeting in October 2012. Members of the CWDC agreed to meet with the WNS group to be briefed on the ongoing disease threat, on the current planning and the need for action. According to an email from the CWHC's Executive Director dated September 19, 2012, the CWDC subcommittee specifically requested information from the U.S. WNS Coordinator regarding the management process of the stakeholders in the U.S., the conflicts or challenges that arose and how regions were able to cope and respond when WNS was discovered in their area.

A number of important developments resulted from the meetings and workshops held by the WNS Management Group. The first of these was the participation of the Canadian Wildlife Federation (CWF) as a financial sponsor of this event. CWF had previously funded an expert panel on Chronic wasting disease (CWD) and participated on the CWD stakeholder committee. An email from the CWHC's Executive Director and to network members dated September 13, 2012 shows that a number of participants did not have funding available through their home agencies or organizations and were able to attend because of CWF's support. CWF then became an active participant in the WNS management plan by supporting and coordinating outreach activities and citizen science programs that raise awareness of WNS and bat health issues (Interagency White Nose Syndrome Committee, 2013a).

Additionally, the participants of the network, including biologists and staffers from provincial governments, the Canadian Wildlife Service, members of the Canadian Wildlife Health Cooperative and academics, were able to use the workshops to expand the management plan goals into action plans (Population Monitoring; Surveillance & Diagnosis; Mitigation; Data Management; and Communication & Outreach). From the creation of these action plans, the working groups responsible for each area were able to identify what resources (financial, legal, knowledge, time, etc.) were needed to implement the plan. The working groups were also able to

connect with the U.S. working groups working in the same area and share information or strategy for implementing the plans.

The CWDC subcommittee working on WNS also provided their recommendations, in a November 8, 2012 email sent by the Saskatchewan provincial member of the committee, to the broader CWDC group regarding the October 2012 meeting. In this document the subcommittee made two recommendations: first that a WNS Coordinator should be hired to coordinate activities for the Canadian WNS management plan. It was suggesting the Canadian Wildlife Health Cooperative would be an ideal place to house the coordinator, given the organization's history with coordinating multi-level wildlife health plans. Secondly, they suggested "funding to support WNS coordination and related national-scale activities (e.g., surveillance, monitoring, research, communication) would be most effective if resources were combined from all affected jurisdictions" given the scope of the disease and the potential impact of federal legislation. This would appear to be a nod to the network's desire to have greater federal involvement (both funding and authority), as the general assumption held by various stakeholders was that bats would be declared a federal endangered species at any moment (Wildlife Disease Subcommittee, 2012).

While there was no immediate change in the level of assistance from the federal government, according to an email sent by the CWHC's Executive Director on November 28, 2012, a request was made by an officer in the Canadian Wildlife Service to provide multi-year funding to CWHC for a coordinator position as Environment Canada/CWS' contribution to fighting WNS. The suggestion from the officer was that a multi-year commitment would not only support surveillance and administrative support but that it could encourage matching funds from other jurisdictions (despite existing commitments at the provincial level).

The next step for the WNS network was the creation and formalization of the technical working groups who would carry out the action plans. Beginning in March 2013 groups were struck in the following areas: Population Monitoring; Surveillance & Diagnosis; Mitigation; Data Management; and Communication & Outreach. These technical working groups act as subcommittees to what was now called the 'Interagency White Nose Syndrome Committee' (formerly the WNS Management Group), which by this point had grown to more than 50 members (Interagency White Nose Syndrome Committee, 2013b). At least one member of each working group also holds membership in the appropriate U.S Action Plan group to ensure

continuity between the countries' activities. The Executive Director of CWHC also joined on the U.S. WNS Steering Committee, the U.S. WNS coordinator holds a seat on the Canadian Inter-agency WNS Committee and the Canadian WNS Coordinator sits on all technical working groups as part of their duties.

In a report to the CWDC seeking their formal approval of the working groups and the hiring of a WNS coordinator, the network laid out their five key priorities based on both urgency and feasibility. These goals include establishing a coordinator for the Canadian management plan, creating a national bat population monitoring plan, creating a national plan for WNS surveillance, developing a mitigation strategy and advocating for research and research funding focused on White nose syndrome and *P. destructans* (Interagency White Nose Syndrome Committee, 2013c).

The CWDC's approval was a mere formality as the wheels were already in motion with a funding announcement from Environment Canada in early April 2013. The CWHC was given \$82,500 per year over four years to support White nose syndrome management across Canada. The press release from the federal government suggested "[n]ational coordination will ensure efficient and effective use of resources in areas such as disease surveillance, reducing rates of transmission, public communication, and research into appropriate conservation actions, as well as facilitating information exchange with similar interests in the United States" (Environment Canada, 2013). This funding has been allocated entirely to fund a coordinator position within the Atlantic Canada branch of CWHC.

In the past three years, the technical working group have developed decontamination protocols for bat hibernacula, established standardizations for testing for WNS, authored a Western Canada WNS transmission prevention guide and launched a citizen science program for daytime flying bats with the assistance of the Canadian Wildlife Federation (Canadian Wildlife Federation, 2013). Members of the Interagency WNS Committee have also been instrumental in furthering scientific knowledge of *P. destructans*' pathology in bats and successfully secured a second emergency assessment from COSEWIC on the status of little brown myotis, tri-colored bat and northern myotis (Species at Risk Public Registry, 2015).

Since its discovery in southern Ontario and Quebec in 2010, White nose syndrome has forged a northern and westward expansion in Canada. The disease is almost at the Manitoba-Ontario border and has been confirmed as far east as Cape Breton (Canadian Wildlife Health

Cooperative, 2015b). The impact of the disease has been catastrophic in certain areas of the Maritimes, with mortality reaching 99% (New Brunswick Department of Natural Resources, 2013). While it is likely the WNS management plan is helping to reduce the spread of *P. destructans* by humans, the migratory nature of bats and the emerging nature of the fungus has complicated mitigation. Add to this the limited resources allocated to wildlife health and the Canada WNS network continues to work at addressing problems beyond its capacity, relying heavily on a small group of individuals highly committed to the problem.

Two developments in 2015 have provided hope to the wildlife sector regarding White nose syndrome. In May 2015, the Canadian government finally added three species of bats to the Species at Risk registry, providing the possibility that there will be more federal intervention as a listing requires a species recovery plan to be developed and implemented in line with the Species at Risk Act (Canadian Broadcasting Corporation, 2014). As well, researchers from the University of California at Santa Cruz have identified a bacterium present in some bats that inhibits the growth of *P. destructans*. This development will potentially lead to a vaccine that can limit the destruction WNS has wrought on North America's bat populations (Hoyt et al., 2015).

### **5.3 Network resilience**

While there has yet to be a key breakthrough of support for the work of the Interagency WNS Committee, there have been small victories punctuating the timeline of the network's activities. The severity of the threat of White nose syndrome and the catastrophic decline in bat populations that have already occurred have been communicated to decision makers in provincial and federal governments. Three species of bats have been added to the endangered species register by the Canadian government, as well as in all the affected provinces in eastern Canada (Species at Risk Public Register, 2015). The WNS network received formal approval for their national White nose syndrome management plan and action plans by the Canadian Wildlife Directors Committee, as well as funding for a national coordinator from Environment Canada through 2018. The network was also able to forge connections with U.S. counterparts, leading academics and non-governmental environment advocates to strengthen their knowledge base and ability to communicate with the public.

In order to investigate the network's resilience in tackling White nose syndrome the three major determinants of resilience will be examined: slack in resources, adaptive capacity and situation awareness. This will provide the opportunity to address how resilience in both attitude and action was displayed by the network between 2010 and 2015, as well as how the failure to act or adapt led to network fragility at times.

### **5.3.1 Slack in resources**

As previously discussed, slack in resources is crucial to network resilience by allowing the network to have the flexibility of when to expend resources, when to save resources in order to tackle threats and the capacity to reconfigure resources in order to take advantage of new opportunities. These resources come in a number of forms including financial, cognitive and social.

In the case of the Interagency WNS Committee (and its earlier incarnations), financial resources proved to be a stumbling block throughout the development and implementation of the WNS Management Plan. The initial group of biologists who began the collaboration to address WNS knew that bats were unlikely to attract much attention as the value of bats was generally underestimated; they were considered a non-economically viable animal and this disease did not appear to be a threat to humans, which lowered any perceived sense of urgency (Personal Communication with F.A. Leighton). There was also awareness very early on from network participants within the Canadian Wildlife Service (CWS) that the federal government would be unlikely to participate in a significant way as funding and jobs at Environment Canada and CWS had recently been cut (Interagency White Nose Syndrome Committee, 2010c). As well, the only federal funding program that was initially available to the group, the Invasive Alien Species Partnership Program (IASPP) was closed in 2012 in another round of budget cuts at Environment Canada (Environment Canada, 2012a).

What the network lacked in financial resources, they made up for in social resources. According to an email sent by a provincial biologist dated September 1, 2010, the initial teleconferences that were planned when WNS first discovered in Canada hosted more than 40 individuals from governments and universities, as well as the Canadian Wildlife Health Cooperative's offices across Canada. Records of meetings show that there were participants from

every province and territory present by the network's third meeting and by the time the formal Interagency WNS Committee was christened there were over 50 participants (Interagency White Nose Syndrome Committee, 2010c).

One of the key values of this level of network participation (or the slack in social resources) was that there were enough individuals to assist with coordination and execution of the WNS action plans without overburdening the core members. As well, it indicates the indirect levels of funding and support being provided to the network. The two main employers of network members are universities and governments. The ability of these individuals to participate in meetings, planning and research represents the tacit agreement of their employers (in the case of government) or the freedom their positions afford to pursue what they consider to be valuable research endeavours (in the case of the academics). This is not to suggest that there is an unlimited availability of research and surveillance at the disposal of the network. The government employees in the network invariably have other diseases and threats that they are responsible for reporting on to their departments and there is only so much that can be done without financial and political support.

In this case, there were also times where the presence of certain social resources were able to assist in generating financial resources. Members of the Interagency WNS Committee were policy staff with Canadian Wildlife Services who were able to advocate strongly to Environment Canada to fund a WNS Coordinator. A member of the Canadian Wildlife Directors also advocated on behalf of the network to their committee and the CWHC had previously received contracts with Environment Canada for disease surveillance on WNS and other disease. All of these relationships provided pathways for advocacy that resulted in funding from Environment Canada for national coordination of White nose syndrome.

There is no real evidence of financial contingency plans, but there is also no evidence of the network committing to financial obligations they could not fulfil. As we will see in the sections on adaptive capacity and situation awareness, most network members understand that they are at a disadvantaged position financially and that in order to make the most of the limited resources being collaborative and adaptable is key (Interagency White Nose Syndrome Committee, 2013a).

Cognitive, social and financial resources have all been sought through partnerships network members have with various communities. The most significant partnership that the

Interagency WNS Committee has developed is with their U.S. counterparts who developed and implemented the U.S. WNS Management Plan, including Jeremy Coleman, the WNS Coordinator for the U.S. Fish and Wildlife Service (U.S. Fish and Wildlife Service, 2011). The U.S. group began working on a WNS mitigation plan three years earlier than the Canadian network and have access to more researchers and experts. According to an email from the CWHC's Executive Director to a member of the wildlife directors committee, dated June 8, 2012, rather than develop an entirely new management plan the Canadian WNS network adapted the U.S. WNS Management Plan, recognizing their U.S. colleagues had valuable experience facing the disease that they did not. Another valuable partnership was developed in 2013 with the Canadian Wildlife Federation. The CWF and the WNS network partnered to develop a citizen science program, using the CWF's expertise at public outreach and education to provide a low cost surveillance program to alert the network to the presence of daytime flying bats (a sign of a WNS-type disturbance) (Interagency White Nose Syndrome Committee, 2013c).

The importance of slack in resources is noticeable throughout the timeline of WNS management. The continuing theme of a lack of financial resources provided a motivation to develop specific approaches that would require action from the federal government if they were to be successful such as a Species at Risk designation. The increase in cognitive and social resources allowed the network to remain in action. The continual discovery of new information in the management of WNS, the ability to close knowledge gaps and work with new partners provided motivation to continue.

### **5.3.2 Adaptive Capacity**

The second determinant of the network resilience model is adaptive capacity. Adaptive capacity is the willingness to adjust behaviours and practices to meet new challenges as they arise. Networks with adaptive capacity will make timely and appropriate decisions when facing stress because they have a culture that is sufficiently flexible and open to change.

As many of the participants in the WNS network were also involved in the Chronic wasting disease (CWD) case, including the CWHC as the coordinating organization, there are certainly similarities in the attitudes and behaviours of network participants in the two cases. The previously discussed commitment to adaptive management and scientific inquiry is present in the

WNS case as well. Even less was known about the pathology of WNS in 2010 when the network began its work than was known about CWD, requiring much input from researchers and a true need for best practices for disease mitigation. An email from a veterinary pathology professor working with the network to a colleague in New Brunswick dated September 29, 2011 indicated that the network's decision to partner with the U.S. WNS group was primarily out of a desire to defer to those working on the problem who were farther along in understanding how to slow down the spread of WNS, if not stop it. According to the CWHC's Executive Director in an email dated June 8, 2012: "[t]hinking about all aspects of management is quite advanced in the US and so we can learn much by joining their teams and planning approaches".

Beyond this important partnership, the foundational activities of the network focused on identifying and closing knowledge gaps. This included identifying maternal roosts and hibernation sites across Canada as well as identifying which researchers in Canada had knowledge of pathophysiology in bats, migration patterns, and surveillance practices that could be brought into the fold on the WNS work in Canada (Interagency White Nose Syndrome Committee, 2010b). This information seeking behaviour continued, as the publication of the WNS Western Transmission Prevention Plan in June 2014 indicated the WNS mitigation working group's intention to learn as much about bat habitats in Western Canada as possible in order to facilitate recovery and stop WNS's spread across Canada (Canadian Wildlife Health Cooperative, 2014).

There is a second similarity to the Chronic wasting disease network case, which is how the network took a rather traditional approach to attempting to secure the support of political decision makers. There was a desire to secure both funds and leadership from the federal government as the disease was quickly spreading across provincial borders. Having been told there were no federal funds in place or desire to lead the mitigation effort, the network took the next available avenue to secure the support (if unwilling) of the Canadian government by requesting an emergency evaluation of three bat species under the Species at Risk Act. In an email from a network member on staff at the Canada Wildlife Service to the Executive Director of the CWHC dated July 11, 2011, advocating for protected status is seen as a strategy that could be successful as it would require a financial commitment to protect and repopulate the affected bat species despite the budget reductions underway at Environment Canada.



In some ways this approach shows that the network members who were involved in both cases (as well as mitigation plans for West Nile Virus and Avian Influenza) have learned to be savvier in their attempts to secure financing for their activities. While the CWD network attempted to build a federal/provincial/territorial agreement on wildlife disease strategy that relied on interest and collaboration between a variety of stakeholders, the WNS group used a regulatory program that requires a formal government response when wildlife is threatened with extirpation. The Minister could either refuse to list bats as endangered, despite overwhelming scientific evidence, or the bats would be listed and a mandatory recovery plan would need to be formulated and funded.

What the network did not expect was that there would be no response from the federal government for more than three years after an emergency assessment was carried out in late 2011. There are references to a potential SARA listing throughout the meetings and the management documents written by the network (Management Plan Drafting Subcommittee, 2012). It obviously was a source of hope and the group even planned how listing the animals as endangered would affect their ability to work (including surveillance on federal lands and transporting specimens) (Interagency White Nose Syndrome Committee, 2012b). The fact that the network did not falter or slow down its operations in light of this challenge speaks to their impression of the magnitude of the disease threat and knowledge that a strong case for government intervention from a wildlife management perspective does not necessarily equate to government action.

After the disappointments of both the Invasive Alien Species Partnership Program being shut down and Environment Canada not responding to the COSEWIC recommendation that little brown myotis, tri-colored bat and northern myotis be listed as endangered federally, the network continued pursuing how to put their WNS management plan into action. Advocating for the network, the Canadian Wildlife Directors Committee (CWDC) Secretariat released a statement and a briefing note advocating funding a national WNS coordinator to be placed in the CWHC via an email sent November 8, 2012 to all the Committee members, which includes directors and Deputy Ministers of wildlife agencies and departments across the country. Network members in the Canadian Wildlife Service advocated to their director to fund the coordinator position.

While waiting for responses from various agencies and departments, the Interagency WNS Committee dedicated itself to fighting WNS despite their financial limitations,

acknowledging that the “nimble and collaborative structure of committees and responsibilities proposed is appropriate to the Canadian reality in which there is no central authority or source of funds for WNS responses” (Interagency White Nose Syndrome Committee, 2013a). The decision to pursue implementation and action when the emergency Species at Risk listing fell through led to the network ultimately understanding that their lack of direct government oversight allowed them to make decisions quicker than other committees and work directly with U.S. partners without political interference (Interagency White Nose Syndrome Committee, 2013b).

The WNS network has not been able to adapt perfectly across the board, as they are limited by structural boundaries of cross-provincial wildlife management within a federal system. The five affected provinces (New Brunswick, Nova Scotia, Ontario, Prince Edward Island and Quebec) have all developed surveillance and mitigation strategies in line with the WNS Management Plan, as members of the network work for each of the provinces (along with work done by CWHC’s Atlantic office located at the Atlantic Veterinary College in PEI where the WNS national coordinator is based). Despite struggles of coordination and limited financial resources, they have shown a level of tenacity and innovation that was not present in the Chronic wasting disease case.

### **5.3.3 Situation Awareness**

The final feature that contributes to network resilience is situation awareness: a measure of how well the network understands its environment (McManus, Seville, Brunson & Vargo, 2007). The suggestion in the literature is that higher levels of situation awareness reduce a network’s liability when facing risk as they have planned for potential crisis scenarios and have a keen awareness of the world they operate in (Bakker, Raab & Milward, 2012).

The WNS network in Canada has shown a calculated response to a potentially catastrophic ecological event. From the earliest meetings of the group, there was an awareness of the high levels of mortality associated with the fungus and knowledge of how little was known about the disease (Interagency White Nose Syndrome Committee, 2010a). The history of government approaches to dealing with wildlife disease was also well known within the group; giving the planning activities a less than hopeful tone. In an email dated June 8, 2012 to a

CWDC member, the CWHC's Executive Director noted the requirements of tackling the situation in Canada:

It has devastated bat populations such that some of the most abundant mammals in North America in 2006 and now threatened with extinction. As yet, there is no evidence of recovery. A wide range of US federal and state agencies, research scientists and NGOs are becoming highly coordinated in rolling out management actions and research priorities. My understanding is that the annual new money investment in WNS by the US federal government was \$4M last year and will be as much or more (up to \$8M) in the coming year... There also has been considerable diversion of people and funds within agencies toward WNS management. A parallel program on a Canadian scale would require on the order of \$400K to \$800K in new money plus staff and resource diversions to achieve equivalent actions on this side of the border.

The network's experience and expertise of wildlife disease and government institutions in place to mitigate wildlife disease made two opposing facts quite clear: White nose syndrome is a catastrophic threat to ecological health in North America and wildlife disease threats, particularly those that do not threaten humans or economic wellbeing, are very low on the list of priorities to political and bureaucratic leaders.

These conflicting realities dominated the network's 'operating context'. Throughout the network's communications, both private and public, there are indications that members are acutely aware of the devastating impact WNS is having on bats. All versions of the management plan seek to inform the reader of the levels of mortality and the "increasing uncertainty as to what, if any, measures can be taken to alter the prevalence, impact or spread of WNS" (Management Plan Drafting Subcommittee, 2012, p. 1). The wording in the management plan and other documents sent to potential funders strongly suggests awareness that the best that can be achieved may be delaying the spread of the disease (Canadian Wildlife Health Cooperative, 2014).

The knowledge that there are often very few resources available to address the effects of WNS stems from the experience the network members have working on other diseases and crises for wildlife overtime, including Chronic wasting disease. There are acknowledgements on multiple occasions that despite the 'support' of authority figures, few resources are forthcoming, as seen in an email, dated October 5, 2012 from the CWHC's Executive Director to a network member working with Canada Wildlife Service stating: "It may be up to the participants to drive the actions, hopefully with the blessing of the CWDC and whatever support they can provide".

These two considerations, the severity of the threat and the lack of resources, appear to weigh heavily on the network's planning and actions throughout. The way the group formulated

their action appears to be an attempt to mitigate these problems. The Interagency WNS Committee pared down the management response to what was necessary and feasible. They partnered with groups that had more resources, used legislative means to garner support and developed alternatives while waiting on authorities to act. Evidence of a number of features of situation awareness can be seen in these actions including: awareness of the ramifications of their own actions; awareness of stakeholder expectations; identification of potentials for failure as well as learning from past errors.

Authoring a management plan and action plans that focused on the most pressing concerns allowed the Interagency WNS Committee to attend to the critical items needed to slow the spread of WNS in Canada. A decision to omit ‘Disease Management’ from the management plan is one indicator that the group knew its limitations (Management Plan Drafting Subcommittee, 2012). Resources were instead invested in decontamination protocols to limit the human-led spread of the disease and surveillance to identify maternal colonies and hibernacula in threatened areas (Interagency White Nose Syndrome Committee, 2013b.).

Another major indication of the network’s awareness of its structural constraints was the decision to partner with groups that have more resources, particularly their U.S. counterparts. As previously discussed, the network decided that there was no need to recreate work that was already happening in the U.S. when it would apply to the Canadian context. This led to the Interagency WNS Committee adapting the U.S. Management Plan directly for the Canadian context. Having the high levels of coordination between the two countries would allow the Canadian network to access the latest information on WNS management and adapt it as necessary without starting from scratch.

In identifying potential opportunities for action, the decision to apply for federal Species at Risk status for the three species of bats primarily affected by White nose syndrome was not only a well-informed choice but also a seemingly strategic move to garner more resources and legislative clout. Evidence of this is seen in minutes from a network teleconference in which CWDC members indicate that a recommendation that bats be put on the Species at Risk registry would most likely shift priorities and funding commitments in the CWDC and Environment Canada (Interagency White Nose Syndrome Committee, 2012a). We also see this information being taken on board in an email from the CWDC’s Executive Director to a network member: “COSEWIC recommendations, slowly growing public awareness and alarm and pressure from

US programs... all may push Canadian agencies toward giving WNS more management attention". A further consideration was the desire of the U.S. agency overseeing WNS to have a federal counterpart in Canada (Interagency White Nose Syndrome Committee, 2010c).

Upon realizing that a COSEWIC recommendation was not going to result in any immediate action by the federal government, the Interagency WNS Committee members made the decision to continue their work as planned rather than delaying while waiting for a response. Whether this is due to the severity of the threat or because they had learned from previous experience, where a slowdown in action resulted in a loss of momentum, is unknown. Recognizing that relying on one primary source of funding and authority was a past mistake, and attempting to diversify approaches as well as continuing work while awaiting responses shows an awareness of past failure and an attempt to mitigate future failure.

The White nose syndrome case appears to present a network that has shown more resilience than it did during the Chronic wasting disease case, as the WNS network is still actively collaborating on implementing the management plan for WNS. The identification of bacteria in bats that can inhibit *P. destructans* provides hope that a treatment method will be available in North America in the near future (Hoyt et al., 2015). In the meantime, the Interagency WNS Committee appears to have the means, however limited, to continue their work as they have actively identified the barriers to success and formulated strategies to navigate the limitations of their network arrangements.

## CHAPTER 6: CONCLUSION

This thesis has examined how new governance arrangements in Canada have formed to tackle emerging wildlife disease epidemics. The resiliency of the network that developed to address these diseases has been of key interest. The concept of resiliency, stemming from positive organizational scholarship, relates to the network's ability to make and to continue making positive adjustments in performance in the face of challenges in order to emerge more resourceful and better equipped for future challenges (Sutcliffe & Vogus, 2003). Higher levels of resilience are characterized by strong evidence of adaptive capacity, situation awareness and slack in resources. By examining the activities of the network while dealing with two cases of disease outbreak (Chronic wasting disease and White nose syndrome), I have been able to identify attitudes and actions that suggest the network has the capacity to make positive adjustment. The ability to operationalize these attitudes and actions into productive behaviour that allows the network to overcome obstacles, however, appears to be uneven.

Governance networks have received attention and been the subject of much debate, as complex problems emerge that single agencies are unable to address on their own. One element of governance network activity that has received limited attention is what drives the ability to sustain network activities. Resilience ought to be a key issue in the life of a network, as higher levels of resilience is assumed to reduce the chances of network failure. Network failure should be of primary concern for any government that relies heavily on networked arrangements to provide services. Brian W. Head (2008) suggests that assessing network effectiveness based on outcomes is problematic because a useful pattern of outcomes may take years to materialize and the causal factors at play in complex policy areas may make judging the impact of the network impossible. Head suggests that network evaluation must navigate these evaluative limitations in an attempt to assess both whether there is the sustainability of good processes in play and if the desired (feasible and attainable) outcomes have been achieved. Focusing on resilience can be seen primarily as developing the sustainability of good processes and ensuring network members are equipped to make sound decisions. This practice will contribute to both successful policy

development and the sustainability of the network's activities despite the external challenges in the political environment.

The wildlife health network in Canada has proven itself a foundational piece of the animal health infrastructure in Canada. Without the collaborative work the network conducts, there would be very little state-sponsored capacity for veterinary health in Canada outside of livestock monitoring. The collaborative efforts of the network have produced national disease management programs and disease surveillance projects well beyond the capacity of a single province's wildlife management resources.

The path to developing, coordinating and implementing a policy response to outbreaks of emerging diseases is fraught with challenges, particularly the securing of funding and approval from various levels of government. In the face of a regulatory deficit in wildlife health in Canada, individuals with expertise in wildlife health from provincial natural resources departments, federal environment agencies and academic institutions have developed an ad hoc governance network to tackle wildlife disease epidemics and the bureaucratic blockages impeding their success (Farnese, 2014).

Examining the network's capacity for resilience has shed light on both the strengths and weaknesses of the network, provided potential areas for improvement and also produced a first step towards building a model of governance network resilience. Exploring how the network managed policy responses to Chronic wasting disease and White nose syndrome has also shed light on the limits of comparison for the two case studies. As section 6.1 will discuss, the differences between the two diseases - specifically the participation of agricultural interests and the delayed onset of symptoms in the Chronic wasting disease - proved to be a more important variable than previously thought. This does not mean that resilience characteristics have no role to play in how the network handles its work, however, it is important to emphasize how the nature of these diseases can be significant constraints on action. We can and have speculated about how resilient capacity can increase the likelihood of successful policy outcomes but without a more extensive comparison, no definitive conclusions can be derived.

In investigating how the wildlife health network, coordinated by the Canadian Wildlife Health Cooperative (CWHC), functioned while facing the two cases of disease in wildlife, I was able to assess how successful the network was at achieving its goals in each case. Even a brief glance at the evidence suggest that the network's methods have been more successful at securing

the financial and political support required for the White nose syndrome (WNS) management plan than for the Chronic wasting disease (CWD) management plan. The Interagency WNS Committee is still active across the country and their efforts have continued to make gains towards eradicating WNS. The CWD Inter-agency Oversight Committee, on the other hand, stalled out in late 2008, regrouped for a period between 2010 and 2011 but has not been active since. The affected provinces have suspended culling programs and the Canadian Food Inspection Agency has categorized those areas as ‘Endemic’, suggesting the disease is now a part of the ecosystem (Cotter, 2013).

What is less apparent without a deeper exploration of the network’s behaviour and methods is why attempts to mitigate CWD proved ineffective while many of the same players participated in the more successful Interagency WNS Committee just a few years later. I argue that in the WNS case, the network displayed more resilience to setbacks than it did when working on the CWD problem. This conclusion is based on a deconstruction of the network’s behaviour and interactions with stakeholders into the component elements theorized to be reliable indicators of resilience in organizations. Table 6-1 provides a snapshot of the differences between the two cases. The first seven categories are derived from the governance network resilience model in Chapter 3 and the remaining four categories are external factors, which appear to have influenced the actions of the network or relevant stakeholders.

The similarities seen between the two cases include network behaviour that is information seeking and preoccupied with failure, both characteristics that are indicators of willingness to explore new approaches and to plan for setbacks in a way that should contribute to higher levels of resilience (Vogus & Sutcliffe, 2007). In both cases the network’s activities and outcomes were shaped by a lack of financial or regulatory support from the federal government as well as the non-zoonotic nature of the diseases. That neither disease affected humans reduced the urgency of mitigating the effects on the animal population.

The areas of difference between the two cases include financial, relational and cognitive slack: all important for resilience because they provide the network with the freedom to reconfigure resources as needed, to stave off burn out by network members and to put new information to use. The CWD case resulted in an exhaustion of financial and relational slack as funds and political support ran out. The research conducted on the disease did not provide new avenues for disease management until the network had already ceased working on the issue. In



this case, the network focused almost exclusively on securing approval for a national CWD management plan, an ambitious, proactive disease mitigation strategy. This approach ultimately proved unsuccessful and left the network with limited options. The strong start to the network’s work petered out over time, as did research funding and attention to prion diseases.

**Table 6-1. Network resilience by characteristic**

	Financial Slack	Relational Slack	Cognitive Slack	Information-seeking	Attempt to alter strategy	Preoccupation with Failure	Awareness of Stakeholder Expectations	Federal gov't disposition	Disease progression	Presence in Livestock	Zoonotic disease
<b>Chronic Wasting Disease</b>	Exhausted over time	Exhausted over time	No	Yes	No	Yes	Sensitive to other gov't departments	Unreceptive	Protracted	Yes	No
<b>White Nose Syndrome</b>	Gained some over time	Yes	Yes	Yes	Yes	Yes	Awareness but not acceptance	Budget cuts	Short	No	No

The White nose syndrome (WNS) case, on the other hand, saw a gain in financial slack as the network was able to secure funding from Environment Canada for a national WNS coordinator. The network benefitted from support from the American WNS coordinator, employed by the U.S. Fish and Wildlife Service, as well as from academics who continued to make scientific discoveries about the disease across North America. The Interagency WNS Committee was able to muster their resources and their knowledge of the government stakeholder’s priorities as well as a measure of adaptive capacity (which was not seen in the CWD case) to maintain the high level of resiliency needed to eradicate WNS in Canada over many years. In particular, the network’s decision to take a multipronged approach in tackling WNS resulted in much needed financial and social resources from the federal government that was essential to support the ongoing work. The network was able to formulate and implement management plans for various aspects of the disease, to incorporate new scientific information as it was discovered and ultimately to target the federal government on a number of fronts to secure a financial commitment and a Species at Risk listing for endangered bats.

**6.1 Overall ability to manage disease is heavily dependent on disease characteristics**

A key difference in the cases illustrated in Table 6-1 relates to disease progression. Chronic wasting disease has an extended incubation period; animals can be infected with the

disease for more than a year before symptoms present (Bollinger et al., 2004). White nose syndrome, on the other hand, is fast moving, killing bats in a matter of months, not years. This disease specific characteristic, and a number of others such as pathogen complexity, the effect on wild animals and livestock, the speed and method of transmission, coloured the network's ability to respond, in particular its potential for adaptive capacity.

A resilient network should be able to adapt its planning and approaches to match its current circumstances; this is adaptive capacity. However, when tackling emerging diseases like CWD and WNS, the amount of information known to scientists and policy makers limit the available approaches. The speed and severity of WNS's progress through the Northeastern United States caught the attention of veterinary biologists as well as the media (Munroe, 2012). The unknown nature of the disease was problematic, but the fact that the disease took hold of bats while they were hibernating allowed researchers to have ample access to samples and subjects for testing. The pattern of bats' migratory routes allowed surveillance teams to identify hibernacula at risk, as well as develop decontamination protocols for cavers and miners who may be transmitting the disease. The disease itself and the mechanisms by which it kills bats were able to be identified in a matter of years. A vaccine against the fungus is currently being tested.

Chronic wasting disease exhibited several opposite characteristics: the disease has a slower progression, leaving a period of years before an infected animal is able to be identified. Cervids are migratory as well, but they do not hibernate. They are less accessible and evidence of disease is found only after they have been killed by hunters or found dead of CWD in nature. The disease itself was only determined to be a prion disease (caused by misfolded proteins in the brain) in 1979 after more than ten years of study (Goñi et al., 2015). There are no treatment options available, however a vaccine is being tested. Despite being present in North America for more than 40 years, CWD has proven challenging to control in both farmed animals and wildlife. Until a treatment or vaccine emerges, culling and environmental decontamination post-cull are the only way to destroy the disease.

The lack of new knowledge about the disease was a particular challenge for the Chronic wasting disease (CWD) Interagency Oversight Committee. The ways in which prions emerge in the brain are unknown, as is the mechanism of transmission. The network gathered experts on prion diseases at the outset of their work to advise them on best practices for prion diseases. This information provided the basis for the management plan the network attempted to implement and

sell to governments. The plan may very well have been the best option to mitigate with the problem from a veterinary perspective but it was not politically feasible for agricultural interests (as culling farmed animals was the only eradication option) and was not supported by the federal government elected in 2006. There was no progress or improvement in the treatment or containment options for the disease over the years of network involvement and as such there was no new approach taken by the network. The inability to reframe the disease as a feasible management target seems to have been a fatal stumbling block for the network.

In the more successful case of WNS, the network took multiple approaches to gain financial support and regulatory protection for bats, while waiting for action from the federal government. The speed of the disease progression, while devastating, provided the opportunity to have bats listed on the Species at Risk registry, which affords them protection and legally mandates a management plan to either curb the threat or repopulate the species. Partnerships with researchers and U.S. wildlife officials provided access to emerging research and management practices. These relationships provided the network with new information to hone their planning, in an effort to continually make positive adjustments. The network was able to sustain operations in the WNS case because they were able to adapt their methods to meet the changing political and regulatory landscape they were facing in a way that also tackled the type of problem the disease was creating.

Given the outcomes of these cases, adaptive capacity appears to be limited by external factors to a greater degree than is typically acknowledged. The wildlife health network's ability to adjust their approaches to meet new circumstances has been stifled by a lack of scientific information, economically feasible management approaches and coordinated authority between farmed animal and wildlife jurisdictions. In other cases, such as when dealing with WNS, these challenges were not present and better outcomes were witnessed.

## **6.2 Experience increases situation awareness**

Using the network resilience model, we can identify which characteristics were lacking in the wildlife health network that led to less resilient behavior and a reduced ability to overcome stressors. What Table 6-1 does not immediately illustrate, but was apparent in the investigation of the two cases, is that resilient characteristics appear to strengthen as the network gains

experience. This is particularly apparent in the area of situation awareness, as awareness of stakeholder expectations and the ability to anticipate problems appear to increase with continued practice.

Situation awareness is a measure of the network's perception of their operating environment including their ability to identify and navigate opportunities, threats, limitations and the expectations of stakeholders. We are able to identify situation awareness through increased communication and coordination in anticipation of, or in reaction to, potential problems, as well as through awareness of the obligations and needs of stakeholders. This set of characteristics encompasses an understanding of the network's environment (and the players in this environment) gained from experience and also behavior that exploits this understanding for the network's gain.

In the two cases examined throughout this thesis, it appears that the experience and knowledge gained between the Chronic wasting disease (CWD) case and the White nose syndrome (WNS) case contributed to an increase of situation awareness and a subsequent increase in resilience. From the time the network began working on Chronic wasting disease until the emergence of White nose syndrome in Canada, there were a number of high profile wildlife and zoonotic disease issues in Canada; including SARS, West Nile virus and Highly Pathogenic Avian Influenza (such as H1N1). Many but not all members of the network were involved in all these cases and the coordinating agency of the network, the Canadian Wildlife Health Cooperative (CWHC), oversaw national surveillance programs for the latter two diseases as well as coordinating the policy recommendations of the network involved in CWD and WNS. CWHC staff also co-authored the National Wildlife Disease Strategy with members of the Canadian Wildlife Directors' Committee.

Between 2004 and 2010, the numbers of ongoing disease threats dealt with by members of the network appears to have led to an increased in political sophistication required to achieve their goals. We earlier assessed the network as having moderately strong levels of situation awareness because they understood the severity of the threats each disease held. There was appropriate knowledge of the political realities of funding non-zoonotic disease management plans, as well as awareness of potential struggle and failure throughout the formal and informal communications of the network. In the CWD case, this awareness did not translate to action to move the management plan forward or to address hesitancy on the part of the federal

government. Records of network meetings make it clear that the participants were realistic in their expectations; however, there was a lack of planning for alternate courses of actions. The network was passive and reactionary.

The response was quite different when facing WNS. There was a change in attitude and action that seems to be the result of having failed and learned from that failure. There was no sense from the network that the magnitude of the disease threat would be enough to make the federal government intervene, as there was in the CWD case. Rather than simply presenting the facts of the case and the proposed management plan to the federal government and waiting for a response, during the WNS case the network adopted multiple approaches. It seems that the network's awareness of the expectations (and limitations) of stakeholders and potential partners grew enough to understand how to force the hand of politicians and bureaucrats who had WNS low on their list of priorities.

This result leads us to conclude that resilience can be enhanced as the network gains experience. It is not stated explicitly in the assumptions of the model but perhaps deserves to be. This outcome is in line with how psychologists theorize individuals' resilience to shocks and stressors, which is as a function of experience and learning (Sutcliffe & Vogus, 2003). Developing resilience, as the network resilience model illustrates, requires resource capacity to make positive changes as well as the ability to both identify what is a positive change and then to execute the change successfully. Underlying situation awareness and adaptive capacity is knowledge of the network's environmental context and the insight of how to navigate it to achieve the positive change required. The only way, seemingly, to build this intelligence is through experience. For a network this then requires both individual and collective experiences from which the lessons can be learned, successes can be integrated into future behavior and failures can be anticipated. The actions taken in the WNS case show the integration of knowledge culled from past experience with the federal government with actions designed to bypass the settings that stalled the management plan in the CWD case.

### **6.3 Structural limitations to resilience in governance networks**

Adapting a model intended for organizations to governance networks has provided a heretofore unexamined perspective on resilience in governance networks. The results of this

research are a good starting point to discover how other ad hoc governance networks are able to sustain their activities as well as provide insight for networks that are not making positive adjustments when they encounter conflict and stressors. A wholesale adoption of a model from one setting to another is not without its challenges; in particular there are some issues faced by networks that are not part of the experience of a private organization and as such are not addressed by the original resilience model.

The main disconnect between the private firm (discussed in the literature on resilience in organizations) and the governance network is the autonomy firms have to execute their planning and decisions in order to achieve their goals. Firms are obviously dependent on external factors (such as the regulatory environment, market, sales or venture capital) but the leadership of the firm can develop and execute a strategic direction with little interference from outside sources as long as it meets the objectives of the firm. The wildlife health network, on the other hand, is constrained in how much action it can take by multiple levels of authority, including provincial and federal governments. Without access to an independent stream of resources, the network is reliant on the approval of governments to authorize and fund their activities. This limits the ability of the network to be resilient, as the ability to address new issues will always have to pass through a bureaucratic or regulatory approval process, unless the network one day formalizes their activities and develops into a more traditional organization. Unless the network has a dedicated source of financial and social resources with which it can reorganize to suit its needs, it is highly reliant on external stakeholders which can place its resilience at risk.

A further challenge that is not accounted for in the current resilience model, but would be valuable to explore in a more systematic manner, is how governance network members negotiate the terrain between their collaborative work in the network environment and the more traditional bureaucratic environment with which they must engage for access to authority and financial resources. The nature of governance networks, particularly in a federal system, requires a certain level of cooperation between various levels of government and non-governmental agencies. These formal institutions will often use a command and control system, which organizational theorists argue is not particularly adaptive when facing stressors as there is limited situation awareness and adaptive capacity (McManus et al., 2008). A network that expects to succeed in generating positive policy outcomes is required to engage with these traditional institutions while

maintaining the characteristics that contribute to a successful and resilient collaborative enterprise: knowledge-seeking behaviour, adaptability, deference to expertise and flexibility.

Overall, the network resilience model has provided a useful starting point to conceive of resilience for governance networks. Future research in network resilience would benefit from including the aforementioned concept of learned experience in a more overt manner as a factor that contributes to successful positive adjustments. Resilience is better conceived of as a reflexive concept where our knowledge and abilities affect how we use it; how we use it further reinforces our abilities, ideally equipping us to have a higher capacity to make further positive adjustments. Further examination of how resilient characteristics displayed by individual actors influence the network would be of value, as greater insight into how better to engender highly resilience characteristics both individually and network-wide would be useful. A revised and refined resilience model for networks needs to acknowledge that resilience is not a binary state: an individual in the network or the totality of the network itself has a range of capacity for resilient attitudes and behaviors that will, given the effort, grow over time.

Developing a model that explores both the actions and the attitudes of the network has provided insight into how some networks continue to collaborate and produce policy outputs despite having little to no obligation to do so. The wildlife health network in Canada has developed out of the sense of responsibility professional biologists and academics felt to fill the gaps in health policy around emerging wildlife and zoonotic diseases. The orientation of this group is toward ongoing learning, through their own work and the work of their colleagues. Along with this information seeking behaviour, there is a fundamental awareness of the disadvantaged position they are in with regards to the priorities of funding agencies and governments. This knowledge shapes network activities towards a realistic perspective where failure is acknowledged, allowing the group to not be blindsided when things do not go their way. This perspective, unfortunately, has not always translated to adequate planning to overcome setbacks but it is obvious that the network has improved its practices to better deal with obstacles.

Defining resilience as the ability to make positive adjustments during challenging circumstances and assessing resilience through the network's ability to have slack in resources, adaptive capacity and situation awareness has provided the opportunity to evaluate a network in a substantive fashion. Behaviours that are valuable to network resilience have been identified, as

well as structural and cognitive limitations that restrict the types of actions and decisions that a network can make. Any future iteration of a network resilience model will have to account for the limitations that organizational resilience presents to network theory. Networks that do not have operational funding and require outside authority to support their work can potentially face serious limitations in their ability to achieve their goals. The presence of resilient attitudes and actions will help networks mitigate some of the uncertainty around their continued existence but the presence of a supportive government will always be a necessity.



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