AN INVESTIGATION OF FACTORS THAT INFLUENCE COASTAL COMMUNITIES' ABILITY TO ADOPT OR PARTICIPATE IN CLIMATE CHANGE ADAPTATION PLANNING IN THE ATLANTIC PROVINCES

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ABSTRACT

Coastal communities in the Atlantic Provinces are currently facing a number of social and economic challenges related to climate change. Community decision makers in the Atlantic Provinces have expressed further need for guidance to make informed decisions to adapt to their changing coastal environment in order to avoid the possibility of maladaptation. Research was situated within a broader Atlantic Climate Adaptation Solutions Association (ACASA) Atlantic project developing the Coastal Community Adaptation Toolkit (CCAT). Engaging with decision makers in small communities in the Atlantic Provinces, and understanding how they make decisions (or not) around adaptation was the key foundation step in developing the on-line decision support tool. Coastal stakeholder insight was solicited through workshops, interviews and an online survey. Themes that help community decision makers participate in adaptation planning: include: knowledge transfer, partnerships, policy enforcement and development, and economic structure. Identifying these themes acknowledges the need to build meaningful relationships between community decision makers and Provincial/Federal departments to improve confidence in the knowledge shared. Many believe Federal and Provincial government departments should be setting standards that municipalities can follow to move forward with their planning There is also a need to acknowledge the value boundary organizations (NGOs, local knowledge holders, academic institutions) add to communities' ability to access expertise, data, expand public awareness and foster internal confidence. Knowledge transfer is still considered a major obstacle in disseminating information to coastal communities across the Atlantic Provinces. Decision makers express that financial constraints in their community leave them with limited resources to plan for long term coastal adaptation.

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1.1 Research context

Climate change is one of the biggest challenges of the twenty-first century. Individuals and communities are expected to cope with the impacts associated with changes in temperatures, variability in precipitation and sea level rise, which are virtually certain to impact coastal populations (IPCC, 2014). The coastal zone, where land meets the sea or ocean, is considered highly vulnerable to the impacts associated with relative sea level rise (RSLR) and increases in sea surface temperatures. Impacts include increased flooding extent, storm surge and rates of erosion that will have significant effects on the natural and human coastal environment (Davies, 2011; James et al, 2014; IPCC, 2014). Coastal communities need to start planning for the climate change and sea level rise which will involve changes in the way we use the coast to keep residents safe and avoid damage to important infrastructure and habitat. Planning for long term changes is difficult and coastal communities in the Atlantic Provinces are no exception (Savard et al, 2016; Schipper et al, 2010). The goal of this research is to identify factors that influence coastal decision makers' ability to participate in and adopt climate change adaptation in the Atlantic Provinces. The research conducted in this thesis is situated within a broader Atlantic Climate Adaptation Solutions Association (ACASA) project, the Coastal Community Adaptation Toolkit (CCAT) (https://atlanticadaptation.ca). The CCAT purpose was to provide decision makers with adaptation options that are appropriate for their community's specific coastal issues in order to maximize their ability to achieve success.

1.2 Coastal climate change adaptation – Atlantic Provinces

Communities in the Atlantic Provinces face a number of challenges and opportunities concerning climate change impacts. Coastal communities are already experiencing an increase in relative sea level (caused by thermal expansion and subsidence), increase in storm surge extent, loss of winter ice cover, temperature and participation fluctuations (Savard et al, 2016). Flooding events are encroaching further inland along low-lying vulnerable properties and rates of erosion are increasing, putting a financial strain on coastal property owners and communities trying to protect public safety and coastal infrastructure (roads, bridges, buildings, ditches and important service centres) (Auld & MacIver, 2007; CBCL Limited, 2009; Corporate Research Associates, 2012; Schauffler, 2014; Steemer, 2003). Decision makers in coastal communities are concerned about the future, as there is overwhelming consensus that the coastal impacts, RSLR, storm surge, winter ice cover loss, temperature and precipitation fluctuations will exacerbate flooding and erosion issues that already impact the community and create new challenges (Savard et al, 2016; Schipper et al, 2010). This will be particularly hard for vulnerable small towns and rural communities that do not have the resources and financial support to help alleviate current coastal impacts (Savard et al, 2016).

In the past decade, there have been many projects, studies, and presentations prepared by academics, government departments, local (e.g. watershed management groups) and nongovernmental organizations (NGOs), as well as environmental and engineering consulting firms to support Atlantic Canadian communities in their efforts to mitigate and adapt to current and future coastal climate change issues (Arlington Group,

2013; NRCan, 2013; Savard et al, 2016). Previous research has focused primarily on regional and local risk and vulnerability assessments (Arlington Group, 2013). Recently, climate change adaptation has been at the forefront, providing communities with potential approaches and tools to help adapt to coastal issues (Arlington Group, 2013). Community decision makers need information that helps initiate the discussion around effective and appropriate adaptation solutions. Effective adaptation is achieved if the strategy does what it is supposed to do: alleviate the impacts of coastal hazards in a way that does not cause additional damage (Arlington Group, 2013; Commonwealth of Australia, 2015; Savard et al, 2016). Effective adaptation is not guaranteed, but has a higher likelihood of occurring if appropriate adaptation approaches are implemented, based on local environmental and socioeconomic context (Commonwealth of Australia, 2015). The process of implementing effective and appropriate adaptation strategies can be supported through knowledge building, incorporating environmental and social justice, creating flexibility in the strategies that can change under uncertainty and reducing long term vulnerability (Commonwealth of Australia, 2015; Savard et al, 2016).

Municipal staff and decision makers rely on government agencies with responsibilities in climate and the environment, non-governmental organizations (NGOs) and other collaborative environmental organizations to provide information, research and data to make informed decisions about coastal issues. It is important for these groups to continue providing data and information to municipal decision makers so they can make appropriate climate change adaptation plans to deal with current and future issues.

One of the main concerns coastal communities will face is deciding the best way to approach planning in a changing environment. Climate change adaptation planning has

been slow to start in coastal communities (Savard et al, 2016). Moving forward, community decision makers have to decide what coastal adaptation strategies best suit their coastal environment and context (Savard et al, 2016). When it comes to adapting to climate change impacts along the coast, there is no one-size fits-all solution. Different coastal environments will require different solutions. Social, ecological, economic, political, technical, institutional, psychological, cultural and historical contexts must be taken into consideration (Appenbrink et al, 2012; Arlington Group, 2013; Linham & Nicholls, 2010; Moser & Boykoff, 2013; Schauffler, 2014; U.S. EPA, 2009). Implementing unsuitable adaptation strategies can threaten public safety and lead to further damage to coastal infrastructure and coastal habitat (Savard et al, 2016). This is maladaptation and increases the costs of addressing the problem in the future (Barnett & O'Neill, 2010; Savard et al, 2016).

Not every community has adequate resources and expertise when it comes to dealing with coastal issues such as flooding and erosion. There is information available to support coastal community decision makers however, their ability to access the information is limited. Access can be limited based on the decision maker's abilities to understand the technical jargon related to the field of climate change research or not knowing where to find or access the information (Brown et al, 2011; Corporate Research Associates, 2012).

1.3 Development of ACASA coastal community adaptation tool

Climate change projects in the Atlantic Provinces conducted between 2009 and 2012 were funded by the Government of Canada through the Regional Adaptation

Collaboration (RAC) in the Atlantic Provinces these projects were administered by Atlantic Climate Adaptation Solutions Association (ACASA). ACASA was a collaborative between the governments of New Brunswick, Nova Scotia, Prince Edward Island and Newfoundland and Labrador to help Atlantic Canadians better prepare for, and adapt to, climate change (http://atlanticadaptation.ca/). It aimed to develop tools and resources that can help decision makers in the Atlantic Provinces address a number of coastal issues including: coastal erosion, coastal and inland flooding, infrastructure design and groundwater management. After the funding through the RAC ended, ACASA submitted a proposal to Natural Resources Canada to fund the CCAT between 2013 and 2016.

The official name of the CCAT project was "Developing a Decision Key on Planning and Engineering Guidance for the Selection of Sustainable Coastal Adaptation Strategies to Climate Change in Rural Communities". The objective was to support the decision-making process around coastal adaptation by providing coastal communities with adaptation tool options that are appropriate to their community's specific issue. The project was funded through Natural Resources Canada (NRCan) "Enhancing Competitiveness in a Change Climate" program, to facilitate the development and sharing of knowledge, tools, and practices that assist decision-makers in the analysis and implementation of adaptation measures.

This Coastal Community Adaptation Toolkit (CCAT) provides communities with a selection of appropriate short- and long-term adaptation options that can help them move forward with planning for climate change. The tool aims to move away from reactive, maladaptive practices that do not fit a community's socio-economic context, cultural

traditions and coastal environment (Adger et al, 2008; Lane & McDonald, 2005; Measham et al, 2011) by providing a list of recommendations based on the community's profile.

1.4 Thesis research

The goal of this research is to identify factors that influence how coastal decision makers' in the Atlantic Provinces participate in and adopt climate change adaptation strategies. Initial research for the CCAT focused on developing an understanding of how coastal community decision makers consider adaptation and what factors might aid or impede their ability to adopt strategies. These factors identified helped inform aspects of the CCAT framework, such as the overall approach, what is need for users to benefit from the tool. This includes the content, language, and visual elements of the CCAT tool of questions and project documents. Participants in the research were decision makers and individuals that influence or contribute to decisions surrounding coastal management and planning in the community. This thesis incorporates all the information gathered throughout the development process of the CCAT, allowing for a clearer understanding of what factors aid or impede community decision makers' abilities to consider adaptation.

1.5 Research statement

The purpose of this research is to:

Determine the factors that influence coastal community decision makers' participation in or adoption of adaptation strategies in the Atlantic Provinces.

Two primary objectives were:

Objective 1: Explore factors that enable or limit decision makers from using adaptation using international, national and regional peer-reviewed and/or grey coastal climate change adaptation literature.

Objective 2: Explore the current constraints and opportunities for coastal community decision makers in the Atlantic Provinces through a survey, eight community workshops and semi-structured interviews.

1.6 Overview of methods

The research took a qualitative approach using mixed methods through structured survey, semi-structured interviews, and process observation through eight community workshops. Information was collected in two phases: literature review and engaging with decision makers and those who helped them through their participation in either a survey, workshop or interview (See Figure 1.1). The literature review focused on adaptation strategies, approaches and tools; specifically the advantages and limitations a community may experience when considering adaptation. A survey, workshops, and interviews completed through the ACASA project provided insight from

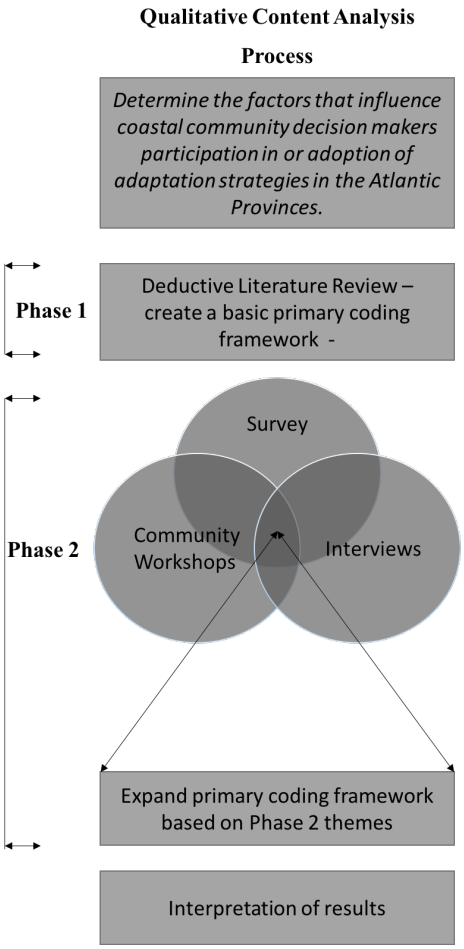


Figure 1.1 Thesis research methods diagram modified from (Mayring, 2000). Diagram was changed and refined to incorporate structure of this research.

community decision makers on what aids or impedes their ability to take on adaptation to help with immediate or long-term climate change risk associated with coastal flooding and erosion.

Qualitative content analysis was used to identify the main themes and characteristics expressed by decision makers in the Atlantic Provinces (Holsti, 1968). It involves creating a coding framework by identifying themes and categories that emerge out of the data (Neuman, 2003). Literature was reviewed using content analysis, and deductive logic to explore existing research focused on advantages and limitations in considering adaptation. This literature review of existing research on adaptation decision-making in Atlantic Canada was used to create a basic primary coding framework (Appendix A) that was used to begin analyzing data collected in this study. An inductive approach was used to condense and refine themes to help contextualize and address the research statement. Figure 1.1 displays the proceses of Qualitative Content Analysis (QCA) used in this project.

The data were organized using a Qualitative Data Analysis software (QDAS) to catalogue data collected through survey, transcripts from workshops and interviews. This provided a platform to manage and organize data and amalgamate the survey, workshop and interview transcripts in one place (Denzin & Lincoln, 2011; Welsh, 2002). Once the data were organized it was used to create Table 4.1 and Figure 4.29, categrizing the main themes that came out of the data and visually representing each theme's influence in helping decision makers' participate in climate change adaptation planning in their community.

1.7 Outcomes

The CCAT development process revealed factors that aid or impede a community's ability to participate in or adopt adaptation. Projects like the CCAT, which focus on engagement with community decision makers will aid in advancing adaptation planning in coastal communities. Providing guidance and tools to help community decision makers plan for climate change issues alleviates the use of maladaptive practices.

Chapter 2

Literature review

2.1 Climate change in Atlantic Canadian coastal communities

Coastal communities around the world are experiencing the impacts of climate change. Research is responding with providing national and regional climate change projections, scenarios, risk and vulnerability assessments. As of 2005, over 60% of the population in Atlantic Coast (including Quebec) lived within 20 km or less of the coast. (Manson, 2005). Throughout the Atlantic Provinces, population density decreases the farther you travel away from the coast (Lemmen et al, 2016; Manson, 2005). In Newfoundland & Labrador approximately 90% of the population lives in coastal communities (Irvine, 2012). This is slightly greater than Nova Scotia with over 70% of the population living in coastal communities (CBCL Limited, 2009). The economy in coastal communities often depends on natural resources from the adjacent land and sea. This dependency to the coast increases their vulnerability to climate change. The coast is not just an economic driver but where people have established their homes and communities (Campbell, 2010; Fisher, 2011; Lemmen & Warren, 2004). Many coastal communities have an overall smaller social capacity with a smaller operating budgets, and are dealing with the impacts of out-migration, an aging population base and aging infrastructure (Campbell, 2010; Fisher, 2011; Lemmen & Warren, 2004). Climate change will accentuate the strain on social services, making it more difficult for these communities to adapt to the changing climate (Fisher, 2011; Lemmen & Warren, 2004; Manuel et al, 2012).

2.2 Effect of climate change on coastal systems and the human environment

Climate change is defined by the Intergovernmental Panel on Climate Change (IPCC) as a "*change in the state of the climate that can be identified (e.g. using statistical tests) by changes in the mean and/or the variability of its properties and that persists for an extended period, typically decades or longer. Climate change may be due to natural internal processes or external forces, or to persistent anthropogenic changes in the composition of the atmosphere or in land use*" (IPCC, 2014, p.1760). The IPCC, comprised of international scientific experts has determined with confidence climate change is having and will have an impact on the natural and human environment. The IPCC AR5 published in 2014 shows with virtual certainty the Earth's surface has been warmer in the last three decades than any preceding decade (IPCC, 2014). Ocean warming has accounted for 90% of the energy accumulated on the Earth's surface between 1971 and 2010 (IPCC, 2014). Ocean warming will have significant impacts on the circulation of ocean systems, changing the diversity and distribution of aquatic ecosystems and change the way communities interact with the coast (IPCC, 2014).

Atlantic Canada is already experiencing the effects of a changing climate (Vasseur & Catto, 2008). Mean annual air temperature for the East Coast (including Quebec) has warmed 0.90 ±0.37°C between 1900 and 2010 (Savard et al, 2016). Stations along the Atlantic Ocean recorded warming between 0.75 ±0.34°C; while stations located along the Gulf of St. Lawrence coast recorded 1.12 ±0.42°C (Savard et al, 2014; Vincent et al, 2012).

Climate scenarios indicate a continued increasing trend in air temperature. Increases in air temperature will cause a shift in weather patterns, precipitation, circulation changes to currents circulation (warmer subsurface temperatures), sea level rise and changes in ocean acidity (Cheung et al, 2010; Drinkwater & Gilbert, 2004; IPCC, 2014). Precipitation trends for the Atlantic region do not show a clear historic trend but it is expected to shift seasonally, increasing during the winter and spring months and decreasing within the summer and fall (James et al, 2014; Savard et al, 2016).

The coast is naturally prone to global hazards, natural or human-induced physical events that may cause loss of life, injury, or other health impacts, as well as damage and loss to property, infrastructure, livelihood, service provision, and environmental resources (IPCC, 2014, p. 1766). Figure 2.1 shows the direct and indirect effects coastal climate change hazards will have on the natural and human coastal environment (IPCC, 2014, p. 1443).

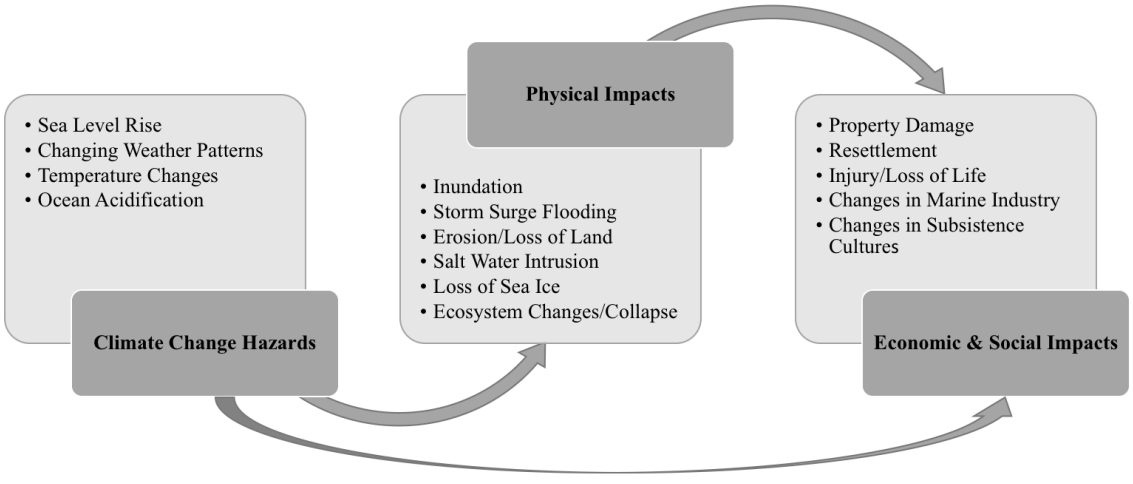


Figure 2.1 Physical and socio-economic impacts of coastal climate change hazards. Diagram modified from figure in National Round Table on the Environment and the Economy (NTREE), 2011, p. 66

The coastal zone, the near-coast waters and the adjacent land area, forms a dynamic interface of land and water that has high ecological diversity and economic importance (Lemmen & Warren, 2004; Lemmen et al, 2007). The dynamic nature of the ocean can trigger chronic and episodic coastal hazards, erosion and flooding, becoming a concern when important coastal infrastructure is damaged (CBCL Limited, 2009). Climate change will intensify these hazards in coastal communities, as relative sea level rise and increase in sea surface temperature will cause significant consequences to the natural and human coastal environment (Davies, 2011; James et al, 2014; IPCC, 2014). Relative sea level rise (RSLR) are the observed or experienced sea level changes relative to the solid surface of the Earth (James et al, 2014; IPCC, 2014). RSLR coupled with an increase in intensity of storms events (IPCC, 2014) will challenge the integrity of coastal infrastructure and natural coastal environments. Relative sea level rise is also influenced by local processes unrelated to climate change and can be enhanced by local subsidence, glacial isostatic adjustment, sediment transport and coastal development (James et al, 2014; Wong et al, 2014). Relative sea level projections (2010-2100) for the Atlantic region range from +0.70 to 1.25 m by 2100 (James et al, 2014). The projections in James et al. (2014) are based on the global scenarios from IPCC AR4 2014 and incorporated vertical land motion, redistribution of melt water (sea-level fingerprinting) and regional dynamic oceanographic effects. Relative sea level projections vary considerably (James et al, 2014) when taking into account local changes to tectonic subsidence (sinking of Earth's crust) and isostatic readjustment (ongoing movement of land that was once burdened by glacial ice loading) (NOAA, 2015).

Projected RSLR will cause an increase in coastal flooding events in low-lying areas and areas not experiencing uplift from glacial isostatic adjustment. It will also increase the rate of erosion along coastal systems that already experience issues related to chronic or episodic erosion (James et al, 2014). Coastal erosion is the wearing a way of coastal land resulting primarily from wind and wave action along the shore (CBCL Limited, 2009; Galloway et al, 2013). An increase in RSLR will expand the high water mark and wave extent of the coast, which may increase the extent of erosion caused by coastal processes (IPCC, 2014; Vermeer & Rahmstorf, 2009). Flooding is "the overflowing of water from its normal confines and/or the accumulations of water in areas that are normally not submerged" (IPCC, 2014, p. 123). This definition of flooding is related to periodic or episodic events causing dry areas to become temporarily wet during storm events, intense wave action and precipitation events. There are several ways flooding can occur including direct inundation, overtopping and breaching of natural or man-made coastal features (Galloway et al, 2013; Mangor, 2004). Direct inundation is the encroachment of sea land-ward and is reliant on the slope of the coastline (Galloway et al, 2013; Mangor, 2004). Overtopping natural or man-made coastal features can occur during storm events, creating swell conditions that exceed the height of natural and man-made barriers (sea walls, dykes, etc.) (Galloway et al, 2013; Mangor, 2004). Breaching a barrier is caused by wave action physically breaking down the barrier (natural or man-made) which allows sea water to spread inland. Flooding caused by any of these events can create a build-up of water and debris within drainage systems (Galloway et al, 2013; U.S. Indian Ocean Tsunami Warning System Program, 2007), causing extensive damage to coastal infrastructure (buildings, roads), inundating land until flood levels receed

(Galloway et al, 2013; Mangor, 2004). An increasing concern for low lying coastal communities is the potential submergence and permanent loss of land and risk to public safety (Galloway et al, 2013; Mangor, 2004).

The level of risk related to coastal climate change impacts is contingent on the severity and frequency of the hazard and the system's vulnerability (IPCC, 2014). In this case the system, is the coastal communities. The severity and frequency of coastal hazards (flooding, storm surge and erosion, etc.) relates to the community's exposure, the presence of human or natural systems that will be adversely affected by a hazard (IPCC, 2014). A community's vulnerability is its predisposition to adverse effects, largely related to their capacity to adapt (IPCC, 2014). How a community adapts to changing climate conditions and impacts is related to their social, human, technical and financial context and capacity (IPCC, 2014; U.S. Indian Ocean Tsunami Warning System Program, 2007; Vincent, 2007). How a community can anticipate, absorb, respond, accommodate or recover from the effects of coastal hazards is related to its resiliency (IPCC, 2014). Resiliency allows a community to effectively respond in the event of a disturbance and maintain its core function during a hazardous event (IPCC, 2014).

2.3 Coastal climate change hazards in the Atlantic Provinces

Atlantic Canada's coastline is dynamic, creating a variety of landscapes and diverse ecosystems, all of which are exposed to different levels of risk and vulnerability as a result of climate change (Daigle, 2006; Thompson et al, 2009). Roughly 2.3 million people reside in Atlantic Canada (including Quebec), in towns and communities arranged along the coast with waterfronts built along historic high water lines and/or infilled

wetlands (Arlington Group, 2013). As temperatures and precipitation increase and sea levels rise, current coastal conditions will be altered, along with many environmental and social interactions with the coast (Forbes et al, 2004). Common concerns along the Atlantic coast include (with significant regional differences): increased storminess driven by more energy in the atmosphere, sea surface and ocean acidity, decrease in ice cover (thickness and duration), increase in precipitation, water stratification and relative sea level rise (Savard et al, 2016). Adverse impacts will vary but common experiences for coastal communities will be related to storm severity, coastal flooding and increased rates of coastal erosion (Forbes et al, 2004; IPCC, 2014).

Atlantic Canadian communities have documented many local and regional changes along their coastal environment (Savard et al, 2016). Newfoundland and Labrador on average already experience six floods per year with average damage costs greater than $3.2M annually (Newfoundland and Labrador Department of Environment and Conservation, 2012, p. 21). Depending on the coastal ecosystem, sensitivity to climate change, sea level rise and storm surge will change (Blankespoor et al, 2012; Brooks et al, 2006; CBCL Limited, 2009). For example, there is an expected increase in erosion along the New Brunswick Northumberland Strait, PEI and areas of Nova Scotia; increased runoff/flooding damage in Newfoundland and the South Shore of Nova Scotia (Daigle, 2011; Davidson-Arnott & Ollerhead, 2011; Corporate Research Associates, 2012). Low-lying coastal estuaries, lagoons, drowned river valleys, sandy barrier beaches, and coastal dunes are all susceptible to RSLR (Arlington Group, 2013; Davidson-Arnott & Ollerhead, 2011).

The coastal zone in the Atlantic Provinces is an area of environmental, biological, social, and economic importance with scattered development and major transportation routes hugging the coastline and waterways. The coastal zone is an important part of the social, economic and cultural wellbeing of the Atlantic Provinces and climate hazards will have direct and indirect impacts on community function, especially for those smaller communities that are an integral part of Canada's food production, resource extraction and energy generation (Canadian Rural Revitalization Foundation, 2015; Daigle, 2006; Thompson et al, 2009). Figure 2.1 displays the main physical and socio-economic impacts associated with coastal climate change hazards.

The threat climate change poses to the coastal environment will have unfavourable impacts for the wellbeing of smaller communities in the Atlantic Provinces if adaptation does not take place (Arlington Group, 2013). There will also be some uncertain opportunities related to a changing climate (Arlington Group, 2013). Many communities are ready to take the next step but need insight into the most effective ways to prepare for changes to their local climate. Over the last decade, there has been a focus on cataloging adaptation approaches and tools that can help alleviate climate change hazards for coastal communities (Arlington Group, 2013). Providing coastal decision makers with adaptation strategies can open up the discussion on ways they can recuperate from adverse impacts and create opportunities for their communities to succeed (Arlington Group, 2013).

2.4 Adaptation

2.4.1 Adaptation: consensus and advancement

Climate change will continue even if future global greenhouse gas emissions are reduced to zero (IPCC, 2014; Richards & Daigle, 2011). The concern to alleviate the impacts of climate change has created a movement towards adaptation, an adjustment in natural or human systems in response to actual or expected climatic stimuli or their effects, which moderates harm or exploits beneficial opportunities (IPCC, 2014). Within North America, engagement with adaptation planning is taking place mainly at the municipal level through the planning process and risk/vulnerability assessments (Causley, 2008; IPCC, 2014).

Research on climate change adaptation is expanding, exploring different ways nations, regions and communities are changing with the environment; with research opportunities in this field more than doubling between 2005 and 2010 (Preston et al, 2009). The Arlington Group Sea Level Rise Adaptation Primer (2013) definition modified the definition of adaptation to address sea level rise and coastal environments. Adaptation for the coastal environment is, "*an adjusting in natural or human systems to a new or changing environment that exploits beneficial opportunities or moderate negative effects. With respect to sea level rise, adaptation refers to action taken to prepare for its occurrence*" (Arlington Group, 2013, p. 100). Coastal communities have no choice but to adapt, to look for ways of adjusting the way we use the coast to take advantage of future opportunities and to reduce potential damage (Engle, 2011; Lange et al, 2009; IPCC, 2014).

Strategies for coastal adaptation emerge as various tools and approaches, operating through legislative or engineering guidelines, public policies, infrastructure investment and upgrades, design standards, building codes, insurance policies, behavioural changes or through technological or scientific advancements (Auld & MacIver, 2005; Lange et al, 2009; Richardson & Otero, 2012). Technical tools available for use are: environmental impact assessment, risk hazard assessments and management, weather warning programs and monitoring systems, landscape and visual resource analysis and geographical information systems (Auld & MacIver, 2005; Department of Environment and Heritage Protection, 2013; Dexter, 2012; Hynes & Graham, 2005; Ross & Easley n.d; Stewart et al, 2003). Adaptation strategies can range from complex models assessing climate change risk and vulnerability (Coldwater Consulting, 2011; IBC, 2015; James et al, 2014; Lemmen & Warren, 2004), to step by step guides that help identify, design, implement and evaluate adaptation (Arlington Group, 2013; Atkins Ltd, 2009; NRCan, 2013; NOAA, 2007; Newfoundland and Labrador Department of Environment and Conservation, 2012). Adaptation tools include guidebooks containing key decision making steps common for planning strategies, risk management processes for selecting the best course of action for local issues, and case study reports that provide examples of how other communities have dealt with challenges (Arlington Group, 2013; CCRM, 2010; Jager & Moll, 2011; Novaczek et al, 2011; NRCan, 2013).

Adaptation strategies can be used based on anticipatory, long-term planning before the impact takes place, or reactive actions, which takes place after hazards have already developed (IPCC, 2014; Parks et al, 2007). Anticipatory planning is favoured over reactive methods as it has proven to be more economical to prevent impacts

compared to responding to them after they occurred (NTREE, 2011; Linham & Nicholls, 2010; IPCC, 2014). However, a lot of adaptation tends to take place in a reactive way, after a coastal infrastructure has been damaged as communities do not have the financial and resource capacity to approach planning for long term needs (Parks et al, 2007). Maladaptive practices, actions taken to reduce vulnerability that end up emphasizing or create new problems, ultimately increasing vulnerability, are associated with reactive adaptation (Burton, 2005-2006; IPCC, 2014). New opportunities rely on attempting to cope with current hazards while planning for future extremes (Nicholls et al, 2007; UNEP, 2006).

2.4.2 Adaptation strategies

Adaptation strategies can be divided loosely into five main categories: procedural, accommodate, avoid, retreat and protect (Manuel, Reeves & Hooper, 2016). Procedural strategies can include land use planning approaches and tools that aim at generating local climate change data, build upon local knowledge and capacity and create planning frameworks (such as land use policies, watershed management plans, climate change adaptation plans, wetland policies), and land use regulations and/or develop site design standards (Arlington Group, 2013; Nicholls et al, 2007; Shaw, et al, 1998; Vasseur & Catto, 2008). Avoid strategies are made up of a number of land use planning approaches that prevent or discourage development in hazard prone areas. These strategies are generally anticipatory, as they require identification of high risk areas before development.

Accommodation strategies can either allow for the same use of the coast as before through engineering or design standards, or change the use of coastal land to accommodate for rising sea levels. Strategies that aim to relocate infrastructure and development are known as retreat strategies. Retreat strategies are generally long-term plans that move back previous development (small scale, site specific or larger scale such as communities) from high risk areas into lower risk areas. When infrastructure is required to stay directly on the coast, engineered strategies that protect from flooding and erosion are often used to allow coastal use to remain the same. Protection strategies are the most exploited form of adaptation strategies; often used as reactionary responses to ongoing coastal issues and are short-term solutions (Arlington Group, 2013).

Adaptation capacity, the combination of strengths, attributes, skills and resources available can assist in an individual or community's ability to cope with adverse effects of climate change (Adger et al, 2005; Adger et al, 2009; IPCC, 2014) is dependent on a variety of factors. These factors include human (diverse and experienced work force), social (cohesive community), political, legal, institutional, scientific, technological (experience and training to implement tools), and economic (financial) resources (Wall & Marzall, 2006). Although the challenges surrounding adaptation action are unique and situational for each community, there are fundamental steps that can lead to effective adaptation.

2.5 Fundamental steps for adaptation planning and the process of decision-making

Adaptation follows a series of fundamental steps that can lead to effective planning (Barnett & O'Neill, 2010; Moser and Boykoff, 2013; Richardson & Otero, 2012).

Adataption is a decision-making process (Lawrence et al, 2018) and in the case of climate change impacting coastal communities, it is the planning for long term changes and determining suitable options for coastal hazards. Climate change adaptation planning tends to follow 4-6 fundamental steps: 1) Initiate, 2) Research, 3) Plan, 4) Implement, 5) Monitor and 6) Review. The first two stages, initiate and research are based on knowledge building, attempting to establish a resource of the most up-to-date local information; integrating local skills to explore current capacity to deal with climate change and ways to increase community awareness and engagement. There is a focus on adaptation being context specific with explicit goals or objectives that manage priorities and promote flexible responses of conflict when changes arise.

Part of initiating the process of adaptation planning is gathering existing knowledge of the coastal community, where coastal issues have happened in the past, and what approaches were used to alleviate or change the risk. This involves beginning the conversation with stakeholders, forming relationships and establishing partnerships that facilitate public education on current and future risk. This stage overlaps with the research phase as information gathered about a community's physical and socio-cultural setting, risk and vulnerability are necessary to provide the public with information about future climate change scenarios (Richards & Daigle, 2011). Data gathered during the research stage can identify economic and political background, knowledge gaps and gather information on the local land use and coastal environment, the physical processes and ecosystem. Research can take place with community volunteers and/or partnerships with organizations, government departments, professional and educational institutions (elementary, high schools, colleges and universities).

The planning stage requires vision and forethought from all coastal stakeholders. To begin the planning process, adaptation objectives need to be established. This often includes determining top priority coastal issues (current and future), reviewing adaptation options that would support the community's best interest in keeping within the bounds of their objectives (Bowron & Davidson, 2011; Brown et al, 2011).

The selection of appropriate adaptation options takes time, and often requires community decision makers, stakeholders and public involvement to make sure most coastal users are aware of and approve the plan. A stakeholder is a person who had a legitimate stake or interest in a particular issue (Vogal et al, 2007). In this case, stakeholders are those that have a vested interest in the planning and development of their coastal community (Brown et al, 2011; Tett et al, 2011; Vogal et al, 2007). Suitability of adaptation can be influenced by how effective, efficient and practical the strategy is at alleviating coastal issues, in a way that promotes political and cultural ideals of the coastal setting (Bowron & Davidson, 2011; Brown et al, 2011). Once suitable options are selected, a plan for implementing should be drafted which will be brought forth for approval.

Implementation generally includes the approval or support of the plan by the community. The background information, social and physical data necessary to reach the agreement of a plan requires extensive resources. Approval of any adaptation option can be a long process, especially if there is any disagreement in the community, but providing the space for communities to engage with the planning process early in the development can help alleviate tension. Monitoring and review is the final stage of adaptation. Engineered adaptation options are monitored to ensure there are no structural problems

(CBCL Limited, 2009). Land use planning tools or those tools that involve assessing social goals and objectives are often not reviewed to the same degree (CBCL Limited, 2009). When an adaptation plan is implemented, the project or program is usually at the final stages. This usually leaves little in the budget for monitoring or evaluation to take place post-implementation (CBCL Limited, 2009).

Approaching these fundamental steps is not a simple task for decision makers; it requires initiative, commitment, leadership and time from all active stakeholders (Causley, 2008). No single adaptation approach will be equally effective for all communities, due to unique geographical and environmental issues which will be impacted by climate change (Causley, 2008; NRCan, 2013). For these reasons, best management approaches, selecting those options that are appropriate and suitable for the situation, remain important for long-term coastal planning.

2.6 Adaptation innovation and the role of organizations

There are a number of toolkits, platforms and guidance documents that provide a framework for the decision-making process of adapting to climate change. These documents and tools also explore different adaptation options in detail and provide examples of where it was used elsewhere. Table 2.1 provides a collection of notable contributions that provided a template for the development of similar tools and guidance documents in the Atlantic Provinces, mainly the CCAT. An important aspect of all notable products is their ambition to exchange ideas, and simplify the process of identifying vulnerability and risks and creating adaptation plans. Table 2.2 shows the notable contributions from organizations in their support to adaptation decision-making.

A number of these organizations have platforms including training workshops and forums that allow users to exchange ideas and projects that have already been done. The notable documents by organizations followed step by step guidance through the process of decision-making around adaptation and an extensive catalogue of coastal adaptation strategies. The guidance documents are those that offer additional information for adaptation tools, describing advantages and disadvantages, schematics of what tools work well together and real life examples. Few resources take the time to describe the implementation process and how to apply these tools.

The Virginia Institute of Marine Science coastal decision support tool for undefended and sandy shorelines (CCRM, 2010) was significant in the development of the ACASA Coastal Community Adaptation Tool (CCAT). The VIM was not suitable for use in Atlantic Canada but the decision tree format was emulated by the CCAT to create a similar function by emphasizing the importance of shoreline characteristics. The CCAT asks the user a series of questions that lead to a list of appropriate adaptation options tailored to reflect Atlantic Canadian coastal hazards (flooding and erosion) in complex, coastal environments. The CCAT also created a social capacity section in order to provide users with capacity building techniques and emphasize their existing land use plans as ways to incorporate adaptation into future municipal decision-making.

Table 2.1 Notable toolkits that provided a template for the development of CCAT

Notable toolkits that provided a template for the development of CCAT		
	Description of Tool	

US Climate Resilience Toolkit	• Managed by NOAA Climate Program Office
	• Helps people find and use tools and information:
	  o Case studies
	  o Training course
	  o Expert library
	• Build climate resilience
		Topic:
		• Built environment
		• Coast
		• Ecosystem
		• Energy
		• Water
		• Food
		• Health
		• Transportation
		• Tribal Nations

Climate Adaptation Knowledge Exchange (CAKE)	• Founded by EcoAdapt and Island Press (2010) and managed by EcoAdapt • User based platform to share knowledge, studies and projects • Creating a network between users • Aspire innovative community practice	**EcoAdapt: Meeting the challenges of climate change** • Advisory role for groups wishing to engage in climate change adaptation • Develop material and training opportunities for decision makers
Virginia Institute of Marine Science (VIM) Decision Support Tool	• Tool for undefended and sandy shorelines • Follows a decision tree format where answers to questions lead to appropriate adaptation options	• Emphasized importance of shoreline characterization (unlike many tools) • Lead to development of similar tools with varying coastal settings
BC Climate Action Toolkit	• Knowledge sharing and collaboration to help BC local governments • Provides tools for communities and guidance documents: o Sea Level Rise Adaptation Primer: Information on a range of tools for adaptation specific to Pacific and Atlantic Coast • Plan2Adapt: Assess climate change based on standard set of climate model projections for Pacific Coast	

Table 2.2 Notable organizations that provided a support for coastal adaptation decision-making

Notable organizations that provided a support for coastal adaptation decision-making		
	Description of contributions	
Canadian Institute of Planners	• Championing climate change policy action • Partnering with organizations, communities, government to develop reliable data and knowledge exchange between scientific experts and policy planners • Integrating climate change into planning activities and planning education	
Atlantic Climate Adaptation Solutions Association (ACASA) ***(Ended 2016)***	• Managed by the UPEI Climate Lab • Exchange climate change research and tools for Atlantic Canada • Resource library on website: https://atlanticadaptation.ca/	• Municipal partnership among provincial governments in Atlantic Canada (Nova Scotia, Prince Edward Island, New Brunswick and Newfoundland and Labrador), Tribal governments, Non-profits, and Industry
Local Government for Sustainability Canada	• Works with communities to build capacity by connecting leaders and providing solutions • Knowledge sharing and partnerships	
Climate – ADAPT European Climate Adaptation Platform	• Partnership between European Commission and European Environment Agency Platform to access and share information	• European Union, National and Transnational knowledge and adaptation strategy development Case studies and tools to help with planning

UK Climate Impacts Programme (UKCIP)	• Multidisciplinary web based platform
	• Lead to the development of similar tools:
	  ○ European Adaptation Support Tool
	  ○ Klimalotse (Germany)
	  ○ Cegnar (Slovenia)
	  ○ Climate Adaptation Wizard (Australia)
	  ○ Adapting to Climate Change in China
		• Online community to exchange knowledge, workshops ideas and publications
		• Houses tools and resources for decision makers for adaptation:
		  ○ Adaptation Wizard
		  ○ Local Climate Impacts Profile (LCIP)
		  ○ Business Area Climate Impact Assessment Tool (BACLIAT)
		• UKCIP Risk Framework

The Insurance Bureau of Canada	• Notable Tool – Municipal Risk Assessment Tool (2015) • Identify and evaluate high risk areas within municipal water infrastructure systems and create recommendations	

Adaptation strategies, guidance documents and toolkits are being developed across Canada and internationally. Observations of decision making by researchers (Schauffler, 2014) suggest that although there have been advances in the development of adaptation guidance documents, community decision makers are unsure of how to begin the process and feel they lack the technical training and expertise to move through the adaptation planning and implementation process (Schauffler, 2014). Many of these guidance documents and toolkits tend to have restrictions in their use and can only be used in specific situations due to their geographical or institutional link to a particular place or issue (Sheppard, 2005; Sheppard, 2008; Sheppard et al, 2011). Other guidance documents falter in their ability to provide concrete examples of adaptation options that a community can emulate for their specific situation.

There is opportunity to utilize products already created by organizations, agencies and governmental departments and disseminate them to the wider audience. Although there is little capacity to alter existing plans, guidance documents and tools by community staff (Sheppard, 2005; Sheppard, 2008; Sheppard et al, 2011), dissemination has been a focus of environmental organizations. Climate change is a multidisciplinary issue, therefore tools and work created within one organization or department would benefit from the expertise and knowledge of other groups. There has been a push for collaboration between organizations and provincial and federal government to not only share information between each other, but also make that information accessible to the public. Natural Resources Canada developed an Adaptation Platform which hosts webinars in order to disseminate new research and knowledge between federal,

provincial, territorial departments, First Nation communities, academics, professionals, environmental NGOS and civil society organizations.

2.7 Status of adaptation in the Atlantic Provinces

The discussion surrounding the uncertainty of climate change and the safety of communities initiated the development of provincial climate change action plans. Newfoundland and Labrador was the first province to create this formal document, with a focus on emission mitigation, with minimal discussion surrounding adaptation (Government of Newfoundland & Labrador, 2011). Similar documents where created for each Atlantic Province, each having their own priority items and commitment to Provincial greenhouse gas (GHG) emission regulations.

With the reality of climate change impacts coming to the forefront, the topic shifted toward adaptation and long term preparation. To aid in research regarding risk and vulnerability, the Federal government initiated a Regional Adaptation Collaborative (RAC), putting into practice the importance of regional knowledge exchange that the Provincial action plans highlighted (Government of New Brunswick, 2014). As mentioned previously, this initiative was run in the Atlantic Provinces by a multi-provincial partnership called Atlantic Climate Adaptation Solutions Association (ACASA).

The general scope of coastal climate adaptation research in the Atlantic region has focused on regional and local vulnerability, risk and impact assessments (Savard et al, 2016). Figure 2.3 is a visual representation of climate change work conducted along the East Coast of Canada, located in the Canada's Marine Coasts in a Changing Climate

report, Perspectives on Canada's East Coast chapter (Savard et al, 2016). Partners in New Brunswick, Prince Edward Island, Newfoundland and Labrador, Nova Scotia and Quebec helped populate this East Coast research database. Figure 2.2 does not visually represent all research conducted in the area. However, the figure does provide a spatial represetantion of the type of research being conducted in the Atlantic region, organizing data into categories of community vulnerability assessments, erosion, flooding A (RSLR general extent), flooding B (SLR including storm surge and/or social variables), hydrodynamic models and scenarios, management and restoration, and saltwater intrusion (Savard et al, 2016). Forty percent of the available climate change vulnerability research in Prince Edward Island, Quebec and New Brunswick focused on coastal erosion. Flooding research dominated (60%) the vulnerability literature in Newfoundland. Province-wide erosion assessments, such as Catto (2012) in Newfoundland and Webster (2012) in PEI are not sufficiently characterized in this analysis (Savard et al, 2016). These Province-wide assessments only account for one point on the map, even though the assessment would be working with geospatial data for the entire province and not a small scale project like some studies.

Savard et al. (2016) suggests that it remains a challenge for Atlantic Canadian communities to start planning for adaptation. Research has begun to shift focus from determining impacts and vulnerability to trying to provide best practice guidance to those who wish to adapt to climate change impacts. Studies related to adaptation, reviews of adaptation strategies and the creation of guidance documents for adaptation have expanded in the last decade (American Society of Civil Engineers (ASCE), 2012; Burton, 2002; Preston & Stafford-Smith, 2009; Preston et al, 2009; Rapaport et al, 2012).

Communities rely on provincial governments for leadership and best practices when it comes to managing the coast. Each Atlantic province has its own strategies to aid in local decision making, providing provincial standards (Newfoundland and Labrador, New Brunswick) or placing the responsibility with municipal decision makers (Nova Scotia) or both (Prince Edward Island). Despite these efforts to foster governance, coastal management practices have remained somewhat stagnant in the Atlantic Provinces.

Lack of adaptation planning along the coast can stem from a variety of internal and external pressures, as each community has socioeconomic challenges and priorities to delegate. Although the information available is valuable and useful for coastal stakeholders and decision makers wanting to initiate the adaptation process, there are still gaps that need to be addressed. Stakeholders require guidance in creating long-term climate change adaptation plans and insight in selecting appropriate adaptation option(s) for their specific coastal environment and social capacity in order to avoid maladaptation (Magnan, 2014).

Atlantic Canadian communities have been taking advantage of partnerships, like ACASA, as well as local NGOs and provincial/national academic collaborations. International research networks, such as the Community-University Research Alliance (CURA) (Government of Canada, 2008) and the Partnerships for Canada-Caribbean Community Climate Change Adaptation (ParCA, 2006) involved in multi-year interdisciplinary research and collaborated with local community partners (fishery organizations, NGOS and first nations). The interdisciplinary partnerships helped identify local coastal vulnerability and fostered knowledge sharing by listening to community experiences with coastal climate change adaptation. Although there has been a decrease

in the number of people who rank “not enough information” as a barrier in climate change adaptation (Framework Partners Inc, 2012); there are communities that do not feel equipped to actively participate in discussions around the topic of adaptation (Framework Partners Inc, 2012).

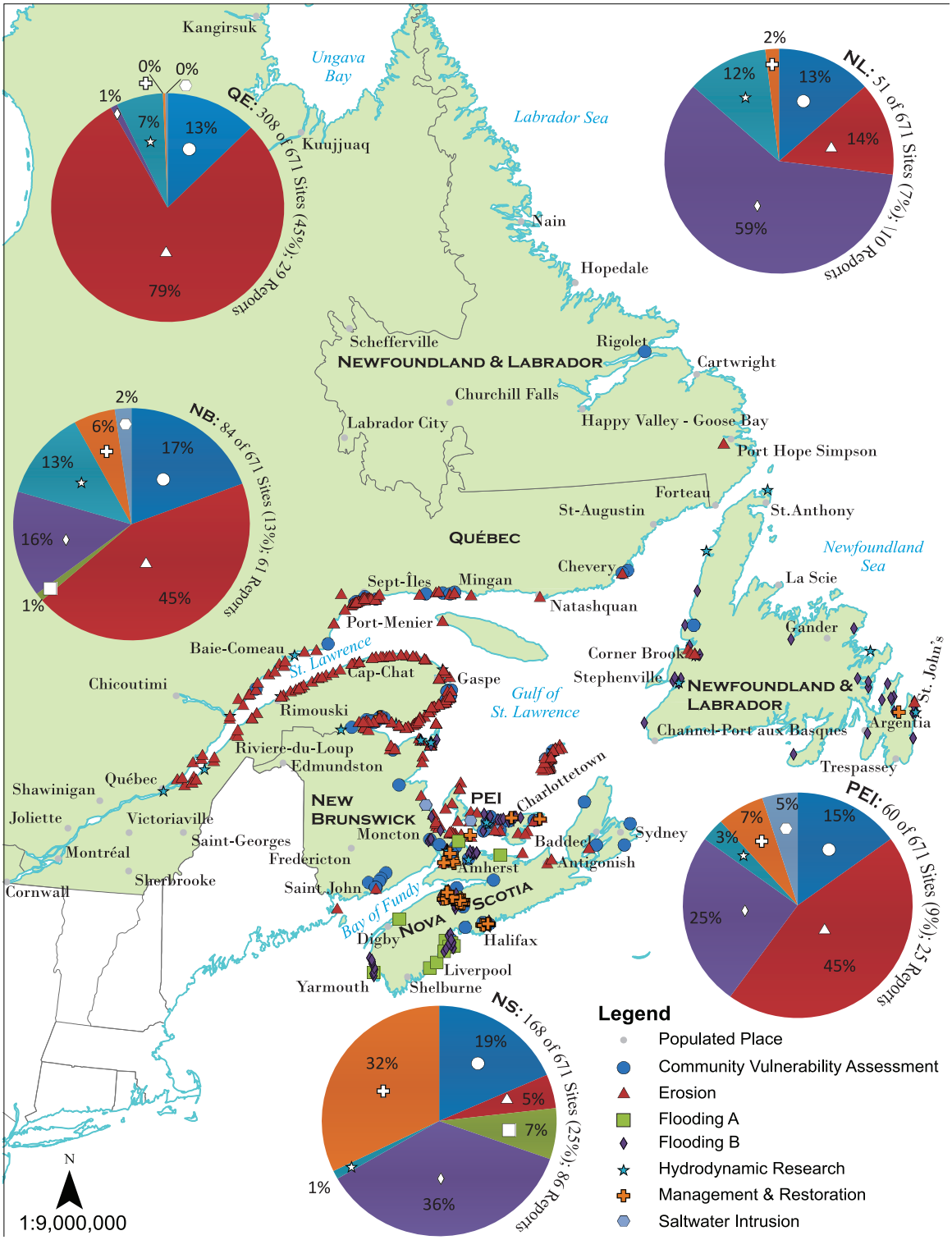


Figure 2.2 Spatial compendium of sites examined through vulnerability studies in the East Coast region created for the Savard et al (2016) Canada's Marine Coasts in a Changing Climate. The inventory was limited to publicly and readily accessible documents is the therefore not exhaustive. Compendium compiled by B. MacIsaac and cartography by B. Perrott (Maritime Provinces Spatial Analysis Research Centre, Saint Mary's University)

Chapter 3

Research methodology

3.1 Overview

The goal of this project was to identify factors that influence Atlantic Canadian coastal decision makers' ability to participate in and adopt climate change adaptation. The research conducted in this report is situated within a broader Atlantic Climate Adaptation Solutions Association (ACASA) Coastal Community Adaptation Toolkit (CCAT) project, funded through Natural Resources Canada (NRCan) "Enhancing Competitiveness in a Change Climate" program. The project intended to facilitate the development and sharing of knowledge, tools and practices that assist decision makers in the analysis and implementation of adaptation measures. The research took place during the first phase of the CCAT project from November 2014 to January 2015. My role in the CCAT project involved research and development of guidance material, creating the framework for the web-based tool and aiding the facilitation of the 8 community workshops.

3.2 Research objectives

The purpose of this research is to:

Determine the factors that influence coastal community decision makers' participation in or adoption of adaptation strategies in the Atlantic Provinces.

Two primary objectives were:

Objective 1: Explore factors that enable or limit decision makers from using adaptation using international, national and regional peer-reviewed and/or grey coastal climate change adaptation literature.

Objective 2: Explore the current constraints and opportunities for coastal community decision makers in the Atlantic Provinces through a survey, eight community workshops and semi-structured interview.

3.3 Data collection procedures

The research used a qualitative, mixed method approach, collecting data through a survey, workshops, and interviews. The research received ethics review and approval through Saint Mary's University. Qualitative Data Analysis software (QDAS) was used to organize this large dataset. Analysis was completed using QSR International Pty Ltd 2014 qualitative software program NVivo 10.2.2. Qualitative data analysis software has the ability to incorporate survey results, workshop and interview transcripts providing an excellent platform to manage and organize data in one convenient location (Denzin & Lincoln, 2011; Welsh, 2002). Software programs increase transparency in content analysis studies, having the ability to record each step the researcher has taken during data analysis (Denzin & Lincoln, 2011; Welsh, 2002).

NVivo has the ability to annotate documents, explore subsets of the data through queries, extract quotes and retrieve text, allowing the user to explore important themes (Denzin & Lincoln, 2011). Once all the data goes through the process of content analysis, the themes (the meaning or the stories in the data) will address the research statement.

The following section provides insight on the literature reviewed and how it helped develop the primary framework (Appendix A) used to analyze the three types of engagement: survey, interviews, and community workshops.

3.3.1 Literature used in the methods

Select Atlantic Canadian climate change adaptation research was reviewed to establish the primary coding framework to analyze the engagement strategy datasets (survey. workshop and interview transcripts). The literature used to create the primary coding framework focused on projects across the Atlantic Provinces, including documents from Municipal Affairs in all four provinces, ACASA, and other organization engagement projects. Documents were included if they provided personal accounts from local decision makers through the use of interview, survey or workshop transcripts, and meeting minutes. Topics and/or themes that made up the primary coding framework were based on frequency and consensus between reports on the strengths, limitations and needs when coastal communities experienced flooding and erosion issues.

A collection of academic publications and grey literature sources were reviewed. Academic literature was collected through a variety of databases; the main sources used were Web of Science, ScienceDirect, JSTOR, SpringerLink and web search engines like Google Scholar as well as climate change databases such as CAKE, (2010) (Climate Adaptation Knowledge Exchange) and CCACoP(2010) (Climate Change Adaptation Community of Practice). Grey literature in this context refers to non-conventional publications that are produced by "all levels of governments, academics, business and industry in electronic and print formats not controlled by commercial publishing i.e. where publishing is not the primary activity of the producing body." (Mackenzie, 1997; Schöpfel & Farace, 2010). The grey literature considered here includes: toolkits, technical reports, working papers, conference proceedings, project documents (community

vulnerability assessments and adaptation plans) created by government agencies, scientific research groups and community organizations. These reports provide important information about current local research and are often more detailed in content than academic journal sources. Provincial partners and ACASA project leads provided access to relevant local reports and surveys that may otherwise have been missed. All literature was chosen based on level of relevance in exploring advantages and limitations towards coastal adaptation in Atlantic Canada using both direct quote and Boolean search (AND/OR) techniques. Using both techniques ensured that the literature search was exhaustive and all relevant documents were obtained (Gravetter and Forzano, 2012). Table 3.1 shows the text search used in obtaining the literature relevant to climate change adaptation strategy selection.

Table 3.1 Key words used during literature search

Adaptation Planning Adaptation Action	Vulnerability Tool	"Impact Assessment" or impact and/or assessment	Coastal Hazards
Adaptation Barriers Adaptation Opportunities	Adaptation Strategies	Stakeholder Engagement	Atlantic Canada Climate Change
Adaptation Tool	Coastal Management	Decision Tools for Adaptation	Coastal Strategies

3.3.2 Engagement strategies

Engaging with decision-makers is an important step in understanding a community's current coastal hazards and how they alleviate impacts. Research shows that engaging with stakeholders (decision makers) is an integral component in increasing success of climate change adaptation planning (Arlington Group, 2013; CBCL Limited, 2009; Linham & Nicholls, 2010; NRCan, 2013 ; NOAA , 2007; Schauffler, 2014). Steady

dialogue between participants and the CCAT team provided an opportunity to gather knowledge (skills, experiences, perspectives); thereby giving a clearer picture of each community's context and their potential assets and limitations.

3.3.2.1 Survey

The online survey allowed the research team to contact the largest possible number of Atlantic Canadian community decision makers and those that help them (municipal staff, members of council, committees and others who might provide professional advice) in the shortest amount of time. Online surveys are efficient, cost effective and can be used to access participants that fit a particular set of characteristics necessary for this project (Babbie & Benaquisto, 2010; Gravetter & Forzano, 2012; Neuman, 2003). The online survey focused on a broad overview of current coastal management planning techniques and how adaptation tools are chosen within a community. A section exploring the survey participant's level of understanding of coastal processes was also incorporated. It was developed through Survey Monkey and included a total of 30 questions (15 pages), which were divided into four subtopics (Table 3.2) a full survey can be found in Appendix B. The survey went through an extensive editing process with ACASA CCAT team members from all four provinces. Question structure included multiple choice, contingency questions (skip logic), Likert scale responses, and open-ended questions.

Having a wide variety of question types can decrease responsive bias (Denzin and Lincoln, 2011; Neuman, 2003) and increase the likelihood that research objectives were mutually exclusive and exhaustive (Babbie and Benaquisto, 2010 ; Neuman, 2003).

Table 3.1 Description of topics in the online survey

Coastal Management Systems
This section focuses on the steps and variables involved in current management strategies and decision making. The main factors that go into adaptation and management planning will be identified, providing a framework for future opportunities
Land Use Planning
This section explores potential land use planning adaptation strategies and tools that are known to decision makers and have been used along the coastal zone of Atlantic Canada
Coastal Structures
This section asks participants about their current knowledge of structural controls along the coastal zone; going through a series of questions about their perceptions of how useful they are.
Coastal Processes
This section is to determine local understanding of coastal processes that take place within the survey participant's area.

Matrix questions were used as an easy way to ask a series of questions with the same response categories (Likert scale) (Neuman, 2003). Visual aids were used for the participant to keep track their progress in the survey. Photos and diagrams were also provided to help the participant answer the questions. The survey took approximately 25-30 minutes, depending on the level of detail provided in the open-ended questions. Due to the wide variety of potential participants (municipal officials and staff, provincial departments, organization leaders, land use planners and engineers), the questions needed to reflect their particular experience. Skip logic was used for survey respondents to only address the questions that pertained to their knowledge. For example, if the respondent did not have any experience with land use planning, the question questions were skipped.

The responses collected provided a better understanding on how current decisions are being made and what motivating factors go into planning for adaptation in a coastal community. Surveys are a good method for research that focuses on self-reported beliefs and behaviours (Neuman, 2003), how decision makers view their community's response to climate change impacts. One of the main themes of this research topic is to better understand current constraints and opportunities within the community. This knowledge helps determine the applicability of strategies and tools found within the literature.

Of the three engagement strategies, the online survey represented the largest population, receiving 52 completed surveys from the 265 sent out (N=52). The survey had a return percentage of 19.6%. This is considered to be a fairly low response rate for an online survey (Moser & Kalton, 2017). From the 52 surveys received back completed, there were 6 people who skipped the majority of the questions. The survey had an 88% completion rate. The survey incorporated input from participants in larger coastal cities, small towns and rural communities. Each of the participants filled out demographic information to provide their occupation and location.

With the help of government and academic partners, the survey was pre-tested before it was sent to municipal officials and their supporting staff, as well as planning agencies (including members of the Atlantic Planners Institute, API) throughout the Atlantic Provinces. A master list of potential participants was created and verified by provincial partners to check for proportional representation between the Atlantic Provinces (Neuman, 2003). The list included municipal officials of coastal communities, planners, academics and organizations with vested interest in coastal management.

3.3.2.2 Community workshops

Eight community workshops took place over the course of several months (November 2014 - February 2015); during Phase 1 of the CCAT project. The communities that participated include (alphabetically): Town of Borden-Carleton (PEI); Town of Souris (PEI); Municipality of the District of Digby (NS); Town of Parrsboro (NS) that is now merged with Cumberland County Municipality; Town of Shelburne (NS); Municipality of the District of Shelburne (NS); Town of Sackville (NB); Town of St. Andrews (NB); and Town of Woody Point (NL). Each community taking part were at different stages in climate change adaptation planning. Not all communities have the same level of experience when it comes to climate change adaptation; it is important to make sure all knowledge levels are accounted for, not just the more advanced communities.

Each community had an official contact with the ACASA CCAT project team, who determined the amount of time (2-8 hours) they would allow for the workshop. Invitations were sent to municipal officials and staff, representatives of environmental or industrial and business groups. The number of participants for each workshop ranged from 6-15 participants. This fits with the main goal of the ACASA project, to engage with community decision makers to understand how they deal with current and future coastal issues in order to incorporate critical needs into the Coastal Community Adaptation Tool (CCAT).

Project partner NEXUS Coastal Management Ltd. team facilitated the workshops with the help of one representative from each of the following ACASA project partners: Saint Mary's University (SMU), Dalhousie University (DAL), University of Prince

Edward Island (UPEI) and a provincial representative of the Atlantic Province the workshop was taking place in. Councils in eight communities agreed to work with the ACASA team to develop and refine the Atlantic Coastal Community Adaptation Toolkit (CCAT). NEXUS Coastal Management Ltd. prepared community profiles that were reviewed by the engagement team before going into the communities in order to have a better understanding of the socio-economic characteristics and previous level of climate change adaptation planning.

Community workshops were set up to allow for open dialogue between the ACASA CCAT project team and the participants as we explore the process of coastal adaptation in their community. Open dialogue is important (Denzin and Lincoln, 2011; Neuman, 2003) as insight on potentially unforeseen interactions or relationships can be brought out in workshops that may not be caught within individual interviews (Babbie and Benaquisto, 2010). The CCAT Phase 1 workshops followed a similar format (Table 3.4), to gain insight on the current decision-making process in the community and setting up the framework for the eventual CCAT tool where the participants provided input to the tools framework. The workshops were integral to developing the Coastal Community Adaptation Toolkit (CCAT). Community workshops took place in two phases: 1) the Development phase; and, 2) the Testing phase. The research in this study comes from Phase 1 of the CCAT.

The first stage (out of three) included a discussion around the communities' current decision-making process when it comes to dealing with current coastal hazards and any long-term planning. Stage two and three of the workshops presented the framework of the CCAT to the communities for their feedback on the content, design and

build of the tool. The CCAT was designed for community decision makers and getting users involvement in the design process is important for usability (Palutikof et al, 2018). Each workshop had a community specific PowerPoint that guided the discussion. This allowed for a steady evolution of the product that was examined with the user in mind (Palutikof et al, 2018).

Table 3.3 The general format of the CCAT community workshops

Workshop Framework	
Overview of Project	A description of the Project, NRCan and the development of RAC and ACASA.
Current Decision Making	A narrative format of what the community does before, during and after a storm event. Questions were asked related to limitations, barriers and opportunities they face when dealing with coastal hazards. • *Who is involved in making decisions to ensure safety before, during and after storm events?* • *What measures are in place?* • *What has the community learned from past event?* • *Where does the community turn to for guidance to make decisions?* • *What additional guidance does the community want?*
Purpose of Climate Change Adaptation Tool (CCAT)	
Community Profile	PowerPoint demonstration of Phase I: Community Profile. Feedback on how the participants view and understand the content (questions, answers selection and visual aids provided). **Example outputs of Community Profile hand outs and participants are asked to provide feedback on their structure.* • *Does the content make sense?* • *What else needs to be included?* • *What would make this tool better?* • *Is the output helpful?*
Environmental Profile	PowerPoint demonstration of Phase II: Environment Profile. Feedback on how the participant views and understands the content (questions, answers selection and visual aids provided). **Example outputs of Environment Profile handed and participants are asked to provide feedback on their structure* • *Does the content make sense?* • *What else needs to be included?* • *What would make this tool better?* • *Is the output helpful?*

Each ACASA team member present took notes during each of the workshops and the notes were collected and compiled into one document. The compiled document was a collection of observations and recommendations brought up by the participants and personal observations by the note taker. The notes were compiled into the NVivo software program and content analyzed based on major themes and topics that came out of the data.

3.3.2.3 Interviews

A master list of potential participants was created and verified by provincial partners based on who the ACASA CCAT provincial partners believed would be an asset and were not included in the survey list. The list of 26 potential participants included municipal officials from coastal communities, and representatives from environmental organizations, such as watershed management groups and coastal coalitions with vested interest in coastal management. Participants were asked to take part in a semi-structured interview conducted via phone during the summer of 2015. The intention was to conduct interviews with representative groups of decision makers and those who support them but in the end this plan did not materialize. Only three participants engaged in the interviewing process. The three participants who completed the interview process provided insight that supported the data compiled from the surveys and workshops and was included in the NVivo content analysis. The interview semi-structure followed a series of prompt questions to keep the conversation on track to explore the participants experience with decision-making along the coast. Questions include how they currently

prioritize and make decision, what influences their decision-making process, what resources they have and what they would like to have access to when making decisions.

3.4 Qualitative Content Analysis

Qualitative content analysis is broadly defined as "any technique for making an inference by objectively and systematically identifying special characteristics of messages" (Holsti, 1968, p.14). It involves creating a coding framework by identifying themes and categories that emerge out of the data (Neuman, 2003). Literature was reviewed using content analysis and deductive logic to explore existing research focused on advantages and limitations in considering adaptation. This review was used to create a basic primary coding framework (Appendix A) and was used to begin analyzing data collected in this study. The primary framework was used to categorize data collected through the survey, workshops and interviews. Primary coding frameworks can provide clear definitions and examples for each category, providing a basic structure to begin categorizing the data collected from the survey, workshops and interviews (Mayring, 2000). An inductive approach took place where themes were condensed and refined to help contextualize and address the research statement. The framework went through on-going revisions during analysis. Transcripts from data collected through the ACASA project, interviews, surveys and meeting records of workshops provided context specific information. Figure 1.1 displays the proceses of Qualitative Content Analysis (QCA) used in this project.

The data were organized using a Qualitative Data Analysis software (QDAS) to ensure all data were organized. Qualitative data analysis software was initially used to

catalogue literature to create the primary coding framework and later used to catalogue data collected through survey, transcripts from workshops and interviews. This provided a platform to manage and organize data and amalgamate the survey, workshop and interview transcripts in one place (Denzin & Lincoln, 2011; Welsh, 2002). Software programs make content analysis studies, like this one, easily portable as well as transparent as these programs have the ability to record each step the researcher has taken during data analysis (Denzin & Lincoln, 2011; Welsh, 2002). Once the data were organized they were used to create Table 4.1 and Figure 4.29, categrizing the main themes that came out of the data and visually representing each themes influence in helping decision makers participate in climate change adaptation planning in their community.

3.5 Limitations

There are a number of limitations associated with the nature of the project: researcher freedom and control, language barriers, subjectivity of analysis, low response rate and analysis. This section discusses how these limitations could arise during data collection and how they were addressed within this thesis.

Due to the collaborative nature of this project, constraints were put on the timing of project outputs. Although involvement through all phases of the project from provincial partners is important and informative, it prolonged the editing phase as well as any output deadlines. For example, the survey was late going live because of the additional edits and input; however, it did create a much better product.

Obtaining accurate and relevant information for this project was subject to several social, financial and time constraints. In order to link this project to Atlantic Canadian coastal communities, participation and interest was necessary. However, there were some individuals within key coastal stakeholder organizations that did not participate due to lack of interest. The timing of the survey, interviews and workshops also poses a constraint, as they took place during a busy time of year for government officials.

This study involved those that help implement and develop key policy and management decisions within the area. These specific requirements are important in developing an adaptation decision framework that is applicable to communities in the Atlantic Provinces, the main goal within the entire project funded by NRCan. The selection process for municipalities attempted to represent as many potential scenarios as possible by including communities representing different geographic locations and demographic profiles. The project aimed to include communities that were representative of the region.

The literature review was as thorough as possible; however, there is a growing database of adaptation strategies and tools available. Some important international documents are written in languages other than English or are not accessible to the researcher.

The researcher's involvement in the eight community workshops was at times both the facilitator and as a participant, leading to subjectivity concerns in analyzing the information. The sessions were not recorded, relying on ACASA team member's notes who may have recorded information selectively and information may also be missing from the discussions. There were minimal verbatim quotes provided in notes from

ACASA team members. In order to address personal impressions, NEXUS provided each community with an engagement summary for the participant to look over to make sure there were no discrepancies between team and participant impressions. Subjectivity is always a concern when conducting qualitative data analysis (Campbell et al, 2013; Creswell, 2009; Gorden, 1992; Holsti, 1968; Hsiesh and Shannon, 2005; Zhang and Wildemuth, 2009).

Low response rates to survey and interview requests were a limitation to this research. Only three people participated in the interview out of the list of 26 that were sent a request, with a response rate of 11.5%. Although this is a low response rate, interview transcripts were included in order to pull out relevant quotes that could support the survey and workshop themes.

The survey had a low response rate for an online survey (Moser & Kalton, 2017) and as such may not be representing the views of Atlantic Canadian decision makers. There was intent to compare results between smaller and lager communities in the results and although there was a distribution of responses across different communities there were not enough responses in any of the communities to allow for comparison between the smaller and the larger communities.

There were limitations in how the data was treated in this research as the data wasn't organized for the fullest interpretation. The primary framework created was very broad and could have been more specific within each primary category. If the data is to be used in the future, excluding the interviews could allow for a better comparison, looking at trends and specific similarities and differences in order to get a full triangular analysis.

Chapter 4

Results

4.1 Survey results

An online survey (Survey Monkey) was sent out on September 2, 2014 to 265 potential participants (decision-makers and others that are a part of the decision-making process) in the four Atlantic Provinces. The survey was closed October 10th with Fifty-two (52) responses collected out of 265 sent out, for a 19.6% response rate. Participants were able to skip questions if they wished to, with some questions having skip logic attached to them, and were only presented questions based on each respondent's previous answer. Those questions were only relevant to those respondents who had experience in the topic related to that section. Not all respondents answered every question, some due to the surveys skip logic but others who had experience chose not to address it. Although each question was reviewed by the CCAT team, the question may still have been unclear for survey respondents.

4.1.1 Involvement

Questions in this section are related to a participant's involvement in and experience with climate change adaptation planning. Figure 4.1 shows the distribution of participants in the four Atlantic Provinces. Provincial CCAT team leads requested that the participants from the Bay of Fundy be separated from the rest of the coast for New Brunswick and Nova Scotia participation results, as the Bay of Fundy is a geographically distinct coastal area (Figure 4.1). In order to keep track of who contributed to the survey, we asked participants to provide the approximate population size of the community they

were representing. Figure 4.2 shows the distribution of community population, based on the information about communities provided by the participants.

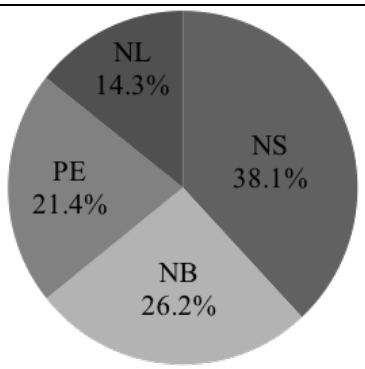
Location of Participants	Coastal region	Response Percent
	Newfoundland & Labrador	14.3%
	Nova Scotia (*Atlantic coast, Northumberland Strait and Gulf of St. Lawrence*)	21.4%
	Nova Scotia (*Bay of Fundy*)	16.7%
	Prince Edward Island	21.4%
	New Brunswick (*Gulf of St. Lawrence*)	7.1%
	New Brunswick (*Bay of Fundy*)	19.1%

Figure 4.1 Location of survey participants (42 of 52)

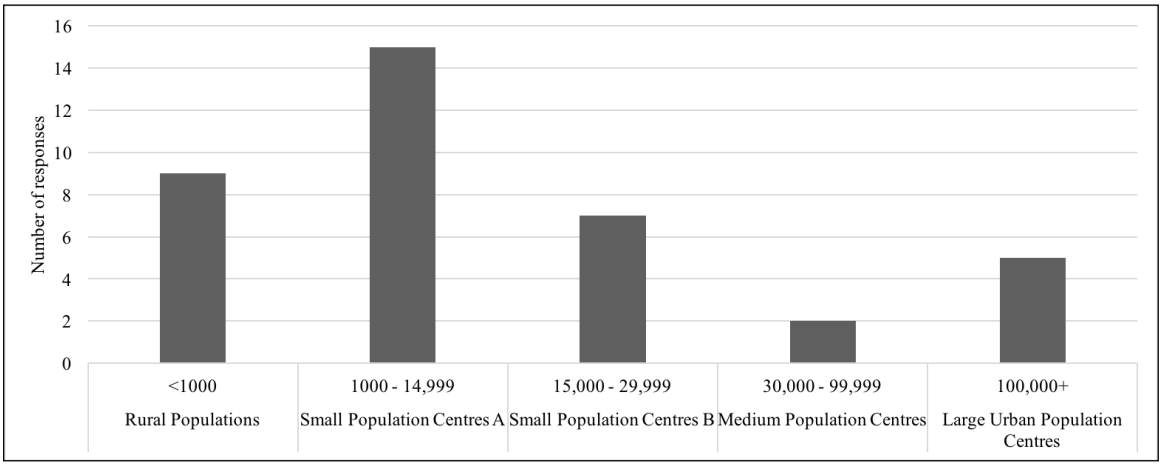


Figure 4.2 Community population sizes represented in the survey (38 out of 52 responded)

The division of population sizes in Figure 4.2 is based on Statistics Canada's population centre information, in order to give a clearer division of the community capacity each respondent is representing. Dividing the information further based on the Province the survey respondent was from would give a better sense of how the municipality is organized. Figure 4.2 shows there is a diverse range of responses based on population size. Twenty-four out of the thirty-eight who participated in this question

stated they represented communities and population centres under 15,000 people. Four of the participants that noted they are representing large urban population centre said they work for the provincial government, and not at a community level.

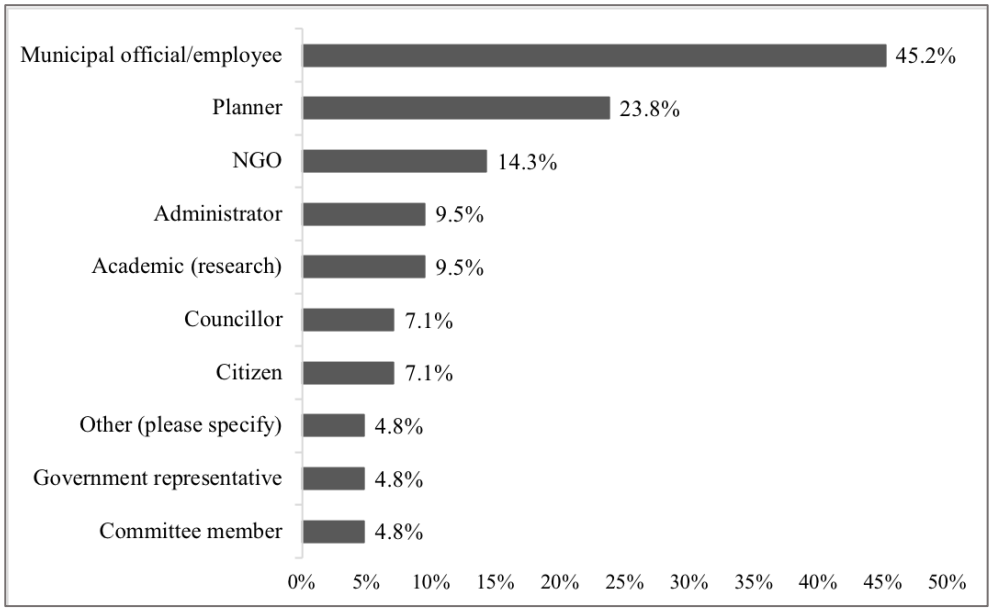


Figure 4.3 Participant role within community or organization they are representing (42 of 52)

When participants were asked about their role within the community (Figure 4.3), 83.3% of those who responded said they were involved in municipal decision-making; either a municipal official, staff, planner, administrator, councillor, mayor, or government representative. Respondents were allowed to select multiple answers,

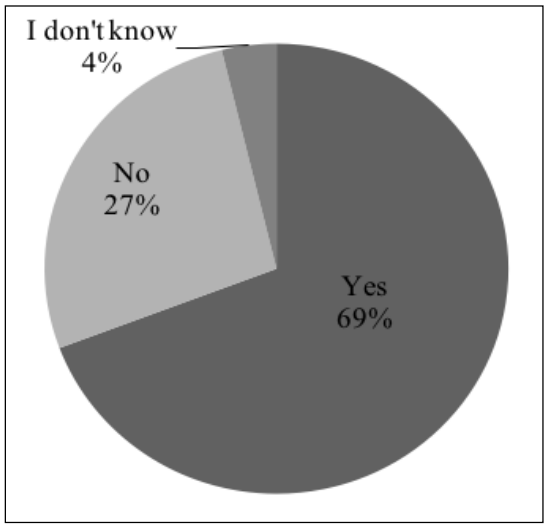


Figure 4.4 Experience with adaptation planning in community or organization (n=52)

or all that applied, which is reason behind the 130.7% total. Answering all that apply was only used in select question.

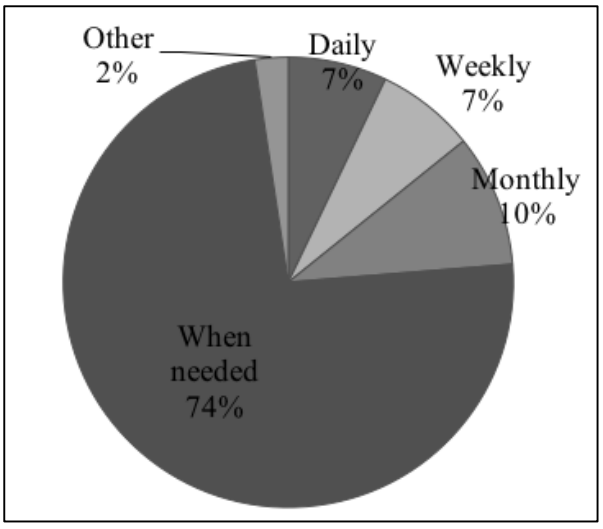


Figure 4.5 Level of involvement in decision making related to coastal planning and management (42 of 52)

When asked about experience with climate change adaptation planning in their community or organization, 69% said they have experience (see in Figure 4.4), 27%

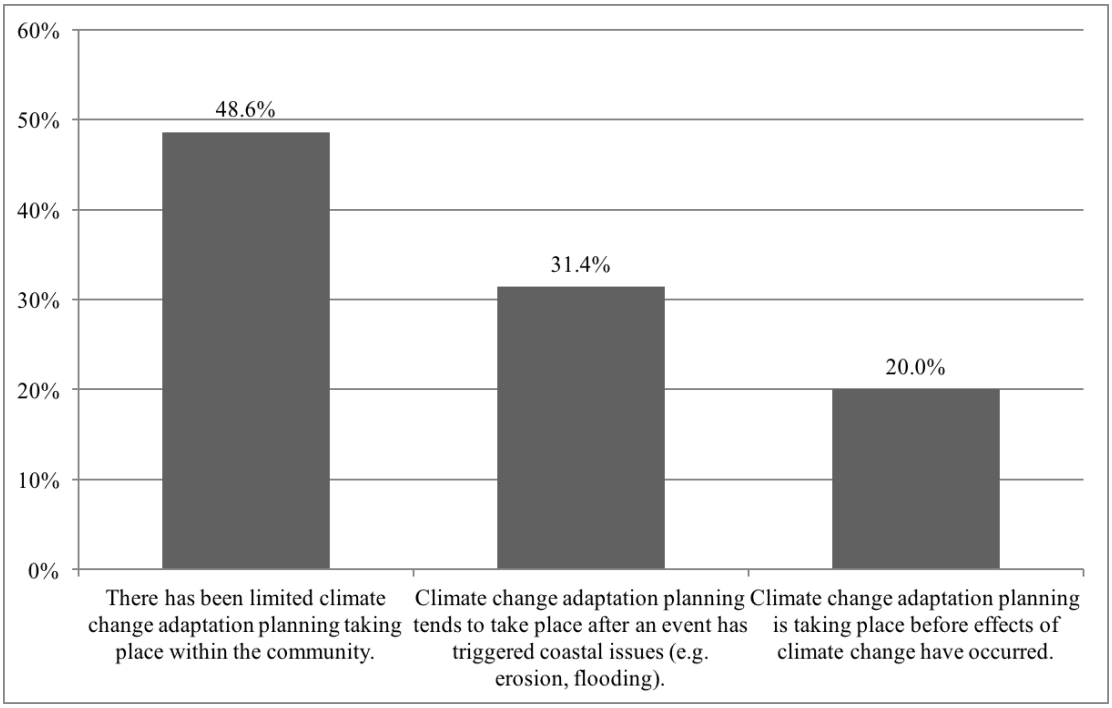


Figure 4.6 Status of climate change adaptation planning in the community or organization (35 of 52)

said they do not have experience and 4% were unsure. When asked how often the participant is involved in decisions related to coastal planning and management, 74% stated they participate when adaptation is necessary (see Figure 4.5).

Participants were asked to characterize the status of climate change adaptation planning in their community or organizations at the present time of the survey (2014). Out of those responses, 48.6% believe there has been limited climate change adaptation planning taking place within their community. 20% of respondents indicated that climate change adaptation planning is taking place proactively, before effects of climate change have occurred within their community. 31.4% said that adaptation planning is triggered by an event. There were two other options, 'climate change planning has not taken place'

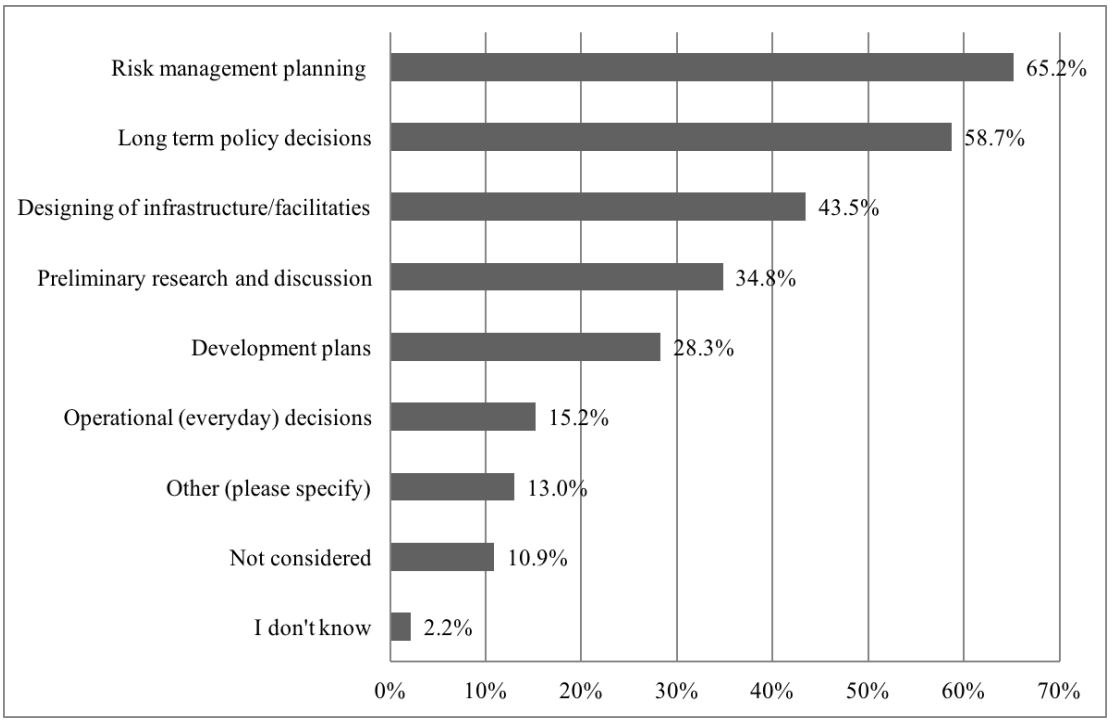


Figure 4.7 Ways climate change is considered in decision making (46 of 52)

and 'I don't know' that no participant chose and therefore were not included in Figure 4.6.

When participants were asked the question, in which of the following ways do you consider climate change in planning and decision making, planning around risk management was the most selected answer at 65.2% (Figure 4.7). Some participants took

the opportunity to provide specific responses. There was awareness that it is important to get decision makers to the point where they are using climate change adaptation planning in their everyday operations, but there has been a lack of effort to do so and/or the feeling that provincial standards should be set before they move forward at a municipal level. Other participants' stated that they are not participating currently, but there are plans for the council or organization to "*start to look more closely at it"* (Participant A, Development and Guidance to Support Decision Making Survey, Oct 10, 2014).

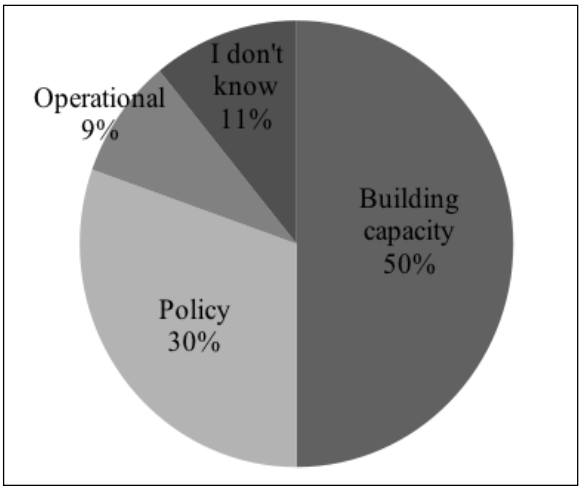


Figure 4.8 Most effective form of adaptation (46 of 52)

Participants were asked to choose which type of adaptation they believe to be the most effective for their current situation. Participants could choose from operational, policy or building capacity. Fifty percent of respondents believe that capacity building was the most effective form of adaptation. Six respondents stated that they did not wish to answer the questions, stating that they do not wish to compartmentalize the forms of adaptation. They believe each of the three choices are equally important. Results can be found in Figure 4.8.

4.2 Knowledge & experience

Questions in this section are related to participants' experience with coastal issues and knowledge related to climate change adaptation strategies, divided into land use

planning or engineered options. Participants without experience in either adaptation approach skipped this question. Participants were asked if their community or organization faced any coastal issues such as erosion, flooding, sea level rise and storm surge that may be related to the impacts of climate change. A high majority (96%) stated their community does face coastal issues related to climate change (Figure 4.9). When asked if they are aware of any work being completed in their community or organization to address these issues, 81.9% answered yes (Figure 4.10).

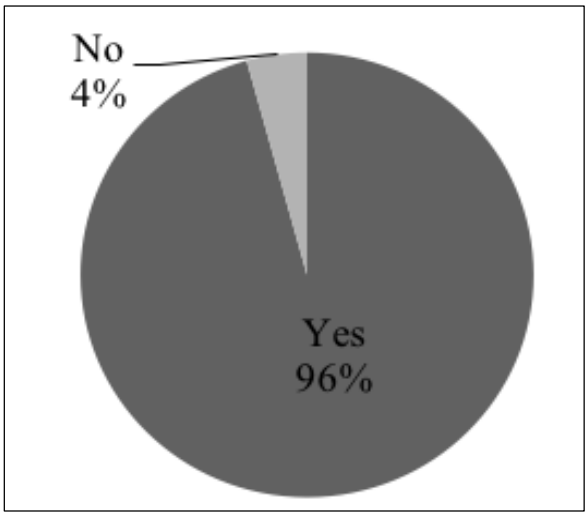


Figure 4.9 Awareness of coastal issues in the community (46 of 52)

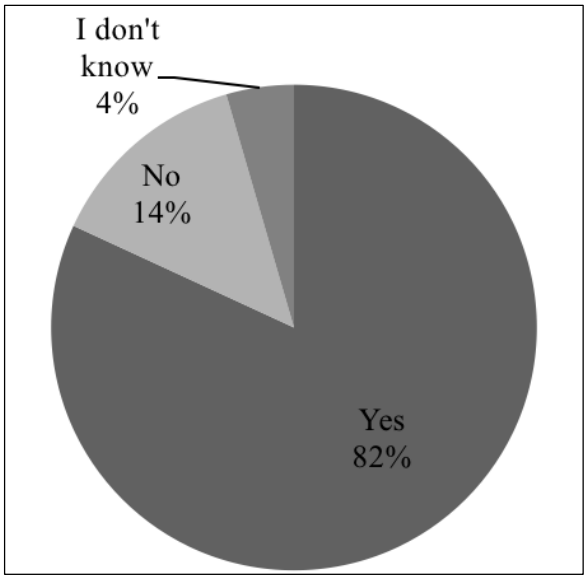


Figure 4.10 Awareness of work done concerning coastal issues (44 of 52)

Participants rated the usefulness of climate change adaptation strategies from a compiled list (Figure 4.11). Emergency response planning and risk and vulnerability assessments were rated 'very useful' by most respondents. Land use planning education and risk and vulnerability assessments were considered 'somewhat' useful by most respondents.

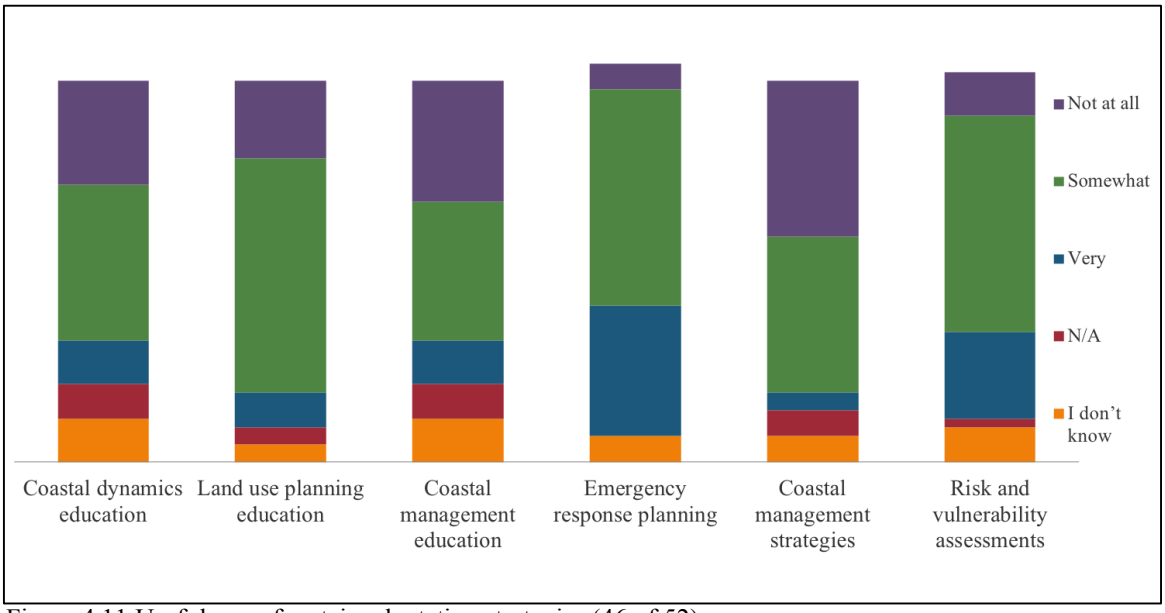


Figure 4.11 Usefulness of certain adaptation strategies (46 of 52)

Before participants were asked questions related to coastal processes, they were asked about their knowledge on the subject of erosion, deposition, wave energy, wind waves, sediment supply and transport (Figure 4.12). Most respondents felt they had 'moderate knowledge' of erosion, more than any of the other coastal processes.

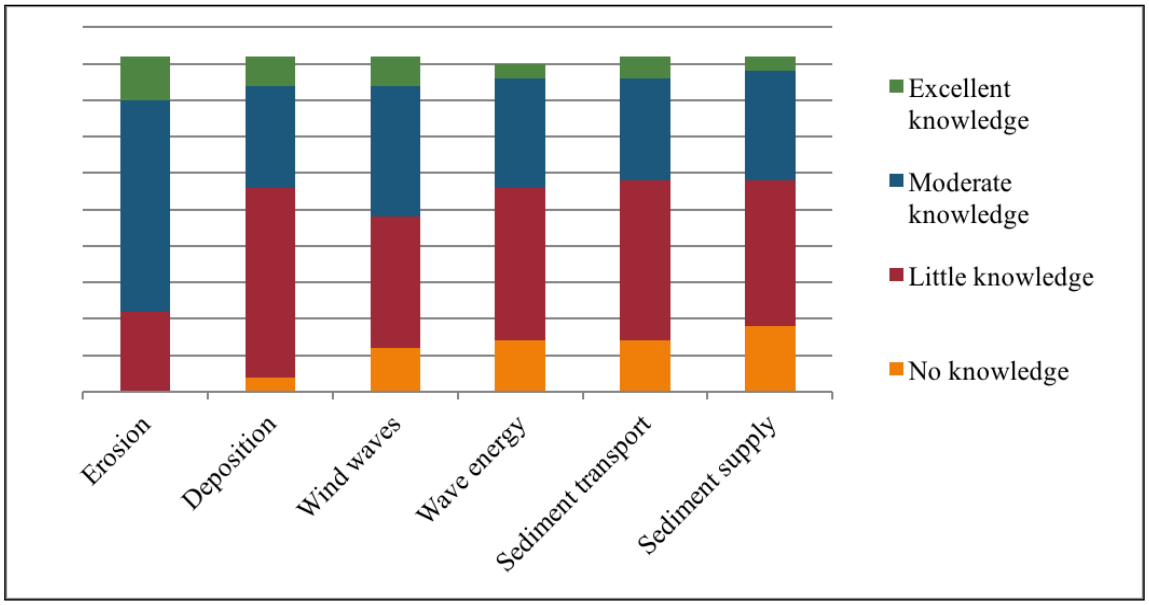


Figure 4.12 Level of knowledge in regard to coastal processes (46 of 52)

Compared to the other coastal processes, more participants felt like they had little knowledge of deposition, followed by sediment transport, wave energy, sediment supply and wind waves. The knowledge of such information may be related to the respondents' familiarity with coastal processes as decision makers in coastal communities.

Figure 4.13 displays the dominant coastal setting the respondent is located in or answering from experience with. The most dominant coastal settings chosen by participants were: sandy coastal systems (21.4%), cliff/rock (16.7%), and saltmarsh or coastal wetlands (14.3%). There were those who specified their answer (21.4%), stating they represent "*diverse, mixed or varied*" coastal environments or are answering from a provincial perspective.

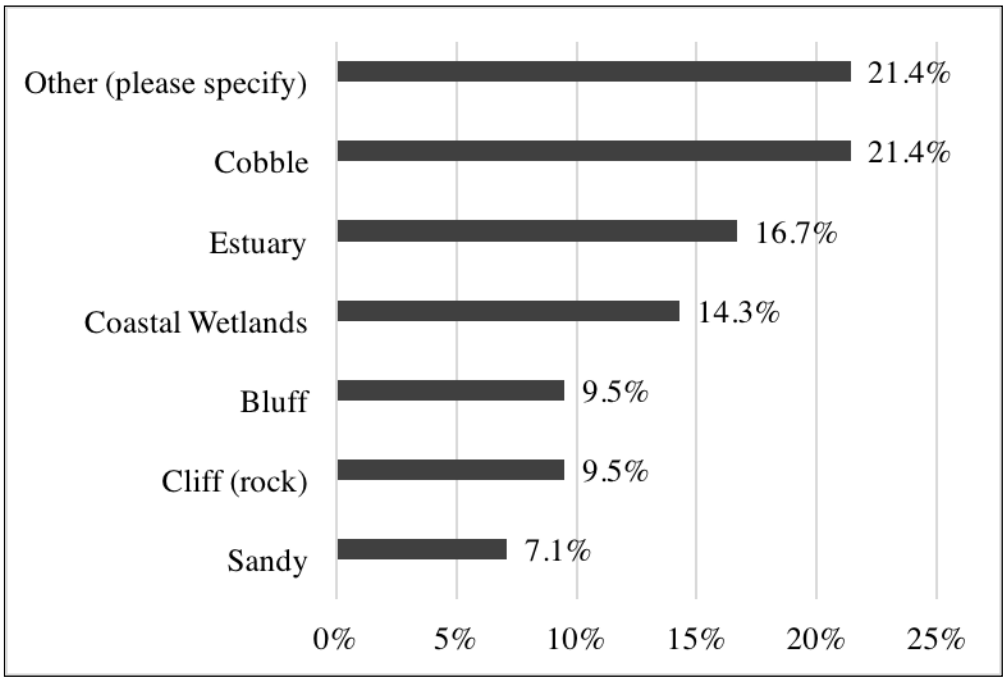


Figure 4.13 Dominant coastal setting of area representing (42 of 52)

The next series of questions asked about specific land use planning knowledge and experience. In order to answer the following questions, participants were asked if

they have any experience with land use planning (Figure 4.14). If participants answered 'no', they automatically skipped the following two questions, as they would be unable to answer the next set of questions. 83% of participants claimed they do have experience with land use planning.

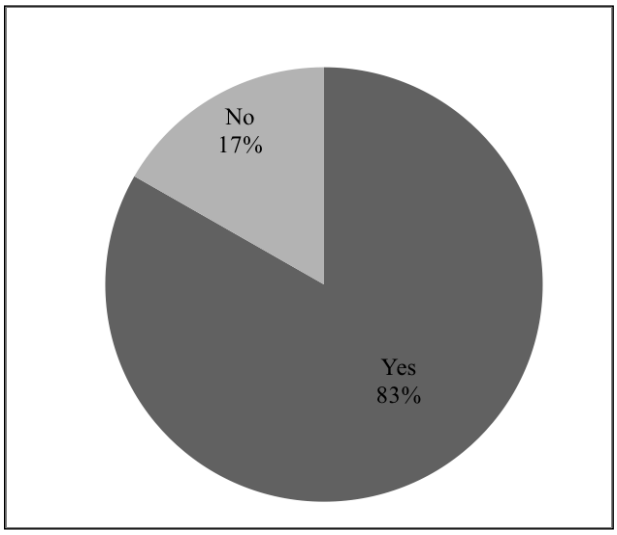


Figure 4.14 Experience with land use planning (n=52)

If they answered 'yes', participants were then asked what type of land use planning strategies have been adopted by the community they were representing. Distribution of responses are in Figure 4.15. Those that selected 'other' responded they participate on an assistants basis (Provincial, organization that helps multiple communities), providing support to more than one municipality that use different types of land use planning tools.

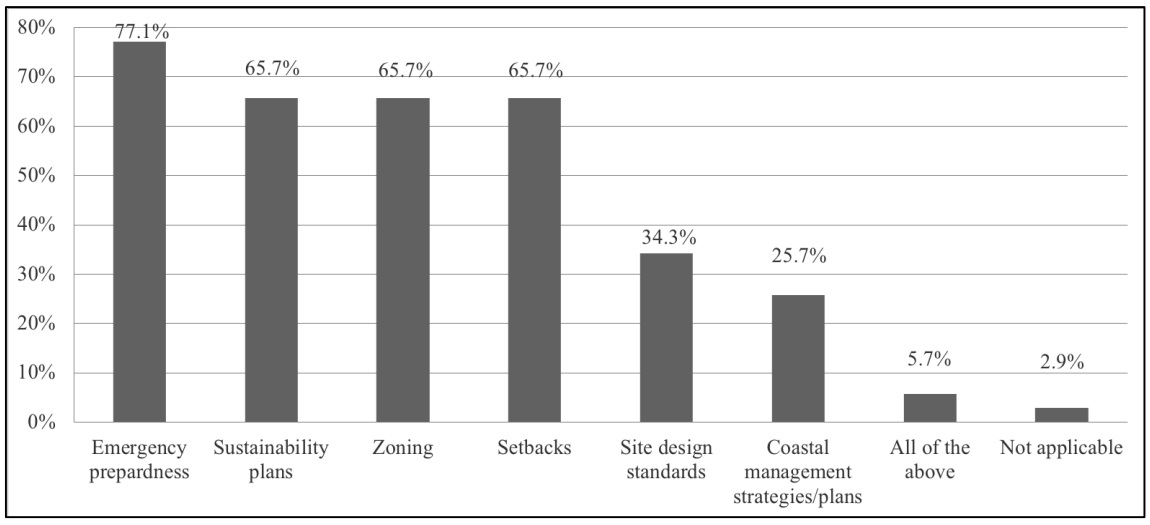


Figure 4.15 Adopted land use planning tools in the communities being represented (42 of 52) – 10 answered no to having experience with land use planning (From Figure 4.14)

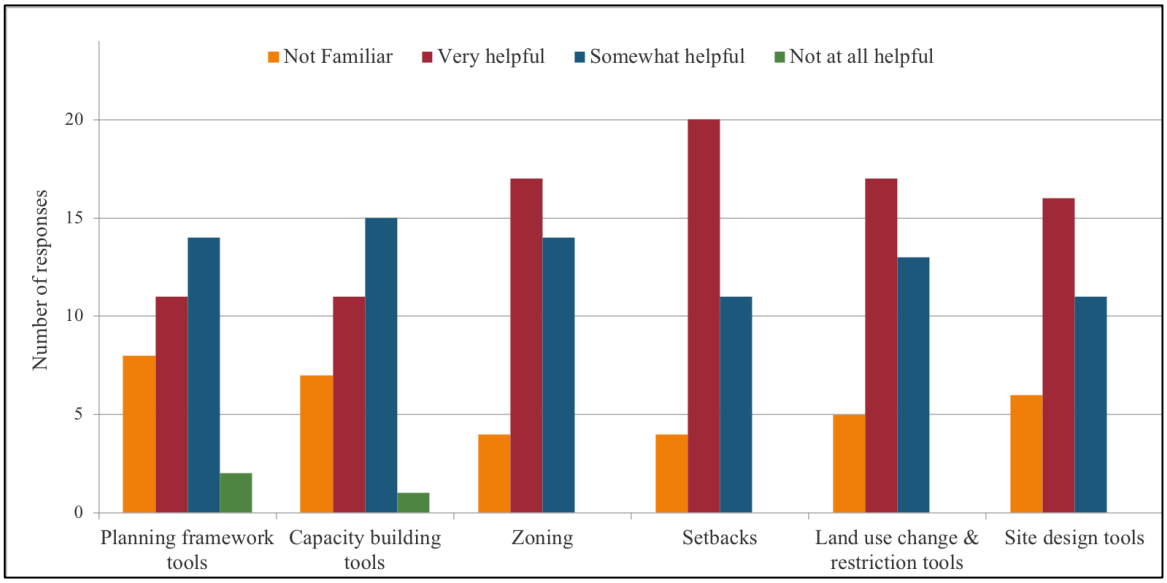


Figure 4.16 Helpfulness of land use planning tools relating to the prevention of coastal vulnerabilities (42of 52)

Most participants of the survey believe their communities have adopted emergency preparedness (77.1%), sustainability plans (65.7%), zoning (65.7%), setbacks of building structures close to watercourses (65.7%) and site design standards (34.3%) and coastal management plans (25.7%). 5.7% stated all of the above were adopted by the community they are representing. Some of these tools are not specifically land use planning (emergency preparedness and site design standards) but may have some elements of land use planning incorporated into them for development.

Participants were asked for their opinion on how helpful each of the following land use planning tools were at preventing coastal vulnerabilities that result from erosion, flooding, storm surge, etc. The land use planning tools were: planning frameworks and strategic plans, capacity building tools, statutes and regulatory tools in the form of zoning, statutes and regulatory tools in the form of setbacks, land use change and restriction and site design tools. Figure 4.16 shows that statutes and regulatory tools in the form of

setbacks are considered very helpful by participants for preventing coastal vulnerabilities that occur from erosion, flooding etc. Statutes and regulatory tools in the form of zoning and restrictions tools also were considered to be very helpful according to respondents while capacity building tools had the lowest rating. Respondents were less familiar with strategic plans and capacity building tools compared to the other land use planning tools.

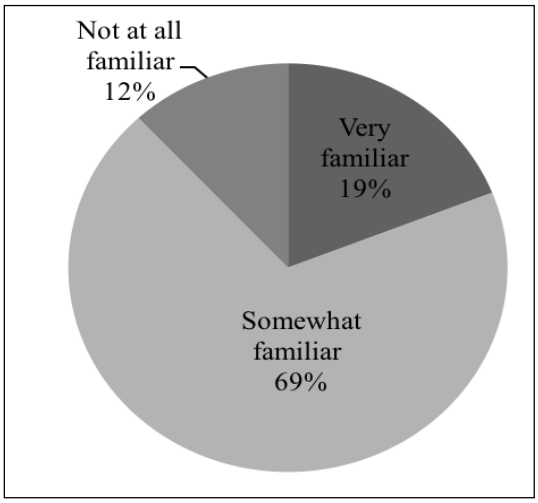


Figure 4.17 Participants familiarity with coastal protection structures (42 of 52)

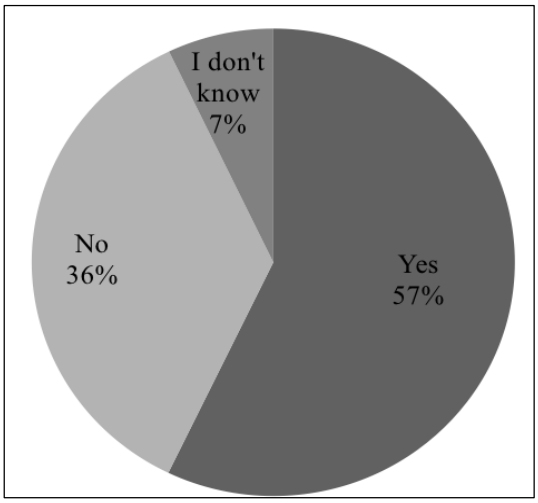


Figure 4.18 Awareness of coastal structures implemented to protect along the coast (42 of 52)

The next seven questions where concerned with the knowledge and experience participants had with coastal structures that protect coastal infrastructure from issues related to flooding and erosion. In order for participants to answer questions related to coastal structures, they were first asked if they were familiar with them. Participants who answered, 'somewhat familiar' (69%) and 'very familiar' (19%) were able to move on to the rest of the questions related to coastal structures (Figure 4.17).

Participants were asked if their community has implemented any coastal protection structures. Figure 4.18 shows that 57% of the participants believed the community they were representing has implemented coastal protection structures, 36% do

not believe their community has implemented any coastal protection structures, and 7% did not know or were unaware of any coastal protection structures in their community.

Respondents were asked to provide information on the function coastal structures perform in the community they represent. Results displayed in Figure 4.19 show that 35.7% of participants believe the coastal control structure is there to protect the

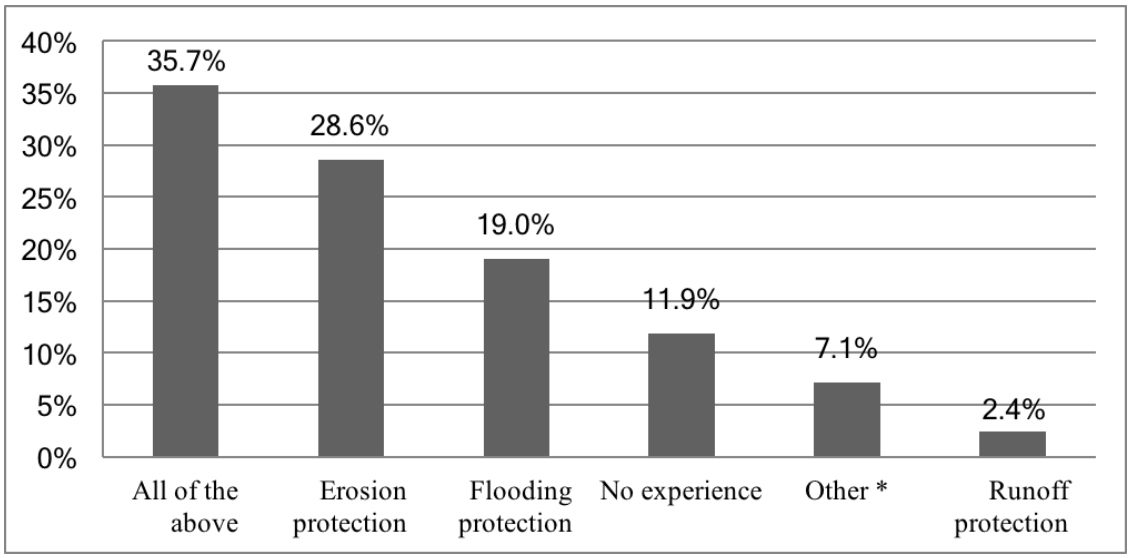


Figure 4.19 Function of coastal protection structures in participant's community (% of respondents)

community from all coastal hazards, including erosion and flooding, both inland and coastal. One of the responses was a concern for a community's road infrastructure that is in a highly vulnerable area. Another response was concerned about the dykes in the community, a concern for many communities along the Bay of Fundy. One respondent was worried about protective structures in their community and the environmental damage they can cause if not installed properly.

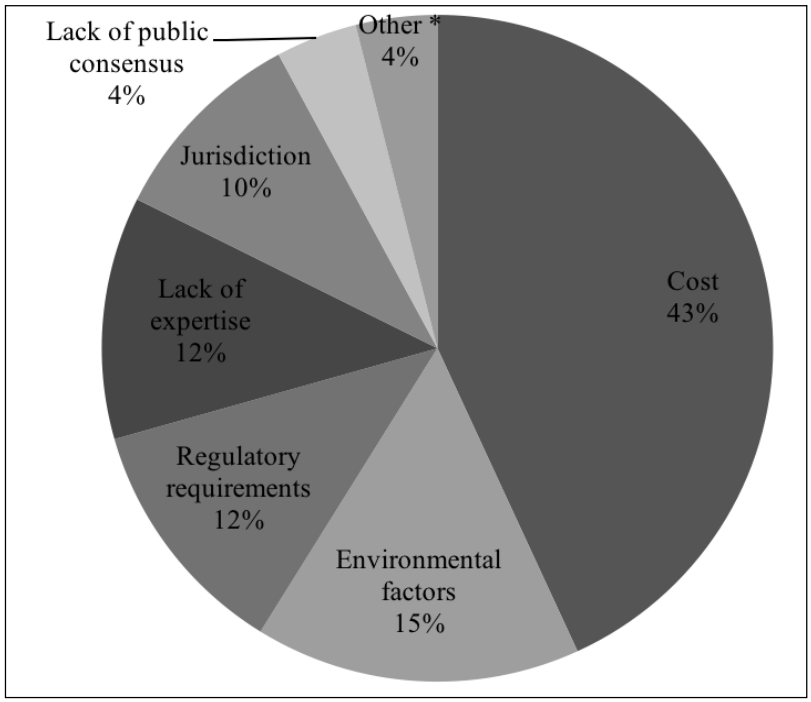


Figure 4.20 Primary constraints impacting the installation of coastal structures (23 of 52)

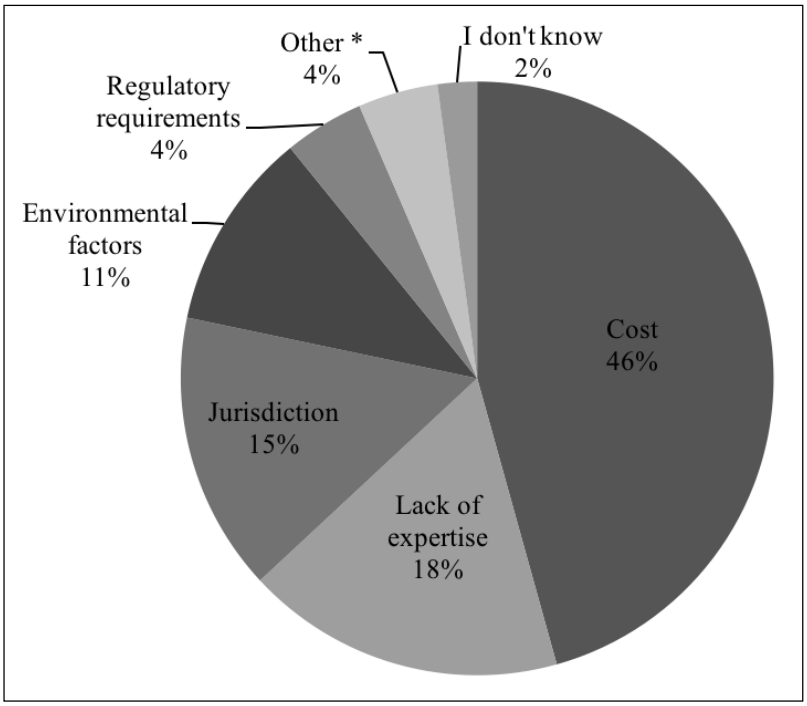


Figure 4.21 Primary constraints impacting the maintenance of coastal structures (23 of 52)

The next two figures are related to the questions asked to respondents on what they believed were the constraints impacting the installation and maintenance of coastal structures. Figure 4.20 displays the responses for constraints impacting installation of coastal protective structures and Figure 4.21 shows maintenance constraints. Figure 4.20 shows 'cost' as the biggest constraint for the installation of coastal structures within a community. Environmental factors include the coastal setting, geology, geomorphology and land use along the coast were considered the second highest constraint in installation of coastal structures. The applicability of a particular coastal adaptation structure being installed along the coast depends on the environment it is based in. There was an option for respondents to elaborate on their response. One respondent stated, *"poor design and lack of political will"* (Participant B, Development and Guidance to Support Decision Making Survey, Oct 10,2014) were a constraint in the installation of coastal structures. Another respondent stated, "*lack of Federal government acknowledgement that climate change is a world phenomenon that needs to be addressed*" (Participant C, Development and Guidance to Support Decision Making Survey, Oct 10, 2014).

Participants were asked about primary constraints impacting the maintenance of coastal structures (see Figure 4.21). 'Cost' was still considered the biggest constraint for maintaining the coastal structures by 46% of respondents. 'Lack of expertise' came in as the second biggest constraint (18%). The personal responses were similar to the ones provided for the installation question, a call for Federal government investment and lack of political will and poor design.

The following two questions asked respondents to choose the top 3 structures they believe are the best for dealing with erosion (Figure 4.22) and flooding (Figure 4.23) in

their community. Although this question is subjective and depends on the participant's geographical location and personal experience, the team wanted to get a sense of what coastal structures are considered the most helpful, even if they may not be the best fit for their particular coastline.

The next two Figures (4.22 and 4.23) are related to respondents' choice of adaptation structures for erosion (Figure 4.22) and flooding (Figure 4.23). Figure 4.22 shows the top structures respondents chose to help with erosion (in order): plant stabilization, armouring and breakwater and retaining wall. Beach nourishment was considered by the least helpful by participants. Figure 4.23 shows the top results for flooding (in order): living shoreline, dykes, and detainment ponds. Bluff drains and dredging were not believed to be very helpful for flooding.

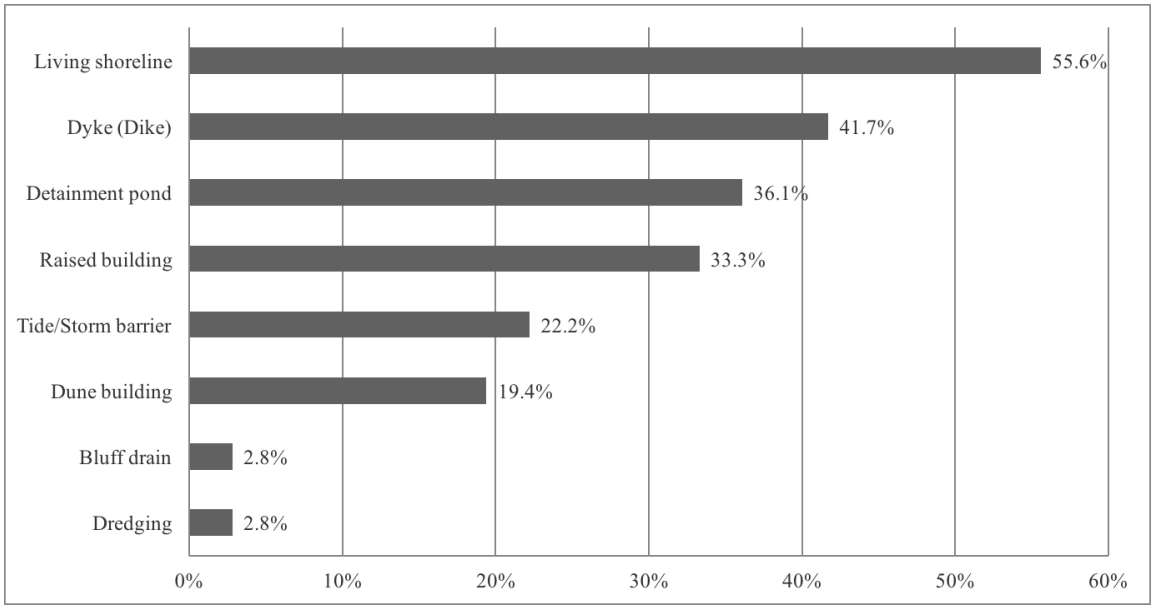


Figure 4.22 Top structures for helping with coastal erosion from respondents (36 of 52)

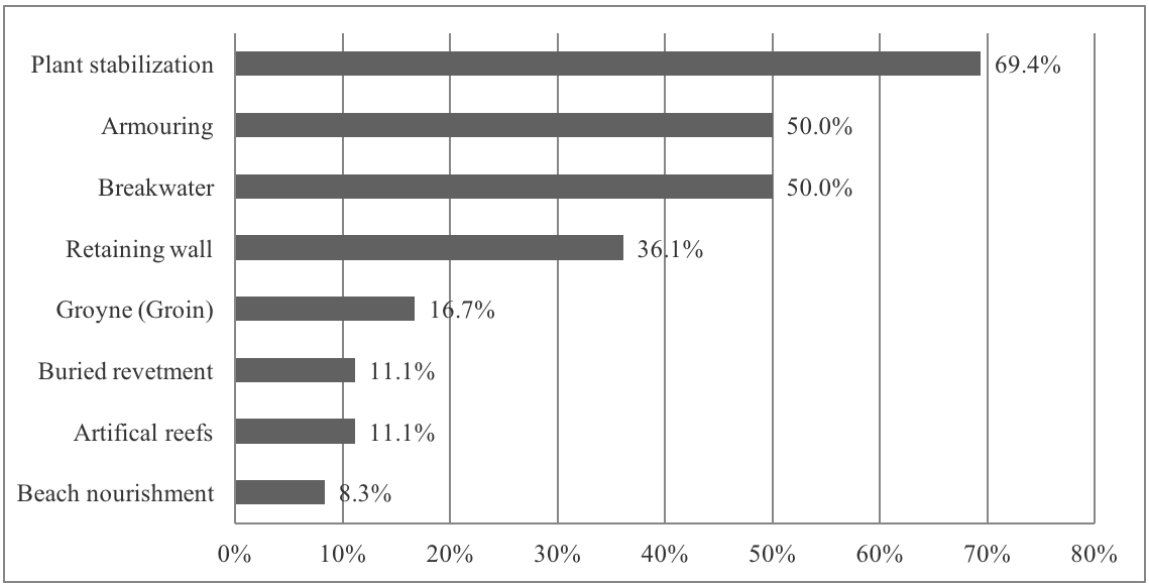


Figure 4.23 Top structures to help with flooding from respondents (coastal/inland) (36 of 52)

The final question asked respondents what they believed was the greatest constraint in implementing climate change adaptation in the community they were representing (Figure 4.24). Lack of funding was considered the greatest constraint in implementing climate change adaptation (44.4%). Personal responses include, "*lack of political will"* (Participant D, Development and Guidance to Support Decision Making Survey, Oct 10, 2014); "*lack of clear direction and sense of priority from the Government*

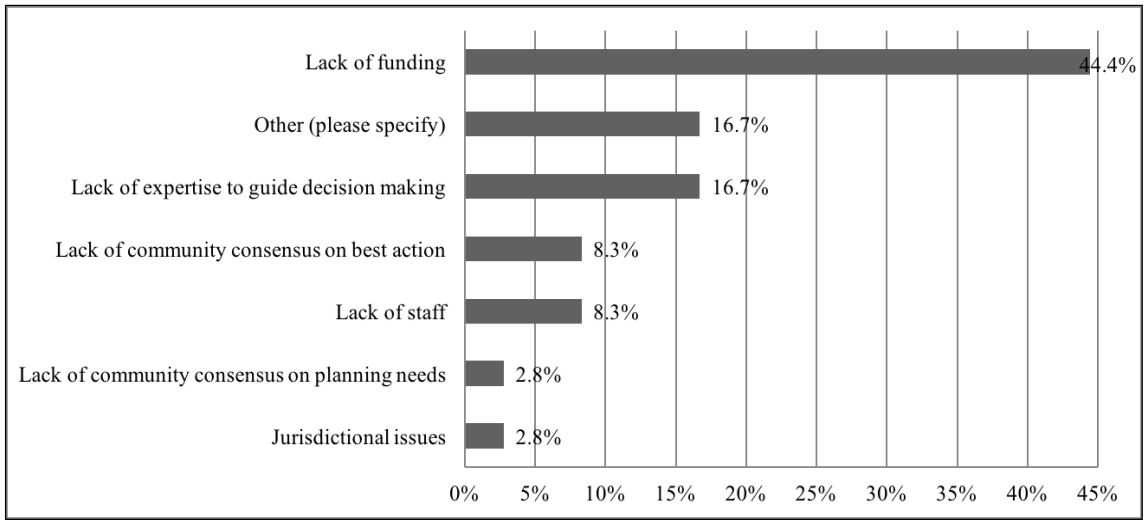


Figure 4.24 Greatest constraint for implementing climate change adaptation planning (36 of 52)

of Canada" (Participant E, Development and Guidance to Support Decision Making Survey, Oct 10, 2014) and "*lack of land use planning frameworks"* (Participant F, Development and Guidance to Support Decision Making Survey, Oct 10,2014). Other respondent believed that it is a combination of all the above constraints and another respondent believe that *"locally it's left to volunteers"* (Participant G, Development and Guidance to Support Decision Making Survey, Oct 10,2014) to try to get action within the community.

4.2.1 Guidance & resources

The following survey results relate to questions asked about guidance currently used and resources that are currently available to respondents. Respondents were also asked if there were any resources they wish they had more access to but currently do not. Participants were first asked where they would turn to seek funding for climate change

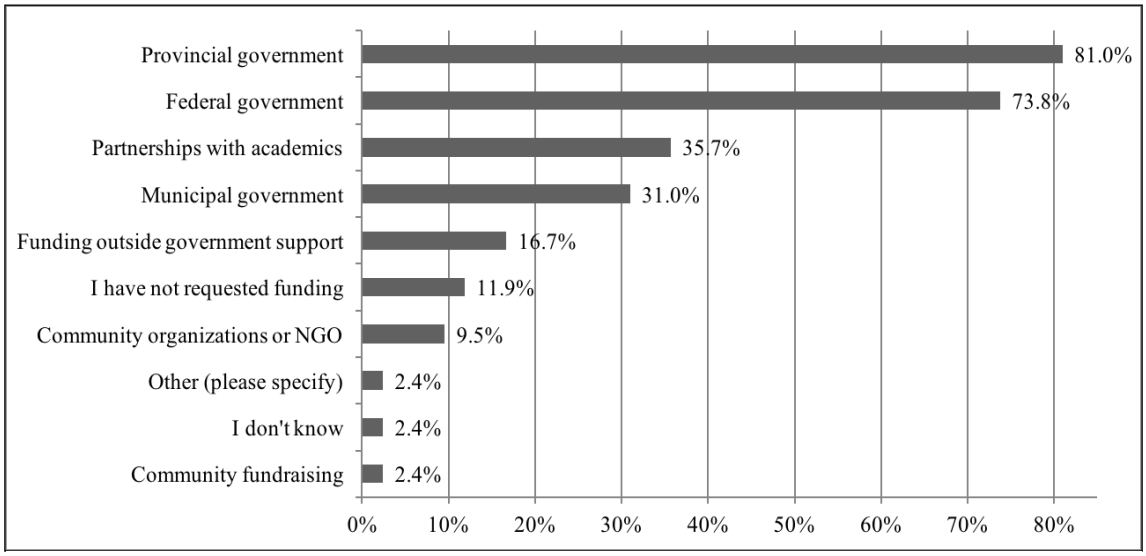


Figure 4. 25 Sources of funding (42 of 52)

impacts in their community. They could choose more than one answer. Figure 4.25 shows that the Provincial government is the most likely source they would turn for funding

(81%) followed by the Federal government (73.8%). Community fundraising was the least likely source. Some respondents (2.4%) responded to 'Other' with specific organizations they have pursued for funding and guidance on where to look for funding.

Participants were asked to rate the helpfulness of the resource they have sought in the past, Figure 4.26. The top three resources, considered to be very helpful were college and university research, professionals and local knowledge. Provincial services, NGOs, websites, peer networks and municipal services followed. Newspapers, radio/television and Federal services were considered 'not at all helpful'. Some participants chose 'Not applicable or N/A', which may mean they may not have experience using that resource. A number of participants took the opportunity to write a personal response about local experiences of resources they have turned to for guidance in the past.

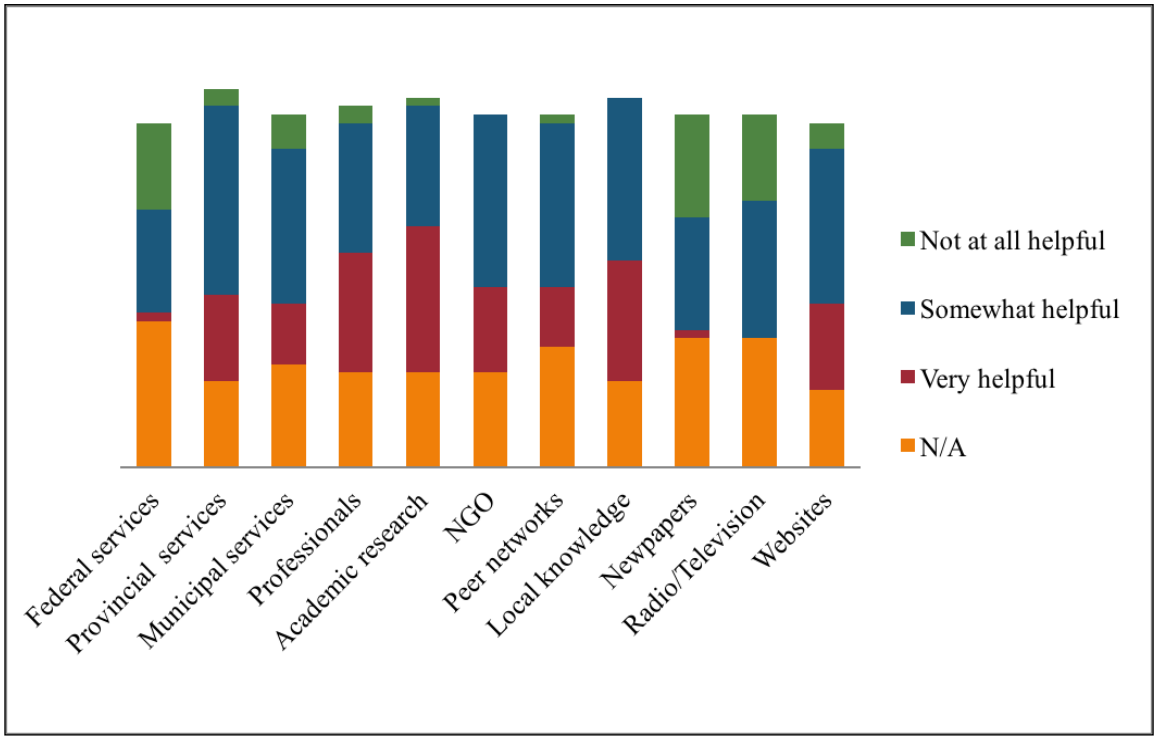


Figure 4.26 Rate of usefulness of the guidance received (if applicable) (45 of 52)

The next figures show the rankings to questions asked about usefulness of resources in helping respondents decide if adaptation is required (Figure 4.27) and helping choose an adaptation option (Figure 4.28). Results are dependent on each respondent's experience with each type of resource. When deciding if adaptation is required, the most useful resource, according to the highest number of respondents is accessible and detailed research information. Seven (7) participants (16.6% of

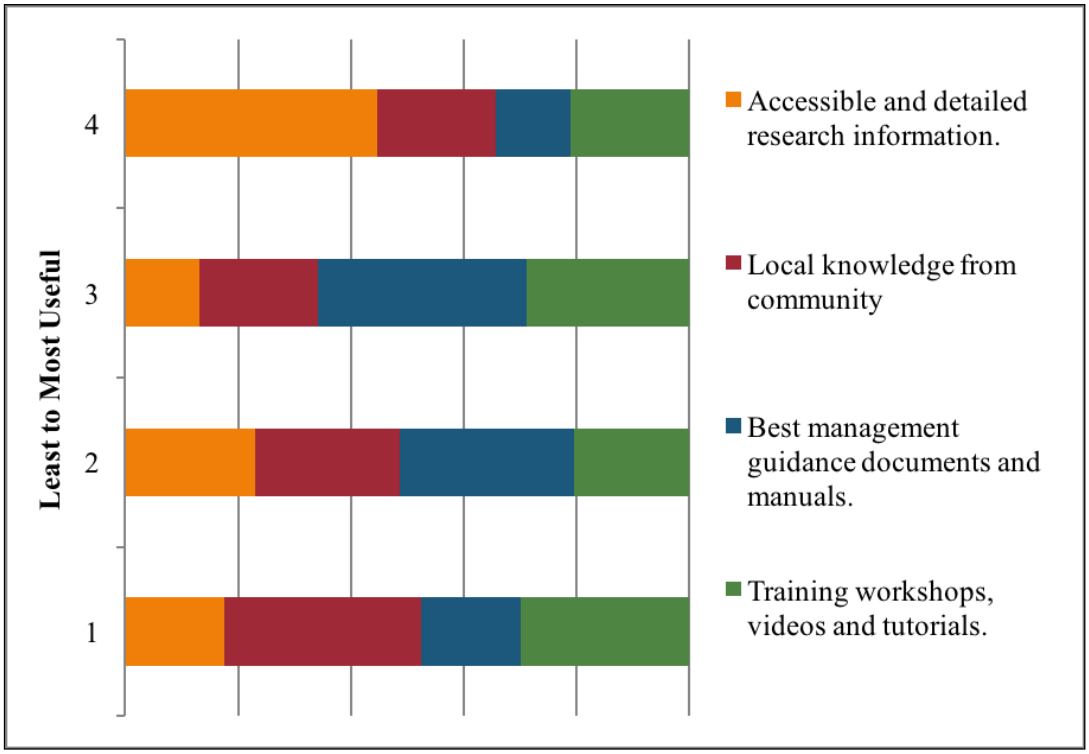


Figure 4.27 Ranking the usefulness of resources in helping decide if adaptation is required. Least (1) to Most (4) Useful (42 of 52)

respondents) ranked this same resource as being the least useful. Most of the resources were considered somewhat useful (between 2-3 rating); with guidance documents and manuals being ranked 2 and 3 the most by participants. Overall, the resource that was considered the least useful by the most number of participants in helping to decide if adaptation was required was local knowledge from the community.

Figure 4.28 shows the results for ranking the usefulness of resources in helping choose adaptation options. Opinions on what will help decision makers choose an adaptation option vary greatly in Figure 4.27. According to participants' experience, the most useful is accessible and detailed research information. Local knowledge from community members is considered the least useful when determining what adaptation options to choose.

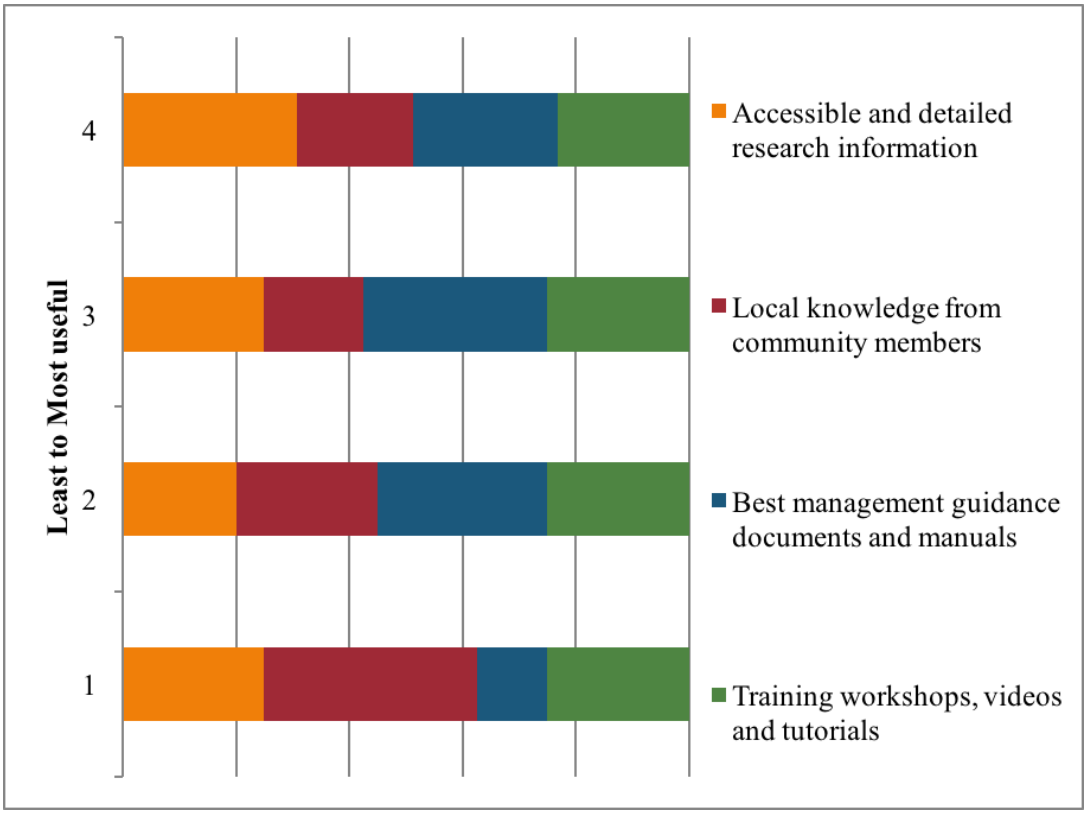


Figure 4.28 Ranking the usefulness of resources in helping choose adaptation options. Least (1) to Most (4) Useful. (42 of 52)

Participants were asked two open-ended questions. More information will be provided in the discussion chapter, but responses for each question have been sectioned into a number of main themes that came out of the personal responses. The first question asked what additional support would help decision makers implement climate change in their community. Twenty-three participants provided responses, most relaying interest in

establishing and strengthening partnerships with community groups, levels of government and organizations to help with the transfer of knowledge, detailed information and research that can help them. Participants want "*opportunities to collaborate and case studies of similar communities*" (Participant H, Development and Guidance to Support Decision Making Survey, Oct 10, 2014). One participant stated; "*An inter-municipal group could be formed to collectively address common issues of climate change. Together there may be more likelihood of obtaining the necessary funding from senior levels of government*" (Participant I, Development and Guidance to Support Decision Making Survey, Oct 10, 2014). Each answer followed the theme of lacking financial resources available for them to participate in these forms of partnerships, leadership or knowledge discovery. Some participants desired higher levels of government (both Federal and Provincial) to step up, and acknowledge that climate change is an issue in order to provide a leadership role moving forward that municipalities can emulate. Senior levels of government need to be at the forefront of establishing the funding programs and opportunities for municipalities to create partnerships in order to gain the information they need from those organizations (NGOs, academics, engineering, watershed management groups, etc.) that can aid them in determining best practices for their coastal issues. A number of participants believed in a need to strengthen land use planning culture and create a better approval system in the province; while others believed taking a regional approach "*coastalshed concept*" (Participant J, Development and Guidance to Support Decision Making Survey, Oct 10, 2014) into consideration for future planning.

The second open answer question asked: "as a decision-maker, are there any areas of coastal management and climate change adaptation that you would like more

information about?*"* Nineteen participants provided responses, ranging for wanting resource information for funding and grants, to specific training to understand coastal dynamics and hazards, as well as those areas that have information about coastal planning and policy. Participants asked about specific coastal flooding and erosion information, how to address it, the "*impacts on homeowners*" (Participant K, Development and Guidance to Support Decision Making Survey, Oct 10, 2014) and where to turn, "*the impacts of stone walling the coast on neighbours and longevity of living shoreline approaches*" (Participant L, Development and Guidance to Support Decision Making Survey, Oct 10, 2014). Other participants wished to know if anything is being done to address the causes of climate change, rather than the symptoms. One participant wished to involve youth more, stating that they are the future and we need to "*feed them what they want to know*" (Participant M, Development and Guidance to Support Decision Making Survey, Oct 10, 2014).

4.3 Themes influencing participation and adoption of adaptation strategies in the Atlantic Provinces - content analysis

This section presents the themes that came out of the online survey, community workshops and three interviews that took place during the ACASA Coastal Community Adaptation Tool (CCAT) development phase. Using the primary framework, compiled data were categorized into themes and subthemes (Figure 4.29 and Table 4.1). Table 4.1 and Figure 4.29 elaborate on the four main themes and thirteen subthemes that came out of the data as factors influencing coastal communities' ability to participate in and adopt adaptation. Table 4.1 is a synthesized version of what came out and what was said during

workshops and interviews and survey responses. Each theme is not mutually exclusive nor is the presence of one factor guaranteed to have a positive or negative influence on the community. Municipal decision makers have the task of weaving together the differing goals of the town residents and businesses, occasionally negotiating conflicting or competing interests.

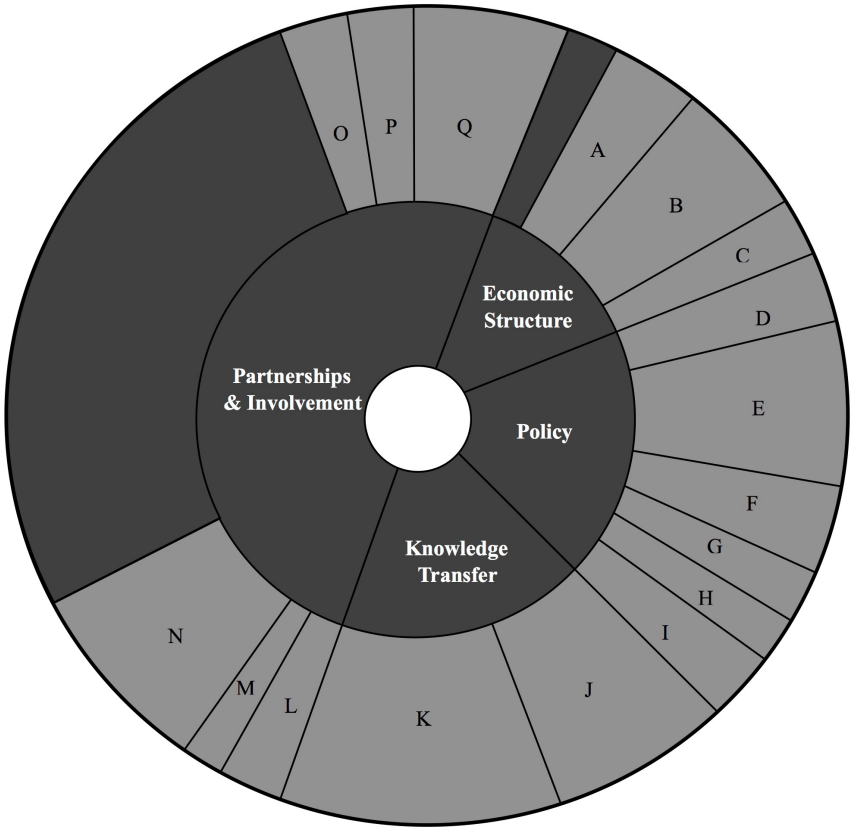
Table 4.1 Final theme descriptions

Economic Structure		There are challenges related to or exacerbated by the economic structure of small communities and municipalities in the Atlantic Provinces. Economic and social trends in smaller coastal communities are influencing decision makers' ability to take part in climate change adaptation opportunities**.**
		Financial: Availability of financial reserves is limited. Opportunities are presented to these smaller communities through project proposals and grants from different national or international organizations, Federal and Provincial governments and work tends to be managed by academics or local organizations.
		Resources: Availability and access to tools, programs, databases, software, basic instruments and human resources (experts, academics, professionals, NGOs, environmental organizations etc.) are limited for smaller communities. These resources are considered necessary and important for developing climate change adaptation strategies.
		Competing Priorities: Limited resources and funding leads to prioritization by community decision makers. Decisions are finalized based on demands for services put forth by the public. Long-term planning is rarely considered a priority when most of economic resources are required to deal with current community needs.
Policy	**Internal**	**Enforcement:** Creating policies and plans that point community development towards coastal best practices has been consistently seen as positive. Ensuring that these regulations and plans are upheld and enforced in practice is necessary for communities to see the benefits.
		Lack of Formal Role: An understanding of where to go for information, who has the authority and who will be in charge of disseminating information to the public and municipal decision makers is not clear to community decision makers and the public. This lack of formal role can lead to diffusion of responsibility and inaction. Good governance ensures that the community has its own clear direction and plans in an accountable and transparent way.
		Local Land Use Dynamics: References to land use planning techniques can be both positive and negative, depending on the nature of the discussion. Land use planning terminology is often not used in the proper context. This can lead to more confusion around the subject and how it can be used as a valuable tool for coastal hazards. Land use planning can be a valuable approach in coastal communities but may not be utilized fully because of misconceptions and language barriers.

		Political Will: There is hesitation from decision makers to participate in climate change adaptation strategies. Lack of their own political will is related to their perceived lack of public interest and desire. Community decision makers will not participate if there is either insufficient support or strong criticism from the public.
		Commitment & Confidence: There is a perceived lack of commitment to leadership at a community level and confidence in community decision maker's own abilities to come up with effective strategies for climate change adaptation. A lack of confidence in government representatives (Provincial and Federal) to deal with climate change, leads to feelings of discouragement at the local level.
	External	**Jurisdiction:** The overlap of responsibilities within municipalities that can cause confusion of responsibilities regarding damage inflicted by coastal hazards. Private land, federal and provincial infrastructure, grandfathered land along the coast are areas where jurisdictional confusion takes place. Insufficient financial, technical and human resources may lead to a municipality's decision to diffuse their responsibility of these coastal issues. Difficulties arise when areas of the coast are impacted by coastal hazards outside communities' jurisdiction are neglected by the party responsible of fixing.
Knowledge Transfer		**Education & Awareness:** Educational activities and tools that support climate change awareness and outreach are important to build community capacity.
		Information Fluency: The way information is presented and disseminated to community decision makers and the public has a lot of influence on how it is perceived. The credibility of sources used to make information available is important. There is concern by decision makers that there is little fluency between departments and organizations that translate climate change information to the public which creates confusion as different information is presented. The language (dialogue), and visual aids used are important for clearly and concisely conveying information to decision makers and the general public.
Partnerships & Involvement		Partnerships foster stewardship and community efforts (community residents and organizations claiming ownership and responsibility of any strategies related to coastal climate change issues.)
		Community Efforts: Efforts are done through community innovation, often through small scale or cost-effective solutions that the community residents and organizations can participate in. There is self-reliance within towns, which cultivates a "do it yourself" approach.
		Local Relevance: Placing climate change risk and vulnerability information in a local context, making the information relevant to the Atlantic Provinces is valuable for community decision makers to seriously consider the information. Providing examples of work that has been done in Atlantic Canada can make adaptation more realistic, attainable and believable, thus increasing local buy in from decision makers.

Partnerships & Involvement	**Boundary Organizations:** Third party organizations and industries are important to bridge the divide between science and civil society in order to disseminate information and raise awareness. They are often used in collaborative projects between government departments and communities/municipalities to manage, facilitate and provide support to foster knowledge sharing.
	Collaborations: Fostering partnerships within and outside of communities, creating connections, trust, sharing resources and knowledge for a mutually beneficial relationship between parties. Multi-sector collaboration is important to continue cross sector dialogue and information sharing. Collaborations are consistently considered beneficial for municipalities to gain information, resources and create allies.
	Proximity Benefits: How close a community is to larger population centres, community colleges, universities and environmental industries and organizations can provide more information and engagement around environmental issues like climate change research. Communities that are close to resources centres are aware of the opportunities and advancements they have at their disposal over those that are not in close proximity.
	Regional Approaches: Opportunities of taking part in a regional level in order to share resources and services that may increase the likelihood of all municipalities succeeding.

The hierarchy sunburst diagram (Figure 4.29) displays the themes, sized by the number of references coded. The number of times the category was mentioned throughout the data, the larger area it takes up. The darker areas show references categorized into the first tier, and not subdivided into a subtheme (e.g. partnership and involvement, economic structures). Involvement takes up a large portion of coded information in partnership and involvement therefore, references to involvement were synthesized to better understand who participants believed should be involved in climate change adaptation planning (Figure 4.30).



Economic Structure	**A -** Financial	**Knowledge Transfer**	**J -** Education & Awareness
	B - Resources		**K -** Information Fluency
	C - Competing Priorities	**Partnerships & Involvement**	**L -** Boundary Organizations
Policy	**D -** Lack of Formal Role		**M -** Local Relevance
	E - Local Land Use Dynamics		**N -** Collaborations
	F - Political Will		**O -** Proximity Benefits
	G - Commitment & Confidence		**P -** Regional Approaches
	H - Enforcement		**Q -** Community Efforts
	I - Jurisdiction		

Figure 4.29 Hierarchy sunburst diagram of main themes and subthemes

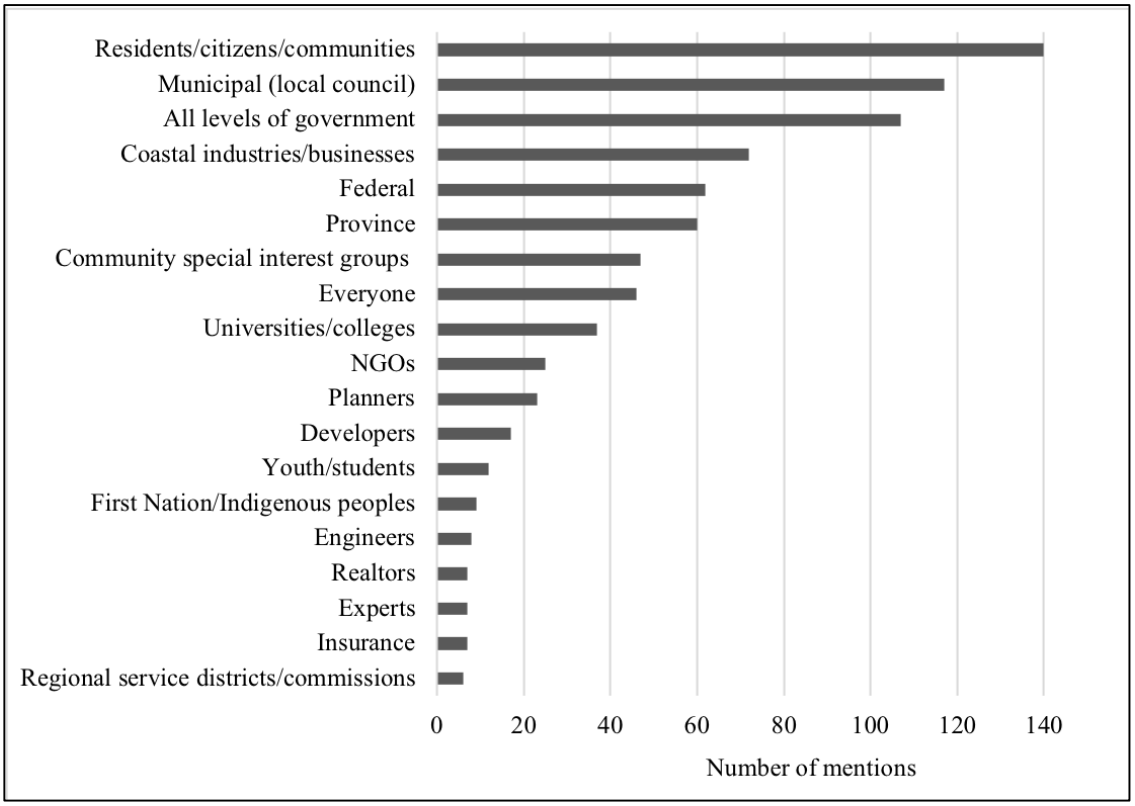


Figure 4.30 Number of times each involvement category was mentioned in data collected from survey, workshops and interviews.

Chapter 5
Discussion

5.1 Overview

This chapter presents the major themes that emerged from the data collected during the online survey, community workshops and three interviews that took place during the development of the ACASA Coastal Community Adaptation Toolkit (CCAT). The goal is to provide an understanding of what decision makers perceive to influence their ability to participate in or adopt coastal climate change adaptation strategies.

Major themes are not and cannot be mutually exclusive. At times, a theme may be briefly mentioned in a following section, further highlighting how interwoven issues are in the structure of a community. The geographic and political landscapes change from community to community. The absence of any of themes in Table 4.1 can hinder a community's ability to take part in adaptation planning, their presence is more likely to aid and benefit a decision maker's ability to move forward with adaptation planning.

Each of the subthemes will be explored as it relates to the main theme (economic structure, internal and external policy, knowledge transfer, partnership and involvement), narratively weaving together the themes as they relate to specific examples from participants. The order each subtheme is mentioned in the section may not reflect the order it is seen in Table 4.1.

5.2 Economic structure

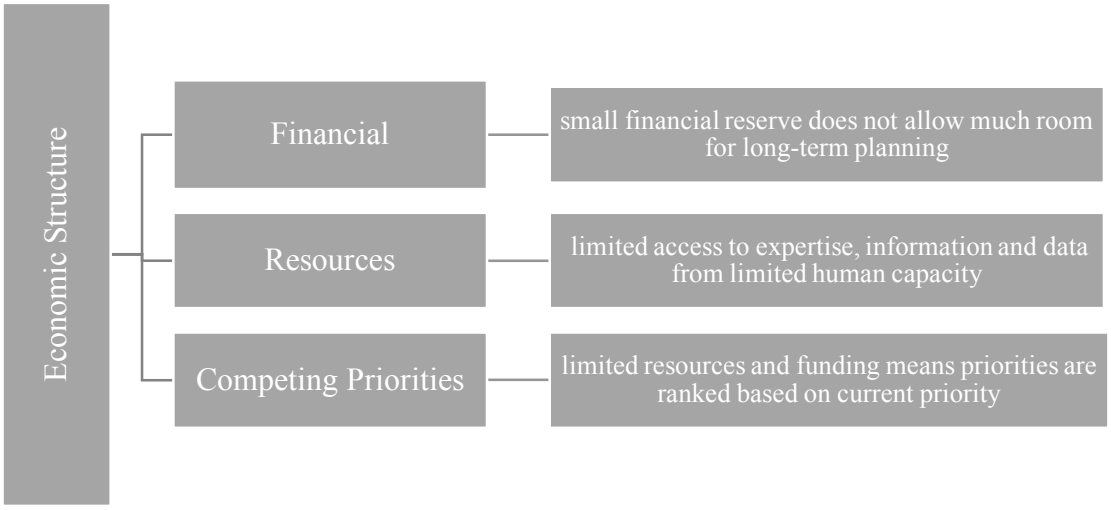


Figure 5.1 Themes related to economic structure

Financial necessities leave many communities with limited resource capacity to plan for the long term. It was very apparent throughout data collection that there were challenges related to or exacerbated by the economic structure of communities in the Atlantic Provinces. In some communities, their ability to allocate money and staff to long-term planning currently does not exist. The concern is not uncommon for smaller communities across the Atlantic Provinces, as one survey participant states: "*Our community is largely residential with farming and fishing and tourism being the economic drivers of the local businesses. We own little infrastructure and have virtually no staff available to respond to climate driven emergencies*" (Participant N, Development and Guidance to Support Decision Making Survey, Oct 10, 2014). Other studies, (Schauffler, 2014; Schipper et al, 2010; Wall & Marzall, 2006) have discussed how budget for every-day operations is an ongoing priority concern for most municipalities without the added pressure of finding money for long-term climate change adaptation planning. Workshop

participants expressed concerns with their ability to provide basic services to their community. Immediate concerns always take precedent over their ability to take part in long-term planning. Every workshop had a discussion related to cost, attributing it to be a main reason why they have not adopted plans or upgraded their infrastructures to address sea level rise impacts. Statements like; "*we know what needs to be done, we've known for years, we don't have the money to do it*" (Participant A, Coastal Adaptation Guidance Engagement Workshop, Nov 6, 2014) were expressed throughout most of the workshops. Community fundraisers were mentioned at all workshops when asked how the community typically secures additional funds to fix aging community infrastructure and was previously mentioned by other researchers (Auld & MacIver, 2007; Gibson et al, 2015; CBCL Limited, 2009; Steemer, 2003). Although this can be a great way for community members to take ownership of the work being done, council members who participated in the workshops said they cannot expect residents to be able to afford to pay for all the maintenance or repairs required for aging or damaged coastal infrastructure. Survey participants ranked community fundraising lowest in where they look for funding (2.4% in Fig 4.25). Survey participants attributed cost as being the biggest constraint for taking part in climate change planning and implementing these plans (Fig 4.24) as well as the installation and maintenance of coastal infrastructure (Fig 4.20 and Fig 4.21).

The lack of financial backing not only puts pressure on other services, it also does not allow for social capacity to grow in the community. Less money means less staff or limited time for staff to access and create partnerships or gain insight from expertise. It may also mean fewer opportunities for education and public outreach to increase awareness of climate change. In order to take part in long-term adaptation planning,

community decision makers need to have access to human resources such as professional staff, planners, engineers, GIS technicians, coastal experts and consultants as well as management staff willing to delegate communication during the planning process. Access to this workforce requires financial support that many municipalities lack (CBCL Limited, 2009; Wise et al, 2014). Oftentimes, municipalities only have access to professional staff on a monthly or yearly basis. In some cases, neighboring municipalities or districts share professional staff by splitting their time between different communities throughout the year, in the case of several of our workshop communities and supported by Canadian Rural Revitalization Foundation State of the Rural report (2015). For many communities in the Atlantic Provinces, town council consists of volunteers who are either unpaid or minimally compensated. Newfoundland and Labrador for example, has very few paid community staff, with most municipal council members working as volunteers (Simms & Greenwood, 2015). While a volunteer workforce is critical in rural communities it's difficult to focus on long-term planning when you only have so much time allotted to council duties.

Adaptation planning requires local preliminary data, such as climate change risk and vulnerability assessments that often require certain skills and software that requires financial capacity to initiate (Bednar et al, 2018). Workshop participants mentioned they were interested in acquiring more accurate terrain mapping, such as LiDAR data to help assess risk. The cost of the data, the software to use it, and the internal housing capacity to access the information deterred them from moving forward. Similar views were expressed in Schauffler (2014) Bay of Fundy Status and Needs report where one respondent stated; "[in order] *to make headway with adaptation planning, they will need*

more funding and professional support" (Schauffler, 2014). This is due to the fact that many of these communities "*lack the expertise and money*" (Participant B, Coastal Adaptation Guidance Engagement Workshop, Nov 6, 2014) to address coastal issues. Financial and human capacity to acquire and use technical programs and software are still considered major obstacles for smaller communities in the Atlantic Provinces to participate in climate change adaptation planning.

A direct result from restricted financial support is budgeting between competing priorities. Cost contributes to lack of resources in many regards, making it less likely for decision makers to push forward a climate change adaptation plan in their community. Competing priorities tend to push many forms of long-term planning off the action item list. When the discussion during a workshop inevitably turned to the town or community's financial capacity, the top of priority always arises, "*money goes to current priority*" and that depends on the "*urgency of the situation*" (Participant C, Coastal Adaptation Guidance Engagement Workshop, Nov 18, 2014). For many coastal communities, coastal change is gradual and therefore there is no urgency to invoke coastal planning until something big happens (e.g. storm event causing higher rate of erosion or wide spread flooding). Lack of priority makes it very difficult for council members to justify spending money on an issue that is "*not a top priority for many residents*" (Participant D, Coastal Adaptation Guidance Engagement Workshop, Jan 19, 2015). Often smaller towns and municipalities that have small budgets and must take care immediate concerns first and do not have the financial backup to support long-term concerns like climate change adaptation planning (Schauffler, 2014).

Financial strain to supply residents with necessary services is a continuing trend for rural municipalities (Canadian Rural Revitalization Foundation, 2015). Awareness of financial strain placed on rural communities is important when organizations, Provincial and Federal departments attempt to provide helpful resources and tools. Grants and programs can offset cost through Provincial and Federal departments and boundary organizations. Apart from financial support from outside sources, participants believe the presence of information surrounding cost effective solutions could help them deal with their situations in a way that does not "*make them feel hopeless….*"(Participant E, Coastal Adaptation Guidance Engagement Workshop, Nov 6, 2014). As a participant said "*it is easy enough to say you need to move the road back but we don't have the money for that….if you provide us with information on where to plant trees and what type works best I think people would be more willing to cooperate*" (Participant F, Coastal Adaptation Guidance Engagement Workshop, Nov 6, 2014).

Some situations and concerns that small town have are different from towns with large populations and urban centres, such as shrinking population, aging demographics, diminishing social safety net and social and economic restructuring (Canadian Rural Revitalization Foundation, 2015; Manuel et al, 2012) and changing economic conditions that continue to be largely natural resource based. Participants believed that in order to take part in adaptation planning they need to have access to human resources, such as professional staff (planners, engineers, GIS technicians, coastal experts and consultants), and management staff willing to delegate communication between municipal departments and sectors that need to be consulted during the planning process. Access to this work force often requires financial support that many communities lack (CBCL Limited, 2009;

Wise et al, 2014). Municipal councils, even those comprised of volunteers are required to provide basic services and often do not have immediate access to local professional staff to address questions or concerns as previously discussed, they share professional staff with neighbouring communities (Canadian Rural Revitalization Foundation, 2015).

Unfortunately, for many communities in the Atlantic Provinces, the capacity to take part in discussions surrounding coastal hazards is often hindered by these financial and resource limitations. Often, any discussion surrounding coastal hazards and climate change adaptation is reactionary, after a storm event of extreme conditions have impacted the communities in a negative way. Communities require shorter review period for land use plans in order to address any future development in at risk areas (Lawrence et al, 2018). Simultaneously, that review process should have a long-term vision for the coastal community (Lawrence et al, 2018). Having a stable economic base within a community increases the ability to adapt to changes that occur along the coast (Denton et al, 2014; Wise et al, 2014). Issues concerning climate change (ground water resources, improved emergency response to weather related incidents, upgrading infrastructure and reviewing land use patterns) are top priorities for the public, however budgetary constraints can prevent the planning process of these priorities (Bednar et al, 2018; Corporate Research Associates, 2012).

5.3 Policy

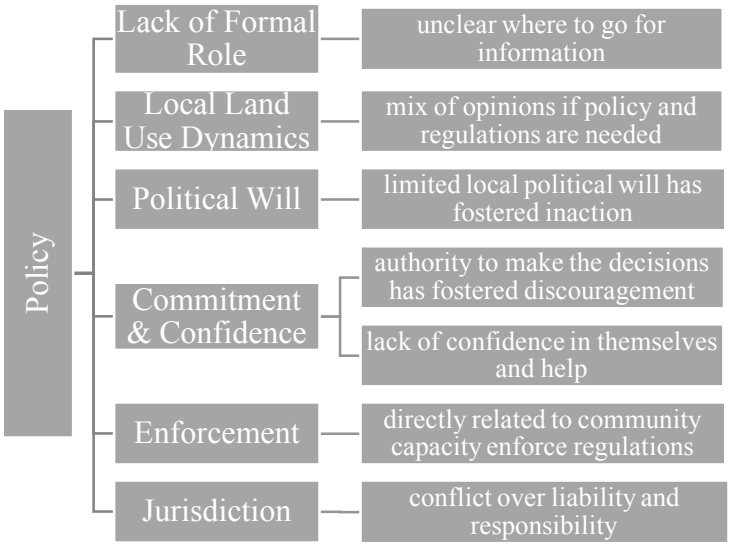


Figure 5.2 Themes related to policy

There are a number of themes related to the presence or absence of policy that halts further coastal adaptation planning in communities and often stops decision makers from starting the process. The main internal themes that came out of the workshops and conversations with decision makers are related to: lack of formal role, lack of confidence and commitment, political will, enforcement, and current land use dynamics in the area. The external theme related to policy is concerned with liability and jurisdiction. Each of these themes play into each other, telling a story of the complex relationship each community and its residents has with the land and their neighbours.

There is a perceived lack of commitment and leadership from all decision makers when it comes to taking climate change seriously. This was expressed by workshop decision makers and may be compounded by their lack of personal confidence in making the right decisions for their community. They do not feel they internally house the

expertise necessary to come up with the right adaptation choice to be successful or effective. Coastal community decision makers perceive the Provincial and Federal government and their departments a main source of information when looking for guidance and funding for climate change adaptation planning. Survey participants do rely on provincial (81%) and federal (73.8%) governments for information (Fig 4.25) and these departments were mentioned throughout the workshops when they look for information about coastal issues and climate change data. Although both levels of government are main sources for information, there is a lack of confidence in the information. When survey respondents were asked to rate the usefulness of guidance they received from each source, Fig 4.26 shows that Provincial services were considered 'somewhat useful' and 'very useful' more often than Federal services. In fact, Federal services were considered not useful as often as 'newspapers' and 'Radio/Television'. The nature of the information that was being ranked by participants was not clarified by the participant other than information related to climate change adaptation along the coast. It is unclear what types of information participants have previously searched for which may sway the results. There was a concern from the workshop participants that the services and information provided by the Federal and Provincial government did not have the community in mind or the information was too complicated for them to follow. Federal services are considered entities that deal with bigger problems that are more wide spread than community concerns. Local decision makers do not feel like the Federal services have their needs in mind even though they still view them as main sources for information. There was also a lack of confidence in these larger organizations and services understanding the needs of the local community experiences; "*lots of formal*

education, less field and personal experience" (Participant A, Personal Communication, Jan 16, 2014). This participant also stated that there was a concern that organizations would assume the property owners or community did not understand what was happening and provide solutions without "*seeing what is actually happening and talk to communities to understand the issues*" (Participant B, Personal Communication, Jan 16, 2014). This response was also expressed within other local studies (Brzeski, et al, 2013).

When the conversation was directed toward where workshop participants turn to for information about the coast, there was some uncertainty about what provincial departments to contact and what level of government to turn to for assistance. Community decision makers have a sense there is a lack of formal role in terms of who has the authority in providing climate change information to the public. One participant said he kept being transferred and shuffled between different provincial departments "*passing the buck*" (Participant G, Coastal Adaptation Guidance Engagement Workshop, Nov 6, 2014) and never got an answer. Workshop participants want to know exactly who to contact to avoid being transferred multiple times. Not knowing who is in charge of disseminating information can lead to discouragement and further inaction as community decision makers are transferred through multiple government departments or staff which can take long periods of time.

Community decision makers also have a perceived lack of confidence in their own skills and expertise to make decisions about climate change adaptation. Three Atlantic provinces, New Brunswick, Prince Edward Island and Newfoundland, have varying levels of coastal policy in place to help communities come up with their own standards, regulations and policies, while Nova Scotian municipalities have been delegated the

authority to come up with their own coastal land use plans (Municipal Government Act, 1998). While this presents an opportunity to strategically develop local governance around coastal land use planning, for many communities it has allowed more inaction. Many communities do not have the in house or local capacity to decide setbacks, regulations and guidelines. Having the authority to make these important decisions has fostered discouragement. For communities who want action, they feel they do not know how to gain the knowledge to create the necessary changes. Lack of confidence does not breed commitment and leadership. As a survey participant states "*at the municipal level, there is very little in place to aid in this process, coastal management is included minimally in land use planning and zoning*" (Participant O, Development and Guidance to Support Decision Making Survey, Oct 10, 2014). They are aware of most of the places (local and provincial) to look for information, but there isn't a system or location that brings it all together. These frustrations were not just felt by Nova Scotians, but throughout all Atlantic Provinces. For example, although the Province of New Brunswick has had a published Coastal Policy since 2002, it has yet to be translated into legislation and relies on local authorities to apply, compile and enforce guidelines and regulations (New Brunswick, 2002). The feeling that the provincial and federal government needed to be providing more guidance for municipalities was expressed in all communities. They felt that more guidance would allow them to set their own standards for coastal land use, where they currently feel unequipped creating these standards and plans alone (Chouinard et al, 2017). It is important however to note that although participants want more support and guidance from provincial and federal government, there is a perceived lack of confidence in their ability to do so. Perhaps this contention comes from their current

feelings that they do not have the guidance they want to participate in adaptation (Chouinard et al, 2017).

There have been changes in the way the Nova Scotia Provincial government views its coastal policy authority. The current Provincial government has committed to creating a Coastal Protection Act for Nova Scotia (CTV, 2017). Regardless of the lack of confidence, local decision makers believe that senior levels of government need to be at the forefront in helping provide guidance, creating programs and funding opportunities for municipalities. The need to strengthen land use planning culture in the Atlantic Provinces was mentioned throughout all data collection avenues as a way that the Provincial and Federal government can help move municipalities towards making best practice decisions related to their coastline.

5.3.1 Political will

There was a common theme between workshop participants that climate change adaptation planning needs to get to a point where it is considered a part of everyday operational decision making; addressed in the services and daily operations the community provides. Although this understanding is widely recognized, it is not a place that many community decision makers have reached. The majority of survey participants have been involved in climate change adaptation planning at one point but involvement tends to be on an as needed basis, seemingly involved in reactionary planning after an event has occurred (31.4% after an event has triggered coastal issues such as flooding and erosion). Decision makers in the Atlantic Provinces are doing very little climate change adaptation work on a daily basis, with only 15% of respondents reporting adaptation as

part of operation (every-day) decision making. Any involvement on a routine basis tends to be dependent on the person's job title and meeting and reporting schedules for particular projects related to climate change research. Survey responses from our study related to the question, "how often they were involved in coastal planning and management" reflected a reactionary response, with 'when needed' at 74%. While this certainly does not reflect that every response is reactionary, it adds to the discussion surrounding political will, as 'when needed' tends to relate to the urgency of issue and support from local citizens. According to all participants, much of the work that has been done has been making improvements to emergency management operations (EMO) and improving road access in the event of a storm, albeit in an inconsistent manner. Similar findings were reported in Chouinard et al (2017) and Guillemot and Aubé (2015).

Risk management planning is an important way communities in the Atlantic Provinces are adding climate change adaptation planning into their long-term plans. From this study, survey results show that 65.2% of respondents consider climate change adaptation in their decision-making surrounding risk management planning. Comments made during the workshops support the findings but also suggested some challenges and opportunities to be more inclusive in their development. Involvement of the senior population in the development of emergency management procedures was briefly mentioned during some of the workshops, in order to make sure there is adequate support for those who need additional assistance during storm related events. A retired EMO committee member mentioned a survey the committee did in order to determine how many residents would need assistance leaving the household in the event of an emergency. Although he could not recall the exact percentage off the top of his head, it

was enough to make sure the EMO plans included extensive support to those with mobility difficulties. A recent study by Krawchenko (2017) recommends municipalities involve senior residents in the development of climate change policies and emergency management operations to allow for more age friendly land use.

There were a number of workshop participants that did not feel their community was ready to take on adaptation planning. Their lack of political will as a decision maker seemed to be related to their perceived lack of public interest. Community decision makers stated they will not participate if there is either insufficient support or strong criticism from the public to move forward.

Perceived personal risk is imperative to generating an engaged community that will bring forth their concerns to council and make climate change adaptation a priority. If community residents fail to recognize the impacts of climate change as a risk to their personal property and wellbeing or do not voice these concerns, there will be no reason for local governments to prioritize adaptation. Results from Robichaud and Wade (2011) general public opinion surveys show that citizens believe climate change is a general risk for their community and should be a priority. The level of personal perceived risk seems to vary in existing research for the Atlantic Provinces. Corporate Research Associates (2012) shows personal perceived risk to be low, while thirty-six percent of participants who participated in a risk communication survey for the Tantramar region survey considered themselves to have a "considerable to severe" personal level of risk (Lieske, 2012). The differences in results between these local studies may be related to scope, where one study focuses in on a specific region, Lieska (2012) Tantramar study while the Corporate Research Associates (2012) has a general scope. The Tantramar region is an

important and highly vulnerable corridor connecting New Brunswick to Nova Scotia gaining lots of media attention over the years (Bousquest, 2013; CBC News, 2014; Corfu, 2017; McClearn, 2018), which may be the reasoning behind the substantial minority perceiving considerable perceived risk. The Corporate Research Associates (2012) study commissioned by the Atlantic Climate Adaptation Solutions Association was not connected to a specific at-risk area, gaining a wider lens from varying regions that may not be as concerned with coastal climate change impacts. It's also important to note that these studies are older and discussion around climate change impacts has expanded in current media topics. Perceived risk may have increased with expanding coverage and increased frequency of coastal weather related events and severity of damage.

Risk to coastal hazards and impacts associated with climate change tend to not be a priority for people until they are personally impacted (Arlington Group, 2013). When workshop respondents were asked about extreme weather events in their community, participants were able to go into detail of past issues they or their neighbours experienced. In many cases, they were aware of the problem before the weather event occurred, such as a road slowly losing the shoulder over time, their property was eroding, or the wharf needed repairs. Regardless of the knowledge prior to event, priority or financial capacity wasn't there to do anything about it. When the extreme weather event occurred, erosion and/or flooding happened quickly and there was no other solution but to react to the damage with resources they had available, even if it wasn't the best option to use. Some workshop participants felt that parts of their community are stuck in a cycle of reacting to damage year after year and are unsure what the best course of action is to take to make their efforts more resilient. When the public perceives their risk to be high, they can put

more pressure on decision makers and increase collective will to do something about it. After a storm event that causes coastal impacts, perceived risk increases in the community, putting pressure on decision makers to do something. However, the response tends to lean more towards reactionary, and often does not involve thinking about long term or resilient solutions. These quick fix solutions allow for much of the public to immediately perceive the at-risk area to be safe, until the next storm event hits. One workshop participant stated: "*people tend to forget it was a problem quickly [once the coastal issue was dealt with, even if the solution was reactionary], we have a forgetful culture*" (Participant H, Coastal Adaptation Guidance Engagement Workshop, Nov 18, 2014). Keeping climate change action as a low priority until a community is triggered by emergency response could lead to social and economic loss for some rural coastal communities (NTREE, 2011).

5.3.2 Local land use dynamics

One of the ways communities can prioritize risks associated with coastal climate change hazard is by mindfully shifting our coastal land use away from vulnerable areas. There are still concerns surrounding current land use along the coast and increased recognitions that planning techniques such as buffers, setbacks, zoning and design standards are valuable approaches to transition out of highly vulnerable areas. Despite this recognition, hard protective structures are still considered the more useful approach to decision makers participating in the workshops. Perhaps what is tangible, what people can see working in front of their eyes, such as a hard protective structure is recognized as adaptation more so than a land use regulation that does not have an instant visual impact.

Discussions took place around adaptation strategies that could help with coastal issues within workshop communities. During these conversations, hard options that provided coastal protection by fortification were mentioned frequently without much consideration for coastal setting (landscape feature and geomorphology). One survey respondent made the point that "*the key problem is people looking for engineered solutions for problems nature deals with better*" (Participant P, Development and Guidance to Support Decision Making Survey, Oct 10, 2014). Within some of the workshops, there were a number of participants who were vocal about hard structures (breakwater, dyke topping, sea wall, etc.) as a way to help with local coastal issues, and brought up very little about cost effective, natural approaches. When participants were asked at one of the workshops what would be their next step in starting the discussion around coastal management and planning for their coast, the first answer was, "*we should probably talk to an engineer*" (Participant I, Coastal Adaptation Guidance Engagement Workshop, Jan 26, 2015). While that may not be wrong, it's telling that they did not mention getting planners involved right away as well. Land use planning was not mentioned as often as engineered site assessments. Some workshop participants believed hard protective approaches were the only way to help their coastal erosion and/or flooding problem, although it might not be the most suitable option. When challenged by other participants, the discussion hovered around harder techniques being the most common strategy in the area and the strategy working for neighbouring communities. This was voiced at every workshop, that land owners continue to use the same solutions they have used in the past and continue to have to maintain without looking for other solutions. A similar conversation was brought up during an interview with a resident of PEI who is retired from the environmental field. In

his community, there is a lot of shoreline armouring taking place and the discussion that takes place between the residents focuses around; "*[since other people are doing it], I guess I have to do it*" (Participant B, Personal Communication, Jan 16, 2014). Providing the correct knowledge and tools to help communities select suitable strategies, and provide explanations and reasoning as to why certain options may not be appropriate can help ensure unsuitable strategies are not used. This can decrease the potential of causing more damage or create more problems in the future (Beatley et al, 2002; PIANC, 2014). The Mekong River Commission (2010) reported that there is limited guidance available on how to select the most appropriate approaches for a given location (Schipper et al, 2010). Similar themes are present in Measham et al (2011), who described concerns about the misuse of adaptation options that might be appropriate at a certain scale or within a neighbouring community but can be harmful or maladaptive at another scale and location (Adger et al, 2008; Lane & McDonald, 2005; Measham et al, 2011).

In the past, one of the workshop communities reported receiving different advice about suitable adaptations to address its coastal problem. The community hired an engineering consultant to propose a solution for beach replenishment along their causeway. The engineers proposed a complex and expensive solution that the town could not afford. Instead they collaborated with a local watershed group to install snow fences along the causeway to capture sand and it has been working fairly well for them, at least in the short term. This experience made the community realize that solutions to coastal problems don't always have to be the most expensive, and partnering with local groups can bring out a sense of stewardship and increase volunteerism in the community. It

became a local effort but there are challenges to this sort of local based work such as local capacity and the longevity of the solution.

Encouraging basic understanding of coastal processes is currently not a priority. There is opportunity to engage the public more about how coastal processes shift and shape our coastal line in ways that can help us naturally adapt to sea level rise impacts if we allow the coastline the space to do so. This type of outreach may allow for a better understanding and appreciation for coastal systems while encouraging and informing potential coastal policy. Efforts to provide public attention to wave dissipation, rogue waves and rip tides circulates on social media during summer months, provided by Parks Canada. A campaign that is related to community proximity around the coast and the need for management and policy has not been widespread in the Atlantic Provinces but has been gaining momentum. The Department of Fisheries and Oceans (DFO) educating coastal communities about sea-level rise (ECoAS) project in partnership with Ecology Action Centre (2017-2019) there has been a focus on making wise choices on coastal land with the threat of sea-level rise. This project has created an information website, infographic, and interactive map to help keep the sea-level rise and coastal planning discussion going. Through the ECoAS project, Planifax created a sea-level rise informational video (Ecology Action Centre, 2017) and a Sea level rise working group comprised of local knowledge holders and experts to share ideas, tools and resources to bridge in order to avoid duplicating efforts and making sure communities have access to and using the most relevant up to date information.

5.3.3 Jurisdiction

During the workshops in New Brunswick and Prince Edward Island, concerns about coastal policy or lack thereof were brought up around regional or local service districts and unincorporated areas that are not governed by their own municipal corporation. Canadian Revitalization Foundation (2015) also mentioned this as being a big concern for a number of Provinces. Some sections of the coast have an overlap of responsibilities within municipalities that can cause confusion on who is responsible for any damage caused by coastal hazards. Private land, federal or provincial infrastructure, and grandfathered land along the coast are areas where jurisdictional confusion takes place. Insufficient financial, technical and human resources may lead to a municipality's decision to diffuse their responsibility of these coastal issues. Difficulties arise when entire/portion of community have to deal with a problem another party is responsible for but is not taking action to repair.

Unincorporated areas lack the formal government structure to control development (bylaws, impose taxes, employed staff), making it easier for residents to build in high-risk coastal areas (ACASA, 2015; Simms & Greenwood, 2015). Chouinard et al (2017) calls this a "deficit of local governance"; where services are shared among communities, often administered to the area by a larger service district or division, coming directly from the province, another municipality, or private industry (Canadian Revitalization Foundation, 2015; Chouinard et al, 2017). In PEI, only 30% of the land is incorporated and only 10% of that is covered by official land use plans (Krawchenko, 2014; Randall et al, 2015). The Tantramar marshes, a highly vulnerable portion of land

that connected Nova Scotia and New Brunswick is unincorporated, with no bylaws controlling development (Hood, 2008). There are planning bodies that are responsible for separate zones of the Tantramar marshes. NB has the Eastern Regional Service Commission that provides planning services to towns and unincorporated areas and the NS portion of the Tantramar is part of Cumberland County municipality. Instead of the Tantramar marshes working under one encompassing planning body for the entire vulnerable area, jurisdiction is split creating tension between users (Hood, 2008).

Jurisdictional concerns were brought up frequently at the workshops and can account for much of the conflict between municipalities, property owners, and provincial departments (Causley, 2008). The responsibly of who should finance and maintain infrastructure that has or will be damaged by coastal hazards is a concern for many municipalities. In some municipalities and regional or local service districts, provincial departments own and are responsible for certain roads, bridges and infrastructure. If not maintained properly, coastal events, such as storms creating washouts and/or coastal/inland flooding, can accentuate weather related emergencies and can block access in and out of a coastal community. This type of isolation was a reality for some of the workshop participants. Much of the conversation in workshops surrounded who would be liable to finance the maintenance required to fix the road or bridge. If it is the responsibility of a provincial department, would it be fixed fast enough to avoid isolation of residents impacted (CBCL Limited, 2009; Causley, 2008).

Another challenge that was touched on previously is that there is a high proportion of coastal land that is privately owned in some of the Atlantic Provinces, mainly PEI and NS. For example, 86% of Nova Scotia coastal land is privately owned (CBC Limited,

2009), including private property and port facilities, making it difficult to design development controls along the coast (CBCL Limited, 2009; Rapaport et al, 2012). Not only is this a concern for municipalities when designing coastal policy and management, but the liability of any coastal issues is the jurisdiction of the landowner, which seems to be a point of contention.

In the future, if there comes a time when smaller towns and rural populations encourage and accept planning, unincorporated areas could provide opportunity to create innovative land use plans, as there are fewer existing planning barriers in place (Hood, 2008).

5.3.4 Policy concerns across the Atlantic Provinces

The ACASA Coastal Community Adaptation Tool (CCAT) engagement sessions fostered dialogue between many different communities, organizations and government departments about ways communities have integrated climate change adaptation into their community, municipal or provincial policies. There is a mix of opinions between participants as to whether or not internal policies and regulations are needed or necessary for their community to move forwards with climate change adaptation planning along the coast. While some participants state that their community or jurisdiction does not have policies in place to protect and manage coastal infrastructure and land use, they believe and/or acknowledge that their community may benefit from them. Regardless of this belief, some participants felt their community does not have the internal resources (human and technical) to create coastal policies or enforce regulations. In most cases, the participants felt like they would need a lot of outside help in order to develop any coastal

policies or regulations for their community, as they do not feel like their in-house skills were adequate enough to determine best practices with concrete objectives, such as setback lines. In some cases, participants expressed that that their efforts would not gain political support from residents.

Separately, participants from larger communities that may have the capabilities to create coastal regulations and internal policies have not done so. These participants stated that residents had no desire for coastal regulations from municipal council. Past discussions surrounding coastal policies in their municipality have been met with conflict, and conversations dissipated. While some residents may express the need for more guidance for managing their coastal property, the main consensus within many communities has been the reluctance of government to enforce any restrictions on their property. The discussion of enforcement over private coastal landowners was touched on at all the workshops, with consensus from decision makers and council being that they can only be "*good examples for private owners. We (currently) cannot tell them what to do, but we can help them choose suitable options.*" (Participant J, Coastal Adaptation Guidance Engagement Workshop, Nov 18, 2014). This ability to provide suitable information depends on the community financial and resource capacity. Although there is an unwillingness from leaders to create coastal policies, the reason is not that they don't believe they are not helpful. Survey results rated coastal policies as being helpful overall and there was consensus during workshops as well. The hesitation around implementing coastal policies from workshop participants seemed to be whether or not that is the "type" of help they want for their community. Much discussion in the workshops was about how the community wants to manage their coast; and "*how do we (decision makers) want them*

(land owners) to decide what to do with their coastal issues." (Participant K, Coastal Adaptation Guidance Engagement Workshop, Nov 18, 2014) Does the community want policy dictating land use around the coast?

There are those communities that have their have coastal regulations in place but express their frustrations concerning their ability to enforce them. PEI's coastal policy is an innovative one, attempting to restrict types of material acceptable to armour/protect the property and establishing setbacks from watercourses. Unfortunately, their ability to provide human resources to make sure these regulations are met are limited. As a result, residents continue to build too close to water bodies and use materials to protect their coastline that have been proven to be unsustainable and ineffective in the long term. This concern was expressed at the two workshops in PEI. Individual municipalities and communities who have established their own regulations, and even those who have not implemented any have expressed similar sentiments; "*how do we, will we enforce these policies if we don't have the funds to hire someone to do it*" (Participant L, Coastal Adaptation Guidance Engagement Workshop, Jan 19, 2015).

Decision makers in this study were involved and present in the affairs and concerns of the community and are aware of many of the challenges that will or currently impact both private and public land along the coast. Some communities have worked toward providing their residents with information to help identify and adapt to risk, such as recommended coastal land use guidelines. Residents view recommendations as suggestions as there is no coastal land use policy in place on a municipal or provincial level to enforce any restrictions.

5.4 Knowledge transfer

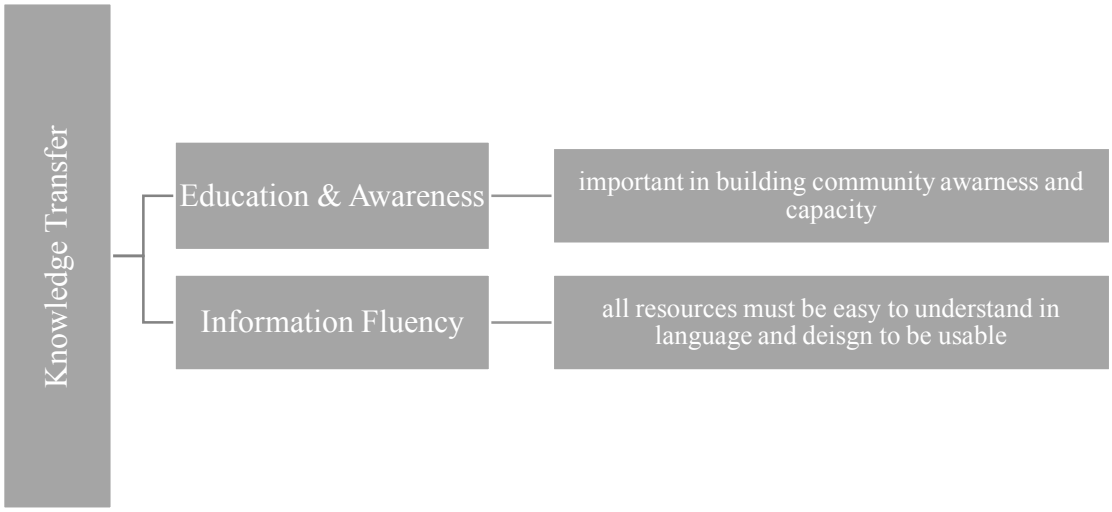


Figure 5.3 Themes related to knowledge transfer

The accessibility and transfer of knowledge is still considered a major obstacle for the dissemination of guidance documents as well as any technical or scientific data related to coastal climate change adaptation. The absence of adaptation action is not due to lack of information; it is clear that research development has been consistent and is expanding with regard to climate change adaptation planning and management (Burton, 2005-2006; Campbell, 2010; Chouinard et al, 2017). Inaction arises from a lack of accessibility and applicability of this knowledge to community decision makers (Burton, 2005-2006; Campbell, 2010; Robichaud & Wade, 2011). Although there may be sufficient tools out there to support effective adaptation, they may not be readily available to a decision maker, specifically true when dealing with decision makers who may have limited access to internet, expertise and communication services.

Although guidance towards adaptation is out there, finding the right combination of strategies for a community's specific coastal issues is a complex process that requires support, coordination, and expertise from all local stakeholders (residents, business owners, coastal industries, council etc.). The way information is presented and disseminated to community decision makers and the public has a lot of influence on how it is perceived. During the workshops, there was a language barrier for terms used to describe the same coastal features even between the Atlantic Provinces and between communities in the same province. For example, during some of the workshops the definitions for bluff, bank and cliff were debated in detail, although the team was using the proper scientific definitions for these terms. Similar conversations took place for the definition of the "coast". This is why establishing a common and consistent language, providing comprehensive definitions and reasoning behind the language used is a very important aspect in providing communities with information. Bednar et al (2018) acknowledge this challenge as well, noting that semantics, different uses of words or different meanings of the same word, can create challenges (Bednar et al, 2018). It is important to frame the information and language selection so people don't get lost in semantics (Bednar et al, 2018).

The workshop participants are the representatives making decisions about coastal communities. Their understanding of the information presented in guidance documents and tools created for them like the ACASA CCAT was a major component of the workshops. It was critical for those who wish to aid and guide community decision makers to make sure the information presented is easily digestible. A number of the workshop participants expressed that if it (the information) looks like a test or is too

complicated, they will not continue reading the content know matter how valuable it may be; they lose focus. One workshop participant stated that if he was completing the workshop document by himself, he would have "*stopped after the first paragraph*" (Participant M, Coastal Adaptation Guidance Engagement Workshop, Jan 19, 2015), due to the amount of text provided on the first page. This is important to know because if decision makers take issue with the way information are presented, inaction is more likely and these tools and guidance documents will not be used. The workshop team made changes to the content and flow between workshops, to better reflect the feedback from previous participants.

The absence of knowledge transfer can also occur between professional departments and scientists as well as between consulting agencies and community decision makers. Planners, engineers and academics do not necessarily speak the same language, which made for some very interesting discussions during the planners workshop in PEI as well as ACASA CCAT team communication throughout the project. During the one of the workshops with a majority of Planners present, it was brought up that staff in charge of developing plans/policies in communities do not communicate extensively with GIS technicians and those who develop climate change scenario data. Lack of knowledge transfer between important knowledge holders is brought up in a number of other studies (Burton, 2005-2006; National Research Council, 2010; Richards & Daigle, 2011; Bednar et al, 2018). This can make it difficult to translate this complex climate information to community decision makers, on top of expecting decision makers in smaller coastal communities to come up with the best solutions for their coastal issues with the information provided by climate scientist and other experts who are well versed

in the language (Bednar et al, 2018). In order for information to be helpful to community decision makers, the information needs to be simplified and tailored to their geographic location (Burton, 2005-2006; Richards & Daigle, 2011; Bednar et al, 2018).

Guidance documents often provide ambiguous information that community decision makers are unable to start the discussion around possible options. The issue of reports being user friendly for those with varying levels of education and free of technical jargon has been expressed by Brown et al, (2011) and ACASA municipal case study reports (Brown et al, 2011). Using simpler language and visual aids is important to clearly and concisely convey information to the general public and decision makers with varying levels of experience with coastal climate change adaptation. This is particularly true for those communities on the lower spectrum of capacity. Community partners on the higher end of the capacity spectrum that participated in the workshops did not have any issues with language used or accessibility. However, communities with little background with climate change adaptation, less financial support and resources were more concerned with the accessibility and language presented in guidance documents and tools (educational and technical) available to them.

Most workshop communities had a good idea where they were situated on the capacity spectrum when it comes to climate change adaptation. Some of the workshop communities had a higher percentage of post-secondary degrees; and a higher than average percentage of young retired residence and volunteers. They were aware of the human capacity and skills their community brought to the table, claiming that a lot of their “success” so far with climate change adaptation has been due to their local knowledge base, volunteers and public interest. This contradicts the survey results where

local knowledge was one of the least valued (Fig 4.26). Perhaps the difference is that the skillset mentioned in the workshops were not necessarily climate related. Workshop participants accounted their resiliency during past storm related events to their heavy equipment operators, firefighters (volunteer or staff) and local organizations.

There was some concern during several workshops that their town will soon be losing its "*institutional memory*"; due to retiring of some "*key people in the community*" (Participant N, Coastal Adaptation Guidance Engagement Workshop, Nov 6, 2014). In many of these communities, knowledge is not recorded or archived and business runs "as is" for much of the year. This seems to be a blessing and a curse; when "key people" are available, the town runs smoothly, even during storm events. Everyone knows their job in emergency situations and everything gets done, and people are dependable. The issues arise when some of those key people are not available to perform their tasks. For example, one workshop community talked about "*The Winter storm*" that happened while several of the towns key emergency and storm water management team, town CAO and the volunteer fire department chief were all away. As one participant stated, "*That is when things fell apart*" (Participant O, Coastal Adaptation Guidance Engagement Workshop, Nov 6, 2014). The town did not have their knowledge base available to rely on and there was no one left in the community that had the expertise they needed. It was after that storm, the town realized they would benefit from documenting all necessary procedures and practices in case anything was to happen like this again when key players are not able to perform their duties. It is a concern that local knowledge legacy information will be lost as local experts retire without recording this knowledge. Making sure knowledge is past down to whomever holds the position next is always important

and necessary for future community function as these knowledge holders reach retirement, and aging population continue to trend across Atlantic Canada (Canadian Rural Revitalization Foundation, 2015).

5.4.1 Education & awareness

There is a high awareness of coastal issues and often personal experience and accounts when it comes to coastal damage (96% of survey participants stated they had personal experience with coastal issues). However, when participants (survey and workshop) were asked what is being done to help alleviate these issues, there was limited knowledge of coastal work done in the community (Fig 4.7; 48.6%). There is an awareness of some form of work being done to help with coastal issues (Fig 4.10, 82%). Potentially this difference could be related to what respondents perceive as physical work (hard structures, bank stabilizations etc.) while the other question could have been limited to the planning of work.

When workshop participants were asked what guidance documents, tools and resources they rely on or have accessed, there were limited reports mentioned. It is understandable that community council and decision makers are not always informed and engaged with international tools and guidance documents, as some of our workshop communities had minimal internet access. It is more concerning when these council members and decision makers, such as workshop participants were not aware of tools and guidance documents designed specifically for them. In some cases, there was a complete lack of awareness of locally relevant guidance documents and tools created by local collaborations, provincial and federal departments. Throughout the workshops, decision

makers had little to no knowledge of key pieces of local publications from Provincial departments, which is a concern as publicly funded projects are not reaching the intended audience. What is happening where these documents and tools are not being used the way they were intended? If public money is being spent to create these decision support tools, the aim should be to make them as accessible as possible or at least reach the intended audience.

Education and capacity building within communities across the Atlantic Provinces is encouraged and necessary at both the decision maker level and public. Survey results have 50% of respondents considering building capacity the most effective form of adaptation. This is especially true in the way that decision makers need to understand and have awareness of ways they can participate in and engage in climate change adaptation They cannot participate without knowledge and also cannot do so without the pull from residents, which means political will hinges on education and awareness, a main component of capacity building. 30% of the survey responses indicated that policy was the most effective form of adaptation. The interaction between education, awareness, interest and political change is one that was expressed throughout the workshops by decision makers who wish to participate more in climate change adaptation planning. Participants felt that each stage (education, awareness, will) build upon each other until residents have nothing left to do but actively seek action.

This brings up the point about the importance and opportunity having basic coastal knowledge can give to a community dealing with coastal issues and the threat of sea level rise. Those community decision makers who had basic knowledge of coastal processes noted using this experience to engage in conversations with the public around

coastal issues and hazards related to the town. Knowledge boosts confidence in decision makers and they become more likely to stir conversation in the direction of adaptation if they have that confidence. Workshop communities that had people on their town council that had a basic to moderate understanding of coastal processes had enhanced understanding of the issues the community faced, as well as an increase in techniques that may be considered less intrusive, or outside the normal protection structures. Workshop communities praised their climate change adaptation participation as successful efforts brought forth by council members, champion community members or organizations with moderate to expert knowledge of coastal processes. At every workshop, participants mentioned specific local residents for their expertise. These residents were known to support council in understanding knowledge of local coastal processes and the local history of the coast.

Living shorelines and plant stabilization techniques have gained public attention, with evidence of natural ways communities can help "*turn back the tide*" (Participant P, Coastal Adaptation Guidance Engagement Workshop, Jan 26, 2015). With a public eye on these techniques, the public's understanding has spread wider, with more people considering a natural approach to protecting the coast to be a viable option. They were rated as helpful ways to protect communities against coastal erosion and flooding (Fig 4.22 & Fig 4.23). Living shorelines are considered to be cost effective and can be used within diverse coastal environments, including some high wind/wave exposed environments (although not all).

Relevant, accessible and detailed information is still considered one of the most useful resources, according to survey respondents (Fig 4.27). When survey respondents

were asked to rate usefulness of different types of resources used to determine if adaptation is required, local knowledge was rated least useful. Local knowledge is still seen as an incredible resource for recalling past local weather events (Chouinard et al, 2017) and in some cases local observations have matched scientific findings, like the case study in Shippagan, New Brunswick (Stervinou et al, 2012). There is a value in enhancing and acknowledging personal observations in order to support climate change scientific research, as it provides more depth to location conditions, both environmental changes and social challenges (Ecology Action Centre, 2017). Local accounts do help determine if adaptation is required, but perhaps are not as useful when determining what kind of adaptation option/strategy to choose, as more detailed information and expertise is necessary for this stage, reflected in the responses in Fig 4.28.

Taking a proactive stance is of the utmost importance; increasing public's perceived personal risk to a reasonable level is essential for coastal municipalities to adopt this strategy. One of the ways this can be done is through public education initiatives and programs to show personal risk to vulnerable communities' public and service infrastructure and private property (Sheppard, 2005). Communities in the Atlantic Provinces have hosted public information sessions and workshops and meetings. This type of work has been done by retired experts or professionals that live in the area, academics from out of town as well as local NGOs and other community groups to provide information about the science and social research surrounding climate change. Local participation has been an ongoing challenge for community decision makers and organizations that wish to move towards action. It was mentioned a number of times throughout the workshops that council needs local support in order to push forward any

policies that lead to action related to climate change adaptation. While attendance was considered high for most of the workshop and public education examples provided by participants, there was hesitation amongst the group as to whether or not the attendance was largely a room full of people already actively participating in discussions around climate change adaptation. The usefulness of workshops was split from survey responses, with an average rating of 2.38 out of 4 for gaining information about needing adaptation (Figure 4.27). The following Figure 4.28 was related to a question on the usefulness of resources in helping make decisions around adaptation. Respondents rated workshops with an average rating of 2.46 out of 4. This split might relate back to the evidence that came out of the discussions in our workshop communities. Although the information is valuable, it might not be reaching the audience it needs to reach. One of the participants who put on an information session in his region said, "*attendance was high, it was packed in there, but there wasn't many locals that came*" (Participant Q, Coastal Adaptation Guidance Engagement Workshop, Nov 20, 2014). In this case, the members of the public who would have benefitted the most from the information presented were not present to hear the information. There is an understanding that participation in climate change adaptation needs the involvement of all stakeholders, with more of a push to bring the issue to the front of public discourse. Town councils stress that the political will is needed to push anything forward on a municipal level, and this lack of commitment was expressed by all parties. Political will is needed to push things forward and that will can come from personal experience or concern, "*if the will is there, the rest would follow through*" (Participant R, Coastal Adaptation Guidance Engagement Workshop, Nov 26, 2014). When survey respondents were asked how they feel adaptation is most effective,

policy was considered one of the most effective (Figure 4.8) and changes in legislation and policy comes from the will of the people and their decision makers to change existing policies that do not serve the need of the people. As one survey respondent stated in addressing the question in Figure 4.8, "(the) backbone of the work needs to be supported through legislative/policy measures." (Participant Q, Development and Guidance to Support Decision Making Survey, Oct 10, 2014). Figure 4.24 survey question asked what the participant believed was the greatest constraint when it comes to implementing climate change adaptation in the community. Results from that survey question relate to lack of political will leading to inaction in many ways. There were 6 participants who chose to specify answers, and these personal responses brought up political will, and the need for communal understanding and consensus around the issues the community face with climate change impacts and how best address them.

Educating youth about and involving them in decisions about climate change adaptation came through in survey responses and the workshop discussions. Participants expressed the desire to get the youth involved within their classes, field trips or getting knowledgeable residents or experts into classroom settings for presentations and workshops for hands on experience. One of the workshop participants expressed that when their school took part in an "Ocean Week" educational program, the discussion around coastal issues was more prominent in the community, and was reflected in the conversations surrounding parents with school age children. The interest and activities that were taking place in the school was moving into the local discourse amongst adults, increasing parents' knowledge on the subject as well. Corner et al. (2015) studied engaging young people and emphasized the use of examples that benefit the community

and create opportunities (like Ocean Week) rather than only exploring negative impacts and consequences of climate change (Corner et al, 2015). Knowledge transfer through youth involvement is important for communities and can increase the perceived risk, thus increasing public interest.

5.5 Partnerships & involvement

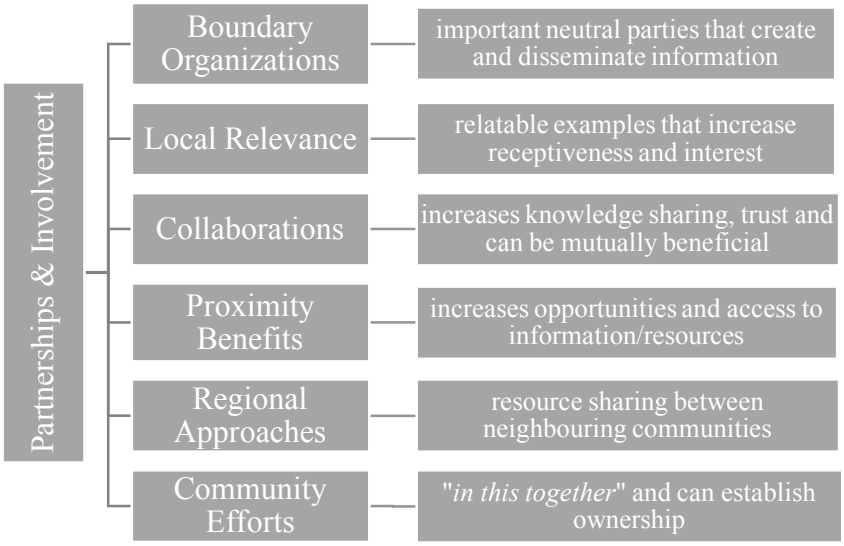


Figure 5.4 Themes related to partnerships and involvement

Partnerships and collaborations are one of the main sources of information and guidance for community decision makers. During data collection, it was clear that partnerships with local and regional organizations, colleges, universities, and consulting firms provided the most useful information for decision makers. Partnerships are the main opportunity for communities to gain access to scientific research, technology and software and can have capacity to conduct research surrounding coastal vulnerability planning. This is consistent with findings from Bednar et al (2018), Chouinard et al (2017) and Richardson and Otero, (2012). Partnerships and collaborations are also

important mobilizing citizens (Chouinard et al, 2017) and sources of guidance and funding (Bednar et al, 2018). Participants with experience working with boundary organizations considered these relationships positive and worthwhile. Those community participants who do not have longstanding relationships with boundary organizations consider it critical for them to create in the future if they are to increase their climate change resiliency. Boundary organizations, like NGOS, local peer networks, and local knowledge sources were considered "somewhat useful" from survey respondent results. It depends on what the organization has to offer. Technical data and increased public awareness through engagement support is considered beneficial by workshop participants. Partnerships can provide communities with resources and technologies from professional consulting firms, research institutes (colleges, universities, research centers, NGOs) that would otherwise require substantial financial contributions that these small municipalities cannot afford on their own (Bednar et al, 2018). Software programs like ArcGIS, mapping data sources, high resolution digital elevation models derived from LiDAR are seen as valuable tools but are costly for small budget communities. Boundary organizations are seen as credible according to the Corporate Research Associates (2012), and have the knowledge and ability to influence elected officials (Causley, 2008). Similarly, workshop participants believe that collaborations with boundary organizations can provide local decision makers the information they need; through the use of tools and software to influence elected officials decisions to make change.

The value of collaboration between neighbouring communities was mentioned in the workshops as means of mutually beneficial support systems. Several communities have participated in regional collaborations in the past to share resources and services,

helping each community meet their local resource shortcomings. This type of collaboration occurs in all sorts of ways in small communities, providing fire department services or snow clearing in the face of emergency situations or social events. Workshop participants stated that this type of collaboration is desirable for long-term planning in the face of climate change and sea-level rise. Partnering up with neighbouring communities to apply for grants and funding opportunities for future adaptation work is seen favourably and "gives it more weight" (Participant S, Coastal Adaptation Guidance Engagement Workshop, Nov 6, 2014). Combining funds can also work towards getting access to expensive data like LiDAR. There are endless ways neighbouring communities can collaborate in climate change adaptation planning. Taking a regional approach to gain access to data and technical support or applying for funding may increase the likelihood of each community succeeding at gaining access to this information or funding. In regards to funding opportunities, communities would most likely be competing over grants if they did not work together, which is less beneficial for both parties and would decrease their odds for approval.

Applying for grants or other funding opportunities establishes a level of governance in these communities. It takes determination and requires additional work from decision makers in smaller coastal communities to apply for funding opportunities. It shows that the community is willing to be innovative and come up with their own solutions to adapt to the challenges of climate change. Other small scale community efforts were mentioned in the workshops and more examples of community efforts were highlighted in the three interviews. Smaller actions taking place in study communities include: rain gardens to deal with storm water management, piling trees and brush against

dune systems to decrease winter erosion, clearing drainage pipes or increasing their width, and planting vegetation on banks. Some of these efforts relied on locals to volunteer their time and energy to complete. Workshop participants said they felt this gave the community a sense of ownership and stewardship over the project. They were rooting for it to succeed. One interview participant talked about a sand capturing fence the community worked together to build along their eroding dune system that protected the causeway behind it, the main artery coming in and out of the community. The collective action strengthened the community.

Providing locally relevant examples will increase interest in any guidance or tools provided to residents and municipal decision makers. Many participants found the presence of local examples increased receptiveness of the information being presented in the CCAT and guidance documents. Participants became more engaged during the workshops when examples of adaptation strategies were from Atlantic Canada (including Quebec), seemingly making the strategy a more viable option because it was adopted by neighboring communities or provinces. There was a spark of interest during the workshops when coastal damage examples were located around or within their region. Participants were willing and eager to voice their own experiences of local coastal damage, large storm events, and areas of concern. Those that expressed the need for locally relevant examples felt the use of international examples gives the illusion or sentiment that it's "*not realistic to be used here*" (Participant T, Coastal Adaptation Guidance Engagement Workshop, Nov 6, 2014). Some participants were less interested in seeing things being done outside of Canada or in larger cities because they felt like it would not and could not translate well into their local situation; having examples that are

applicable here can "*create a sense of relatability*". (Participant U, Coastal Adaptation Guidance Engagement Workshop, Nov 26, 2014)

Examples should not be excluded based on proximity alone, international and national examples are encouraged in the academic community, under the premise that providing as many examples validates chosen adaptation practices. How examples are presented to these communities matters greatly. By framing international examples in a way that communities in Atlantic Canada can visualize their local context could increase their willingness to give these options a chance. Placing information into a local context is considered valuable for community decision makers and the public to take the information seriously and can help increase local buy-in. It can help fuel participation, governance, political will and stewardship. There was a discussion during several workshops about increasing and emphasizing the positive that can be gained from the changing climate and opportunities that can come out of potential adaptation strategies. A couple of participants felt that providing examples of positive opportunities would give residents a reason to get involved.

Participants want "*opportunities to collaborate and (have access to) case studies of similar communities*" (Participant V, Coastal Adaptation Guidance Engagement Workshop, Jan 26, 2015), which goes back to the need for locally relevant examples. Proximity is still considered invaluable when it comes to creating project partnerships with boundary organizations. Workshop participants spoke highly of local organizations and environmental groups that have provided their region with supportive information and community education. Many of the communities who were in close proximity to a boundary organization that had experience with coastal and/or climate change work

believed they would not be where they are today without their help and guidance. As one of the workshop participant stated; *"...there has been lot of research focus on us because we are one of the more vulnerable parts of the Province*." (Participant W, Coastal Adaptation Guidance Engagement Workshop, Nov 26, 2014). Those workshop locations that were not in close proximity to a boundary organization expressed their desire to collaborate in some way with one and believed them to be an asset.

There were some concerns stated at a number of the workshops about the information obtained by partnerships with consulting firms and other boundary organizations, particularly the concern of information ownership. Workshop participants mentioned past experiences working with outside research groups and their frustration with access to collected data and information about their community once the project is completed. Ownership over data collected during a project can cause tension if data cannot be used by the community. In one workshop participant's experiences, they could not access the final reports because the information was housed by another project partner. If the partnership agreement does not explicitly state the information will be available for community use, information may be of little help to the community. *"When the partnership is over, who has access to the raw data? Who can manipulate it and used it again for more research?"* (Participant X, Coastal Adaptation Guidance Engagement Workshop, Nov 26, 2014)

There are other ways that partnerships can be less beneficial than anticipated. Projects that are dictated by timeframes can hinder the development of lasting and meaningful relationships between the researchers and community representatives. This can lead to misinformation, inability to capture local knowledge accurately, and loss of

respect or cultural sensitivity (Dexter, 2012). Other workshop participants mentioned that when external project team members come in, it can be intimidating for community participants to engage. They can feel "put on the spot" and *"put in a position to publicly state their opinion, and possibly be wrong"* (Participant Y, Coastal Adaptation Guidance Engagement Workshop, Jan 20, 2015). There has to be a level of trust between participants and project leaders. One of the ways that government funded projects attempt to avoid some of these issues is to include local volunteer groups, environmental advocacy groups and NGOs to help facilitate community engagement. Volunteer groups, advocacy groups and local NGOs are seen as more trustworthy to the public than government officials (Chouinard et al, 2017; Corporate Research Associates, 2011). Local volunteer groups tend to already have an established respectful relationship with the community, allowing for open dialogue (Adger et al, 2005; Dexter, 2011).

Chapter 6

Conclusion

6.1 Participating in coastal adaptation planning - opportunities and barriers

When it comes to planning around coastal changes related to climate change and sea level rise, communities face challenges that hinder their ability to participate in discussions around adaptation. These challenges create barriers that halt conversations and can prolong inaction.

Coastal climate change adaptation and management across the Atlantic Provinces has been by and large, left to local authorities and community decision makers to create, regulate and enforce (Chouinard et al, 2017). How do coastal community decision makers make decisions about their coast? Much of the adaptation that has taken place in the Atlantic Provinces is reactionary, repairing, reinforcing, or retreating from vulnerable coastal areas after the event (Arlington Group, 2013; Lawrence et al, 2018). Public pressure to repair damage done to the coast quickly can at times, feed this cycle reacting to damage rather than taking long-term planning into consideration.

Having the authority to create or adapt plans can establish governance over local coastal land use in some communities but for many, community decision makers are unable to create action because they do not have the resource capacity to internally address coastal climate change issues. Having the authority to make these important decisions has fostered discouragement in some coastal communities. Community decision makers do not know where to go for information and waste a lot of time trying to find the right point of contact for coastal adaptation or climate change scenarios. For communities

who want action, they do not know how to gain the knowledge to create the necessary changes. Lack of confidence does not breed commitment and leadership. As a survey participant states "*at the municipal level, there is very little in place to aid in this process, coastal management is included minimally in land use planning and zoning*" (Participant Z, Development and Guidance to Support Decision Making Survey, Oct 10, 2014). Community decision makers believed that more guidance would allow them to set their own standards for coastal land use, where they currently feel unequipped creating these standards and plans alone; a response also brought up in Chouinard et al, (2017). It is important to note that although participants want more support and guidance from the Provincial and Federal government, there is also perceived lack of confidence in these government departments to give real guidance. Perhaps this contention comes from their current feelings that they do not have the guidance they require to participate in adaptation (Chouinard et al, 2017) so they feel like they never will.

There are communities that currently implement land use planning along the coast. However, many community decision makers feel the current land use planning is scattered and current standards are not up to date for future sea level rise scenarios and/or have loopholes that allow for much development to continue in high risk areas through exemptions and variances. There is also a concern, mentioned by Prince Edward Island and New Brunswick participants that current land use regulations are often not upheld as there is a lack of enforcement from the province. Staff capacity to monitor coastal land use is not consistent. Even with the current land use dynamics at play along the coast, community decision makers see the value in land use planning to reduce risk and increase resiliency.

Other themes that emerged that hinder adaptation are current jurisdictional responsibilities. In some communities, there is an overlap of jurisdictional roles within some municipalities that can cause confusion around who should pay for damage inflicted by coastal hazards. Private land, federal and provincial infrastructure, grandfathered land along the coast are areas where jurisdictional confusion takes place. Difficulties arise when areas of the coast outside community's jurisdiction are subjected to coastal hazards and impacts the community's way of life. Sometimes, the issue is neglected by the party responsible and the issue starts to impact parts the community. For example, if a low-lying coastal road is damaged, many parts of a community become isolated while other jurisdictional parties fix the damage. Private land owners also want help from government departments for damage caused to their property by flooding and erosion although that is not their responsibility. Tension around liability between property owners, their elected official and government departments continues to arise in vulnerable areas across the Atlantic Provinces.

Economic and social trends, eroding tax base, aging population and infrastructure in coastal communities hinders decision makers' capacity to implement plans. Availability of financial reserves is limited. How can these communities get enough financial help to comfortably support all current essential services and have a cushion to strategically plan for the future? Availability and access to tools, programs, databases, software, basic instruments and human resources (experts, academics, professionals, NGOs, environmental organizations, etc.) are limited. Resources are considered necessary and important in starting the discussions around climate change adaptation and developing strategies for coastal adaptation. Limited resources and funding leads to prioritization by

community decision makers. Decisions are finalized based on demands for services put forth by the public. Long-term planning is rarely considered a priority when most of economic resources are required to deal with current community needs.

Community decision makers believe climate change adaptation should have community involvement and interest. Interest leads to participation and governance. However, many community decision makers believe there is a lack of public interest to move forward with adaptation action in their community. Community decision makers will not participate if there is either insufficient support or strong criticism from the public. The lack of public concern for climate change has led to local governments taking little to no action toward adaptation. If local residents do not raise the concern, the topic is never brought to the table. Bringing forth information about emergency response and management, having experts come to the community for information sessions and workshops may be a cost-effective way to get information to the public.

Partnerships and collaborations are one of the main sources of information and guidance for community decision makers. Fostering partnerships within and outside of communities creates connections for sharing resources and knowledge that can be mutually beneficial for parties. Multi-sector collaboration is important to continue cross sector dialogue and information sharing. Collaborations are considered to be a consistently beneficial way for municipalities to gain information, resources and create allies.

Proximity to boundary organizations still plays a role in the Atlantic Provinces, with many communities taking advantage of local environmental organizations for information for their decision making as well as disseminate information to the public. How close a

community is to larger population centres, community colleges, universities and environmental industries and organizations can provide more information and engagement around environmental issues like climate change research. Those communities who are close to such resources are aware of the opportunities and advancements they have at their disposal over those that are not at close proximity. Opportunities of taking part in a regional level in order to share resources and services increase the likelihood of all municipalities succeeding. A recommendation in the 2010 Nova Scotia Towns Task Force focused on service sharing agreements (Towns Task Force, 2012). Neighbouring coastal communities across the Atlantic Province see the benefit of working with each other to come up with approaches make them more resilient, some of which joining forces to apply for funding as a collaborative (Powell, 2018). Smaller communities feel like they have a fighting chance if they join forces to access resources, funding and expertise.

Boundary organizations and partnerships allow for expansion of information through public education opportunities like open houses, workshops, talks and training. Educational efforts are not always seen as helpful by community decision makers, but can be if they are accessible in the language used and if outreach is strategic and reaching the intended audience. Quick useful ways to educate the public is by highlighting local examples of adaptation action in the Atlantic Provinces, which can make adaptation feel more tangible and may increase political will to address their own coastal issues.

Although this research categorizes main themes that came out of the data, as mentioned above the major themes are not mutually exclusive. The absences and presences of any of these themes in a community holds different weight, predicated on

different relationships and does not necessarily reflect to true resiliency of a community. While the absence of any of main themes can hinder a community's ability to take part in adaptation planning, their presence does not necessarily increase a community's likelihood to benefit a decision maker's ability to move forward with adaptation planning. But their presence, or lack of, is believed to create opportunities or barriers for community decision makers across the Atlantic Provinces in their ability to participate in or adopt coastal adaptation strategies. How interwoven these themes are holds value in how to move forward to address communities needs for guidance. If one of these themes presented itself to a community, this could start the process of participating in adaptation and lead to future opportunities and other themes from the data to emerge. For example, if a council member and a local environmental group started a working relationship, opened up dialogue, there may be more opportunities in the future to apply for adaptation project funding. The themes of partnerships, knowledge transfer, funding, commitment, community effort and formal role would all tie into this relationship advancement over time. Fostering relationships can create opportunities for these other themes to emerge through this relationship (e.g. funding opportunities, information fluency, regional collaborative, and resources).

6.2 Recommendations for coastal decision markers - Atlantic Provinces

There are several key action items that can take place at a community level to begin planning and budgeting for adaptation. Financial necessities leave many communities with limited resource capacity to plan for the long term. Is there a way that these services can be provided without impacting others? To address these financial concerns, municipalities partner with organizations to secure program and grant funding. Although

this is a great way for some communities to work towards climate change adaptation action, many communities do not have the capacity to search out funding opportunities and apply for these grants. In order to address these financial limitations, internal budgeting should take place, however limited that budgeting may be. Because communities have little financial capacity, getting a sense of priority issues is a good step in strategically planning for coastal climate change. The Municipal Climate Change Adaptation Program allowed municipalities in Nova Scotia to take advantage of a funding program in order to identify their vulnerabilities, assets, barriers and opportunities. Similar programs could be created for the other Atlantic Provinces to help their service decision makers identify priority areas. The MCCAP program has not enforced municipalities to use their MCCAP and the report not a part of everyday decision making in the municipality (Vogel, 2015). Even with the MCCAP program, Nova Scotia Municipalities are constrained by low political will, knowledge gaps, financial and resource limitation (Vogel, 2015).

Political will was brought up by decision makers as a main constraint for their ability to take part in long-term adaptation planning. Community decision makers state they will not participate if there is either insufficient support or strong criticism from the public to move forward. If decision makers are aware of future risks, should they not feel obligated to act instead of waiting for public political interest? Waiting on public support can and has led to inaction, reactionary responses (Adger et al, 2009) and maladaptation (Magnan, 2014). How do community decision makers stimulate political will enough to incorporate long-term planning when most action comes from immediate threat (Gibbs et al, 2013)? Perhaps in order to stimulate change in behaviour in the public, efforts should be

increased within municipal council to spread awareness within the community. Inviting organizations to come in to host talks, demonstrations or workshops can help stimulate that conversation.

6.3 Future research opportunities and recommendations

There are many opportunities for further research and use of the data collected during this study. There were limitations in how the data was treated. The data was not organized for the fullest interpretation. The primary framework created was very broad and could have been more specific within each primary category. If the data is to be used in the future, dissociating the data sources and excluding the interviews could allow for better comparison, looking at trends and specific similarities and differences in order to get full triangular analysis. Cross analysis between distribution of survey participate would also be beneficial in gaining more insight on similarities and differences.

It is important to note that our country is in a different political climate compared to when this research started. In 2014, there was little federal funding being placed into climate change research and adaptation. Currently, there are many programs in place with an emphasis on coastal adaptation and innovation; such as the EcoAction Fund, Climate Action Fund and the Environmental Damage Fund through Environment and Climate Change Canada (2018). These funding opportunities as well as many others are providing avenues for communities to create partnerships to gain the knowledge and expertise they desire. In regards to the themes that did emerge through this interpretation of the data, one of the biggest questions to address is how do boundary organizations who aid coastal decision makers make sure they are providing the best possible guidance to communities and support them through funding opportunities. Building relationships and fostering

internal confidence around the subject of climate change adaptation are important factors in supporting community decision makers. A way to help community decision makers' feel more confident discussing climate change adaptation is through trusting relationships and knowledge sharing.

The information is available for coastal communities in the Atlantic Provinces to begin the process of adaption action, but challenges arise in accessibility. Making the information accessible makes it usable, and increases the user's confidence in the information. The way information is presented and disseminated to community decision makers and the public has a lot of influence on how it is perceived. The credibility of sources used to make information available is important. There is concern by decision makers that there is little fluency between departments and organizations that translate climate change information to the public which creates confusion as different information is presented. The language, dialogue and visual aids used are important for clearly and concisely conveying information to decision makers and the general public. Any tools or guidance provided to communities should use easy to understand language, visual keys and local examples to make the content relevant and approachable for community decision makers who may not have a background climate change science. Providing locally relevant examples will increase interest in any guidance or tools provided to residents and municipal decision makers.

To aid these communities, provincial and/or federal government entities should provide consistent information and set of standards for local decision makers. There seems to be a strong desire for local communities to use guidance and support from Provincial/Federal Departments and to establish plans and policies that fit their local

needs and help integrate them into everyday operations. Communities want guidance from higher levels of government that they can trust and adapt to their local context. Communicating knowledge is still considered a major obstacle, providing a space that catalogues and effectively communicates guidance documents, tools, technical and scientific data that can help decision makers was mentioned often by workshop participants. There is also a concern with accessing the physical transfer of information. How do we make sure the intended audience gets access the information that was made for them? Knowledge transfer is still considered a major obstacle for the dissemination of guidance documents as well as any technical or scientific data.

Further initiatives are needed by special interest groups that aid in data collection and guidance for Atlantic Canadian communities, such as Provincial/Federal departments, academics, environmental organizations and collaborations. These efforts should assist in strengthening community capacities, knowledge transfer, geospatial decision support, funding plans, and training programs. Support from boundary organizations (climate services, NGOs, and community groups) to help bridge conversation between government agencies, academics, scientists with community decisions makers and the public can create opportunities to develop strong ties, and foster innovative solutions to local needs. Community decision makers see the value in partnership as a source of information and a bridge to make climate science information locally relevant (Schauffler, 2014; Sheppard et al, 2011). Placing climate change risk and vulnerability information in a local context, making the information relevant to the Atlantic Provinces is valuable for community decision makers to seriously consider the information. Providing examples of work that

has been done in the Atlantic Provinces can make adaptation more realistic, attainable and believable, increasing local buy in from decision makers.

How do boundary organizations help communities escape the cycle of reaction to coastal issues? Outside of leveraging money for projects, there needs to be a focus on actionable ways to increase resiliency and long-term planning. Further focus on the implementation stage of adaptation is needed (Bednar et al, 2018). Bednar et al (2018) states that templates, checklist that guide different sectors and scales would be very useful in order for these communities to set tangible goals and decrease avoidance from being overwhelmed with where to start (Bednar et al, 2018).

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APPENDIX A

Coding manual

Coding Manual

This is the Phase 1 coding manual for research conducted by Brittany MacIsaac to complete data analysis on the social needs of coastal communities dealing with coastal issues related to climate change.

The main research question to be addressed in which this coding manual will help inform is:

Determine the factors that influence coastal community decision makers' participation in or adoption of adaptation strategies in the Atlantic Provinces.

Through the use of NVivo qualitative software, survey, community workshops and semi-structured interviews will be analyzed and important topics will be selected and placed into one of the following "nodes".

The following nodes are initial topics that have come out of the data during Phase 1 of data analysis. Each node will be further analyzed in order to come up with the main themes that arise out of the data in Phase 2 of analysis.

Participation & Involvement

Description: Participants may bring up who they believe should participate during a discussion surrounding coastal issues and climate change adaptation. Or they may explain what they believe it means to be involved in climate change adaptation or coastal work.

*If a participant gives an example of their involvement, that should be coded into a the code **"**

Atlantic Provinces- Current/Past Work"

*Each mention of a group, person, organization or department that should be involved should be coded as separate

Examples: "We conduct presentations within schools regularly"; "Conduct presentations within schools regularly. ";"All level of government"; "NGOs"; "Community"

Making Decisions (Community Level)

Description: How does decision making currently occur within a community or organization? What do participants say about successful decision-making? Themes may be related to economic, policy, ecological, environmental, social, political or cultural dimensions.

Examples: "The community addresses issues as they come up"; "clear jurisdiction and responsibility"; "Cooperation at all levels of government is essential" ; "what we've always done"; "Listen to the people who live by the coast"

Community Needs

Description: What the participants believe would help them deal with climate change and coastal issues. The node is not telling what is not working (that is in the constraints) but rather what community members are actively advocating to have available to them.

Examples: “access to current information may help them make informed decisions on how to proceed mitigating or enhancing the effects of climate change” ; “Promotion of public understanding of the dynamic living coastal ecosystem” ; “strong emphasis on good regulation, zoning and enforcement” ; “Clear guidelines to municipalities on coastal management planning or provincial planning for coastal issues, removing responsibility from municipalities.”

Decision Support Tool (Comments from Participants)

Description: During the AP291 workshops, participants were asked what they would like to see out of the AP291 Decision Support tool; how it might help their community and what they would like to see it function as for them. The comments are specific to the AP291 workshops and will be considered a subtopic in the Comment Needs node. Comments might be related to the tool as a whole or specific aspect of the tool. Project team in discussing how to make this tool user friendly made some of the comments.

Examples: “Participants recommended that qualitative assessment could replace the numbers. For example, ‘highly suitable’, ‘suitable’, etc.” ; “Questions should be worded to reflect its intent.” ; “Adaptation Options provided should align with provincial policies.” ; “A list of available resources can benefit user”

Enabling Factors

Description: This node looks at what participants believe is allowing them to move forward with adaptation planning. What factors make is easier for them to complete adaptation work/projects related to coastal issues on public and private land in the community? Enabling factors are looked at in a participant’s ability to use the

Decision Support Tool; what themes in the tool would make a user want to continue using the tool.

Examples: “I think users would benefit from seeing at least some examples of excluded options in the output, with the reasoning (e.g. armour stone was excluded because there is no foreshore at this site.”)” ; “Provide information to mitigate disadvantages for Adaptation Options.” ; “Identify interactions between Adaptation Options” ; “visually appealing” ; “Resources to help complete the questions would benefit communities.”

Factors that are consistently positive

Description: There may not be a lot of these factors but from the Decision Support Tool workshops, there were a number of themes that were brought up as being consistently positive for enabling a community member’s ability to use the Decision Support Tool.

*Examples: “*Concise and simple language” ; “ Use of local examples” ; “Visual aids” ; “Definitions and links to increase usability” ; “

Resistance Factors

Description: This node looks at what communities believe is causing constraints and missed opportunities for proactive adaptation planning. What are the factors that make is difficult for property owners or municipal/community official to make decisions about coastal issues? These factors often times make it harder for adaptation to take place and therefore are consider resistance factors as they hinder a coastal stakeholders ability to move forward. Resistance factors are looked at in a participant's ability to use the Decision Support Tool; what themes in the tool would make a user stop using the tool.

Examples: "There is an apparent lack of effective communication with non-local governmental departments" ; "multiple governmental jurisdictions within the community have inhibited proactive planning for severe weather events." ; "Funding" ; "experience may have reinforced to them the notion that outsiders know less than locals." ; "do not have access to LIDAR"

Climate Change Action – Importance

Description: Comments from participants on their understanding of why climate change adaptation action is important to them.

Examples: "Water quality will be paramount for fishing and coastal aquaculture – already at risk due to sea level rise" ; "we need to protect our coastal communities" ; "the longer we put off action the more dangerous and costly it will be in the future"

Atlantic Provinces – Current/Past Work

Description: Information that has come out of the workshops, surveys, interviews that provides information on work that has already been completed or is currently being completed within a community, region or province. This can be major projects (Regional climate change action plan) or easy cost effective work (newsletters, tree planting etc.).

***** Do not code potential future work – Future work is subject to change and may not get funded.

Examples: "Effective May 1, 2012, all Newfoundland municipalities were required to have an Emergency Management Plan (EMP)." ; "Souris has in the past received some different advice about suitable adaptation . They hired an engineering consultant to propose an engineering solution for beach replenishment along their causeway" ; "Beach stewardship has a booklet dealing with coastal issues as well as EAC has a booklet on coastal stewardship" ; "Put fences up angled to the west which they figured would trap more sand."

APPENDIX B

Coastal adaptation: input in the development of guidance

survey

Coastal Adaptation: Input in the Development and Guidance of ACASA

Development and guidance to support local decision making

Atlantic Climate Adaptation Solutions Association (ACASA) with the support of Natural Resources Canada is currently developing a coastal adaptation guidance decision tree for rural communities throughout Atlantic Canada. The decision tree will include guidance around a range of engineering and land use planning tools that could be suitable for the situations we encounter or anticipate in our east coast communities.

Your Role: We would very much appreciate your participation in this important project. Your input will provide much needed insight regarding the needs of rural municipalities when it comes to planning for climate change.

Participation in this study is completely voluntary. The questionnaire will take approximately 30 to 40 minutes. You are free to take part in the survey individually or answer the questions as a group effort. The survey can be saved and completed at a later time if necessary. However, due to the nature of the survey, it must be reopened and completed on the same computer from which it was started.

Confidentiality: All of your answers are completely confidential. Information will be kept in a secure location and password protected. Information collected will be used to inform the decision tree as well as in a thesis and any subsequent related journal articles.

Ethics Approval: This project has received ethics approval through Saint Mary's University's Office of Research Ethics. If you have any questions or concerns about ethical matters, you may contact the Chair of the Saint Mary's University Research Ethics Board at ethics@smu.ca or 9024205728. The Research Ethics Board file number is: **#14326.**

Contact Information: If you have questions or concerns, you may contact **Brittany MacIsaac** at ***9024785171*** or by email at: ***brittany.macisaac@gmail.com*** or **Dr. Danika van Proosdij** at ***9024205738*** or by email at: ***dvanproo@smu.ca.***

Thank you in advance for your participation.

Brittany MacIsaac
Saint Mary's University

PART 1:
Management Systems: Current and Future Goals

This section focuses on the steps involved in coastal management and decision making.

Adaptation: Actions taken to help the human and natural environment cope with changing climate conditions.Examples of climate change adaptation include: raising a bridge to accommodate a rise in sea level, building a sea wall to protect against erosion of the shoreline, and restricting development in areas prone to coastal flooding.

*1. Do you have experience with adaptation planning in your community or organization?

- Yes
- No
- I don't know

Management Systems: Current and Future Goals

This section focuses on the steps involved in coastal management and decision making.

Coastal Adaptation: Input in the Development and Guidance of ACASA

Adaptation: Actions taken to help the human and natural environment cope with changing climate conditions.Examples of climate change adaptation include: raising a bridge to accommodate a rise in sea level, building a sea wall to protect against erosion of the shoreline, and restricting development in areas prone to coastal flooding.

*2. How would you characterize the status of climate change adaptation planning in your community or organization at this time?

- ○ There has been limited climate change adaptation planning taking place within the community.
- ○ Climate change adaptation planning tends to take place after an event has triggered coastal issues (e.g. erosion, flooding).
- ○ Climate change adaptation planning is taking place before effects of climate change have occurred.
- ○ Climate change planning has not taken place in this community.
- ○ I don't know.

*3. In which of the following ways does your community or organization consider climate change in planning and decision-making? You may choose more than one response.

- ☐ Long term planning and/or policy decision
- ☐ Current operational (everyday) decisions
- ☐ Risk management planning (e.g. emergency measures operations)
- ☐ Designing of infrastructure/facilitaties
- ☐ Preliminary research and discussion
- ☐ Development plans
- ☐ Currently doesn't consider climate change adaptation
- ☐ I don't know
- ☐ Other (please specify)

*4. Adaptation to climate change can take place in different ways. Which of the following do you feel is the most effective form of adaptation?

- ○ Building capacity (research, mapping, modelling, risk and vulnerability assessments)
- ○ Policy (legislative, jurisdictional, acts)
- ○ Operational (physical or managerial)
- ○ I do not have the knowledge or experience needed to answer this question

Other (please specify)

Coastal Adaptation: Input in the Development and Guidance of ACASA

Management Systems: Current and Future Goals

The coastal zone is defined as the region where interactions between the sea and land processes occur. There are a number of coastal processes that influence the shape and function of a coastal system.

Coastal Processes: The coastal zone is subject to multiple interactions, which work together to create the unique environments you see along the coast. These interactions are known as coastal processes and can be divided into the six main processes described below:

Erosion: the process by which soil and rock are removed from an area through processes such as water flow or wind.

Deposition: when material is removed from one area, through processes such as erosion, and is carried (transported) by wind and water to another location.

Wind Waves: moving water that results from wind blowing across its surface. Factors that influence the formation of waves are: wind speed, fetch (distance of open water), and width of fetch, wind duration, and water depth.

Wave Energy: as wind blows across the surface of the ocean, energy transfers from the wind to the ocean surface in the form of a wave. The amount of energy transferred is the wave energy. The longer the wind is blowing over the water surface and the stronger it is, the more powerful, higher, faster the wave will be.

Sediment Transport: movement of soil, mud, and rock material through the action of water or wind. Sediment transport that occurs in water moves through currents and tides and is deposited further downstream or alongshore.

Sediment Supply: the rate of transport of sediment within a coastal environment from water or wind processes. The supply depends on local erosion rates and deposition.

*5. What is your level of knowledge of each of the following coastal processes?

	Excellent knowledge	Moderate knowledge	Little knowledge	No knowledge
Erosion	○	○	○	○
Deposition	○	○	○	○
Wind waves	○	○	○	○
Wave energy	○	○	○	○
Sediment transport	○	○	○	○
Sediment supply	○	○	○	○

*6. Does your community or organization face any issues from climate change impacts (e.g. erosion, flooding, sea level rise, storm surge)?

- ○ Yes
- ○ No
- ○ I don't know

Management Systems: Current and Future Goals

Coastal Adaptation: Input in the Development and Guidance of ACASA

***7. Has any work been done in your community or organization to address these issues?**

- Yes
- No
- I don't know

Management Systems: Current and Future Goals

***8. What do you feel is the *greatest* constraint when it comes to implementing climate change adaptation in your community?**

- Lack of staff
- Lack of expertise/data to guide decision making
- Lack of funding
- Jurisdictional boundary issues
- Lack of community consensus on need for planning
- Lack of community consensus on best action to take
- I don't know
- Other (please specify)

Management Systems: Current and Future Goals

Coastal Adaptation: Input in the Development and Guidance of ACASA

***9. Which of the following strategies has your community or organization used? Click if you thought it was useful.**

	Not at all	Somewhat	Very well	N/A	I do not have the knowledge or experience needed to answer this question
Community education in coastal dynamics (e.g. erosion, tides, flooding).	○	○	○	○	○
Community education in land use planning.	○	○	○	○	○
Community education in coastal management and decision making.	○	○	○	○	○
Emergency response planning.	○	○	○	○	○
Development of coastal management strategies.	○	○	○	○	○
Risk and vulnerability assessments.	○	○	○	○	○

Management Systems: Current and Future Goals

***10. Who have you sought guidance from in regards to coastal management? Please rate, in your experience how helpful each resource was (You may check more than one answer if it applies to your experience).**

	Not at all helpful	Somewhat helpful	Very helpful	N/A
Federal services	○	○	○	○
Provincial services	○	○	○	○
Municipal services	○	○	○	○
Professionals	○	○	○	○
College/University research	○	○	○	○
Nongovernmental organizations (NGO)	○	○	○	○
Peer networks	○	○	○	○
Local knowledge	○	○	○	○
Newpapers	○	○	○	○
Radio/Television	○	○	○	○
Websites	○	○	○	○

Specific information about certain organizations you turn to for guidance

Coastal Adaptation: Input in the Development and Guidance of ACASA

Management Systems: Current and Future Goals

***11. Please rank the following resources with *1* being the *least* useful and *4* being the *most* useful in helping decision makers decide if adaptation is required?**

▾	Accessible and detailed research information.	☐ I don't know
▾	Local knowledge from community members who may have guidance on dealing with coastal issues through past experiences.	☐ I don't know
▾	Best management guidance documents/manuals.	☐ I don't know
▾	Training workships/videos/tutorials.	☐ I don't know

***12. Please rank the following resources with *1* being the *least* useful and *4* being the *most* useful in helping decision makers choose an adaptation option?**

▾	Accessible and detailed research information	☐ I don't know
▾	Local knowledge from community members who may have guidance on dealing with coastal issues through past experiences	☐ I don't know
▾	Best management guidance documents/manuals	☐ I don't know
▾	Training workships/videos/tutorials	☐ I don't know

13. From the list of funding sources provided below, where would you *most likely* turn to seek funding to address climate change impacts? You may choose up to 3 responses.

- ☐ Federal government
- ☐ Provincial government
- ☐ Municipal government
- ☐ Applying to other funding bodies outside of government support
- ☐ Collaborative research programs with academic institutions
- ☐ Community fundraising
- ☐ Organizations within the community or NGO
- ☐ I don't know
- ☐ I have not requested funding
- ☐ Other (please specify)

Coastal Adaptation: Input in the Development and Guidance of ACASA

Management Systems: Current and Future Goals

14. Can you think of additional support systems that might help decision makers implement climate change into their community planning?

15. As a decision maker, are there any areas of coastal management and climate change adaptation that you would like more information about?

PART 2:
Adaptation Options: Land Use Planning

Land use planning is a branch of public policy which seeks to order and regulate land use in an efficient and ethical way in order to prevent land use conflict, secure health and well-being of urban and rural communities.

***16. Do you have experience with land use planning?**

- Yes
- No

PART 2:
Adaptation Options: Land Use Planning

Land use planning is a branch of public policy which seeks to order and regulate land use in an efficient and ethical way in order to prevent land use conflict, secure health and well-being of urban and rural communities.

Coastal Adaptation: Input in the Development and Guidance of ACASA

***17. Has your community adopted any of the following land use planning tools?**

- [ ] Coastal management strategies/plans
- [ ] Community sustainability plans
- [ ] Emergency prepardness
- [ ] Restricting land use through zoning
- [ ] Incorporating setbacks for buildings or other structures from roadways, watercourses or other areas for protection.
- [ ] Site design standards
- [ ] Not applicable (not part of a community)
- [ ] Other (please specify)

***18. In your opinion, how well does each of the following land use planning tools help with coastal vulnerabilities (e.g. erosion, flooding, sea level rise) Hover mouse over terms for definitions.**

	Not at all helpful	Somewhat helpful	Very helpful	Not Familiar
Planning Framework Tools in the form of *Strategic Plans and Frameworks*	○	○	○	○
Capacity Building Tools	○	○	○	○
Statutes & Regulatory Tools in the form of *Zoning*	○	○	○	○
Statutes & Regulatory Tools in the form of *Setbacks*	○	○	○	○
Land Use Change & Restriction Tools	○	○	○	○
Site Design Tools	○	○	○	○

If you are familiar with other land use planning tools and wish to comment on their importance, please specify below.

Adaptation Options: Coastal control structures

Coastal control structures are features that are placed within the coastal zone that help protect against flooding or erosion. Control structures can be divided into two broad management techniques:

There are many different types of structures that can be used, depending on the coastal issue that needs to be addressed. This section asks for your current knowledge of structural controls in the coastal zone.

Coastal Adaptation: Input in the Development and Guidance of ACASA

1) Hard methods: Protecting the coastline using static material, such as concrete and rock which is difficult to move and often prevents coastal processes from occurring.

2) Soft methods: Protecting the coastline by taking advantage of natural coastal elements (such as sand, reefs, dunes and vegetation). This prevents erosion and flooding by using or enhancing techniques that are part of natural coastal processes (for example beach nourishment and artificial reefs).

Coastal Adaptation: Input in the Development and Guidance of ACASA

3) Hybrid methods: Protecting the coastline by using a combination of both hard and soft methods. For example, planting marsh grass for stabilization as well as using a low rock sill to protect the vegetation from strong wave action.

***19. How familiar are you with a variety of structures designed to protect the coastline?**

- Very familiar
- Somewhat familiar
- Not at all familiar

***20. Please indicate the most important function that coastal control structures perform in your area:**

- Protection against erosion
- Protection against coastal flooding from storm surge and wave action
- Protection against inland/seasonal flooding from runoff
- All of the above
- We do not experience any coastal issues (e.g erosion, flooding) that need to be controled by coastal structures
- I don't know
- Other (please specify)

***21. Has your community implemented coastal control structures?**

- Yes
- No
- I don't know

Coastal Adaptation: Input in the Development and Guidance of ACASA

Adaptation Options: Coastal control structures

22. In your experience, what are the primary constraints that impact the *installation* of coastal control structures? Choose up to 3.

- [ ] Regulatory requirements
- [ ] Lack of expertise
- [ ] Cost
- [ ] Environmental factors
- [ ] Lack of public consensus
- [ ] Jurisdictional conflict
- [ ] I don't know
- [ ] No installation constraints
- [ ] Other (please specify)

23. In your experience, what are the primary constraints that impact the *maintenance* of coastal control structures? Choose up to 3.

- [ ] Regulatory requirements
- [ ] Lack of expertise
- [ ] Cost
- [ ] Environmental factors
- [ ] Lack of public consensus
- [ ] Jurisdictional conflict
- [ ] I don't know
- [ ] No maintenance constraints
- [ ] Other (please specify)

Adaptation Options: Coastal control structures

Coastal Adaptation: Input in the Development and Guidance of ACASA

24. Out of the eight options provided above, please choose the *top 3* (indicated by photo number) structures you believe are the best for dealing with erosion?

- [ ] 1
- [ ] 2
- [ ] 3
- [ ] 4
- [ ] 5
- [ ] 6
- [ ] 7
- [ ] 8
- [ ] I do not have the knowledge or experience needed to answer this question

Coastal Adaptation: Input in the Development and Guidance of ACASA

25. Out of the eight options provided above, please choose the *top 3* (indicated by photo number) structures you believe are the best options for dealing with flooding?

- [ ] 1
- [ ] 2
- [ ] 3
- [ ] 4
- [ ] 5
- [ ] 6
- [ ] 7
- [ ] 8
- [ ] I do not have the knowledge or experience needed to answer this question

Respondent profile:

To get a sense of your area of expertise, a series of questions will be asked regarding your main interactions as a coastal stakeholder.

Coastal Adaptation: Input in the Development and Guidance of ACASA

***26. What coastal region in Atlantic Canada are you representing?**

- Newfoundland and Labrador
- Nova Scotia (Atlantic Seaboard)
- Nova Scotia (Bay of Fundy)
- Nova Scotia (Gulf of St. Lawrence)
- Prince Edward Island
- New Brunswick (Gulf of St. Lawrence)
- New Brunswick (Bay of Fundy)

***27. What is the dominant coastal setting in the area you are representing?**

- Sandy beach and/or dunes
- Cliff (rock)
- Bluff/cliff (galcial till, mixed sand, clay, gravel)
- Salt marsh or coastal wetland with or without dykes
- Estuary (river mouth with bay)
- Cobble beach or barrier
- Other (please specify)

28. If applicable, what is the population size of the community you are representing? Does not have to be exact.

Coastal Adaptation: Input in the Development and Guidance of ACASA

***29. Which of the following best describes your role? Check all that apply if the questionnaire is being completed by several individuals.**

- [ ] Municipal official/employee
- [ ] Government representative
- [ ] Engineer
- [ ] NGO
- [ ] Planner
- [ ] Administrator
- [ ] Councilor
- [ ] Academic/Research
- [ ] Committee Member
- [ ] Citizen
- [ ] Other (please specify)

***30. How often are you involved with decision making related to coastal planning and management?**

- ○ Daily
- ○ Weekly
- ○ Monthly
- ○ When needed
- ○ Other (please specify)

Thank you for participating in the survey!
Results of the survey will be located on the ACASA website (http://atlanticadaptation.ca/) once the project is completed

APPENDIX C

Interview request

SAINT MARY'S UNIVERSITY SINCE 1802
One University. One World. Yours.

923 Robie Street, Halifax, Nova Scotia, Canada B3H 3C3
902-420-5737 www.smu.ca

Dear Participant:

Atlantic Climate Adaptation Solutions Association (ACASA) with the support of Natural Resources Canada is currently developing a coastal adaptation guidance decision tree for small coastal communities in Atlantic Canada. The decision tree will include guidance from engineering and land use planning tools that could be suitable for the situations we encounter or anticipate in our east coast communities.

As part of my masters at Saint Mary's University I am responsible for the development of the decision tree and I am looking to interview a wide range of decision makers and community members in an effort to provide much needed insight regarding the needs of rural municipalities when it comes to planning for climate change. We would very much appreciate your participation in this important project. We are specifically interested in engaging with those who work as community staff and council members, maintenance, public works departments and consulting organizations. Engaging with these members of a community will allow for a better understanding of how decisions are currently being made regarding coastal issues and potential factors that can increase the success of coastal adaptation strategies in the future. This information will allow us to develop a tool that will take into account the current and future needs of communities.

You are invited to participate through a semi-structured interview by phone or skype, depending on what you feel more comfortable with. If you are interested in taking part, please contact Brittany MacIsaac (902-478-5171) or (brittany.macisaac@gmail.com) for more information. If you know of anyone who may be interested in taking part, please fill free to forward this invitation.
For more information about the project, please refer to the attached information sheet. If you have any questions about the project, we encourage you to contact either myself Brittany MacIsaac (brittany.macisaac@gmail.com), Dr. Danika vanProosdij (dvanproo@smu.ca) or project manager Stephanie Arnold (starnold@upei.ca)

This project has received ethics clearance through Saint Mary's University's Office of Research Ethics. If you have any questions or concerns about ethical matters, you may contact the Chair of the Saint Mary's University Research Ethics Board at ethics@smu.ca or 420-5728. The Research Ethics Board file number is: #14-326.

Thank you in advance for your participation.

Brittany MacIsaac

APPENDIX D

REB Certificate

PANEL ON
RESEARCH ETHICS

Navigating the ethics of human research

TCPS 2: CORE

Certificate of Completion

This document certifies that

Brittany MacIsaac

has completed the Tri-Council Policy Statement:
Ethical Conduct for Research Involving Humans
Course on Research Ethics (TCPS 2: CORE)

Date of Issue: **24 January, 2014**