Citizens' Perception of Values Associated with Dykes and Dykelands: The Case of Nova Scotia

By

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

at

Dalhousie University
Halifax, Nova Scotia
April 2013

DALHOUSIE UNIVERSITY

SCHOOL FOR RESOURCE AND ENVIRONMENTAL STUDIES

The Undersigned hereby certify that they have read and recommend to the Faculty of Graduate Studies for acceptance a thesis entitled "CITIZENS' PERCEPTION OF VALUES ASSOCIATED WITH DYKES AND DYKELANDS: THE CASE OF NOVA SCOTIA" by Grace Asiedu in partial fulfilment of the requirements for the degree of Master of Environmental Studies.

Dated: December 11, 2012

Supervisors: _____

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DALHOUSIE UNIVERSITY

DATE: December 11, 2012

AUTHOR: Grace Asiedu

TITLE: Citizens' Perception of Values Associated with Dykes and Dykelands: The Case of Nova Scotia

DEPARTMENT OR SCHOOL: School for Resource and Environmental Studies

DEGREE: MES CONVOCATION: MAY YEAR: 2013

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Signature of Author

Dedication

This thesis is dedicated to my dad (Dr. S. K. Asiedu) for all his immeasurable support in my life, my mom (Edith Fumey) and grandmother (Grace Brempomaa) for their encouragement and continuous prayers, and all my loved ones who have made this dream a success.

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ABSTRACT

Originally built for agricultural purposes by Acadians, dykes and dykelands have now found wider uses in protecting life and property in Nova Scotia and require regular maintenance. This research identifies some values that can be associated with dykes and dykelands and people's perceptions of them. Semi-structured face-to-face interviews comprising open- and closed-ended questions were used in data collection. Agriculture, flood prevention and Acadian history and heritage were the most important values to most respondents in both open- and closed-ended responses. The results identified differences in people's perceived values when they were provided with more information. The values placed on dykes and dykelands depended on their physical location, available information, and the activities and properties around the dykes. Peoples' connections with dykes and dykelands had little influence on their values and perceptions. These findings provide important baseline information for further discussion about dyke and dykeland values and the case for effective maintenance.

LIST OF ABBREVIATIONS USED

IPCC: Intergovernmental Panel on Climate Change

MDRC: Maritime Dykelands Reclamation Committee

MMRA: Maritime Marshland Rehabilitation Act

NSDA: Nova Scotia Department of Agriculture

NSDAF: Nova Scotia Department of Agriculture and Fisheries

NSDAM: Nova Scotia Department of Agriculture and Marketing

NSDNR: Nova Scotia Department of Natural Resources

UNESCO: United Nations Educational, Scientific and Cultural Organization

ACKNOWLEDGEMENTS

I'm immensely grateful to my co-supervisor Dr Peter Duinker for all the support, guidance and encouragement for me to "love" my work and not just like it. I have come this far because of you. I would like to thank my co-supervisor Dr. Steve Clark who encouraged me to undertake a master's degree and introduced the research on dykes and dykelands. I'm so grateful to Dr. Kate Sherren who came in as committee member when I needed assistance, and sacrificed a lot for me.

I thank Prof. William Lahey, my external reader, for his acceptance as external during a busy time of year. To all faculty and staff at SRES, I appreciate your time and support throughout my study. There wouldn't have been any better place than SRES.

I acknowledge and thank my mum and dad for their love and support throughout the study. To my father, my pride, my hope, advisor and source of grant, Dr. Samuel K. Asiedu, I say thank you for being there for me. Life would have been miserable without you but thanks for always being there for me. I thank my grandmother who knew nothing about my thesis yet encouraged me on the journey with prayers and good wishes.

I extend a sincere thanks to Dr & Dr Eghan, Dr. Francis Boabang, Dr Kwamena Aidoo, Mrs Asamoah-Odei, Ms Ntorbea Asamoah-Odei, Mr Stanley Ankrah, and all other family and friends in Ghana who have contributed in many ways in my life. I appreciate your love and support to ensure I complete the program. Finally I would like to thank everyone who either consciously or unconsciously contributed to my work.

I'm proud of you all for making me who I am today.

CHAPTER 1 INTRODUCTION

1.1 Problem Statement

Along the shores of the Bay of Fundy many types of ecosystems exist, including salt marshes and dykelands. The salt marsh is a natural ecosystem that provides important ecological functions and services, which include water filtration, carbon sequestration, habitat for plants and animal species, and a buffer against floods (Connor, Chmura, & Beecher, 2001; Singh,Walters, & Ollerhead, 2007). Dykeland is land created from salt marshes through the construction of barriers known as dykes. Dykelands provide farmlands, recreational and commercial spaces, and terrestrial habitats for plants and animal species. Although the building of dykes changed the natural ecosystem along the Bay of Fundy and affected its biodiversity, it brought substantial agricultural benefits to the province (NSDAM, n.d). Nova Scotia has many dykes which date back to the early 1600s (Bleakney, 2004). The dykes were built to reclaim and protect salt-marsh lands for agricultural purposes.

The tides of the Bay of Fundy have continuously deposited sediments along the coast, leading to high fertility of coastal lands. The early French settlers were attracted to these sediments and introduced the building of dykes so they could turn the marshlands into arable land. The dykelands were the most fertile agricultural lands in the province, so much so that farmers could grow crops without fertilizers (NSDAM, 1987). Not only did the settlers introduce dykeland agriculture but also a unique French subculture (Bleakney, 2004).

Besides farmlands, dykes and dykelands have, over the past 350 years, also provided many other benefits to Nova Scotians. The dykes now protect life, property, and cultural artefacts from floods and storm surges. They protect valuable private, municipal, provincial, and federal properties (van Proosdij, 2011). Presently there are about 17,400 hectares of land protected by dykes in the province (MacAulay, 2012.Through site visits, I observed the extent to which some communities and their economic activities have become established thanks to the building and maintenance of dykes. However, dykes require regular maintenance if they are to continue to serve their multi-purpose function.

There are concerns that dykelands are threatened by the impacts of climate change, especially storm surges and flooding. The storm frequency and intensity and associated floods are predicted to be on the rise as a result of climate change, putting low-lying coastal areas at great risk (Singh,Walters, & Ollerhead, 2007; Möller, Spencer, French, & Leggett, 2007; Lieske & Bornemann, 2011). The Bay of Fundy is known to have high tides, and climate change has the potential to aggravate coastal flooding in the Maritimes. With any appreciable rise in sea level, the existing dykes may not be high enough to protect all the valuable properties. It is, therefore, necessary to plan ahead rather than wait for a disaster before acting. The breaching of the Mississippi delta dykes in New Orleans and the subsequent loss of life after Hurricane Katrina (Jonkman, Maaskant, Boyd & Levitan, 2009) should always be a guide in planning for areas that are vulnerable to similar disaster. Also, the recent flooding of parts of Truro by a breach in some of the dykes protecting the town on September 10, 2012 (Staff~The Truro Daily News, 2012) should be a strong motivator for a serious examination of the system of dykes and dykelands in Nova Scotia as a whole.

The dykes are maintained by the Resource and Stewardship Division of the Nova Scotia Department of Agriculture. The maintenance of dykes has been labour-intensive and costly to the province. Some people believe that dykes that no longer have direct or market (economic) values should be allowed to revert to natural salt marshes. Some of these arguments are made based on research suggesting that maintaining salt marshes is less costly than dykelands, and enhances natural habitats for important coastal plant and animal species (Singh, Walters, & Ollerhead, 2007; Möller, Spencer, French, & Leggett, 2007). The restoration of salt marshes is expected to provide a valuable buffer against storms and sea-level rise. Government is faced with making choices about whether to continue with dykeland maintenance or to allow some of the coastline to revert to salt marsh. Different stakeholders in the province have different perceptions of the dykes and dykelands as well as the salt marshes. Apart from farming, some people put a high value on the socio-cultural and ecological values of dykes.

This raises the following question: how do we know whether these dykes and dykelands are worth maintaining with taxpayers' money? The answer depends on what value society puts on the dykes and dykelands, as compared to other options for use of the land. It is relatively easy to put market prices on farmland, roads, and agricultural output and then let the provincial government use that information to decide how much to spend on maintaining dykes. But it is difficult to measure and put market prices on the ecological and socio-cultural values of dykes and dykelands. Over the years the dykes have become a historical artefact, promoted ecotourism, and provided a sense of place and attachment to different groups of people and communities.

Some values of dykes and dykelands are common to many people while others are not. To determine how valuable the dykes and dykelands are, it is useful to find out people's perceptions about dykes and dykelands and how they value them as individuals and groups. That information should form an important part of any decision-making concerning whether dykes should be maintained or whether they should be allowed to revert to salt marshes and use the resources allocated to dyke maintenance for other developments in the province.

Coastal dykes and dykelands can be evaluated based on the direct and indirect services they provide or values attributed to them. Evaluation may differ across studies depending on what services the researcher deems as more or less important. For example, Wells (1999) looked at the ecological, agricultural and other economic values associated with biophysical features of dykes and dykelands. It is relatively easy to identify some dyke and dykeland values from an economic perspective using market prices associated with them. By contrast, socio-cultural, ecological and other non-market values provided by dykes and dykelands can be identified through non-market evaluations of people's perceptions (Dissanayake & Smakhtin, 2007). Economists use techniques such as contingent valuation methods to assess the economic value of non-market goods and services (Lipton, Wellman, Sheifer, & Weiher, 1995). However, the purpose of this thesis is not to determine monetary value but to determine people's valuation of dykes and dykelands through their perceptions.

1.2 Project Overview

The Bay of Fundy is a unique ecosystem with the world's highest tides (Hebert Wilson, 1990). There were once numerous salt marshes but the arrival of a group of French settlers in the early 1600s to Nova Scotia changed the uses of many of the marshes. The French farmers inhabited the lands along the Bay of Fundy and invested time to turn these coastal salt marshes into dykelands for farming by building dykes (NSDAM, 1987). Although there were uplands available for farming in the province, the Acadians preferred to farm tidal marshes rather than to clear forested uplands. They built drainage systems, called aboiteaux, to allow salt water out of the land at low tide and prevent its inflow at high tide (Robinson, van Proosdij & Kolstee, 2004). Draining of the salt marshes to turn them to arable lands took 4-5 years and the dykes thereafter provided land that sustained farming and provided a livelihood for the people (NSDAM, 1987).

According to Nova Scotia Department of Agriculture experts, the topsoil of marshlands is very fertile due to silt deposits set down by ocean currents (NSDA, 2010). This made it possible for farmers to produce abundant crops without the application of fertilizers or manure (NSDAM, 1987), making farming easier and less expensive. It encouraged the Acadians to clear more marshlands for farming along the Bay of Fundy. It is reported that the dykes changed the ecosystem along the Bay of Fundy and provided a new habitat for some wildlife and plant species (NSDNR, 2009).

The dykes have also enriched Canada's cultural heritage. Building of dykes was a unique aspect of the Acadian culture. Since a large number of Acadians lived and worked on the dykelands, dykes represent an important aspect of Canada's heritage. The dykes also

shaped the culture and religion of the people in the province (NSDAM, 1987). Most of the dykes and dykelands provide evidence of an important historical period, the period of initial Acadian settlements and resettlements. The Acadians had their own unique culture (including food, music, folktales) and beliefs. This has contributed to the considerable diversity in Nova Scotian culture. For instance, places like Grand-Pré, Port Williams, and Annapolis Royal have become important historic sites in Nova Scotia and Canada as a whole. The economic and social templates that were established guided and moulded subsequent developments of not only the Acadian communities but also of the entire province of Nova Scotia (NSDAM, 1987). There are seven major counties in Nova Scotia where Acadian dykes are prominent (Figure 1.1). Some famous dykes built by the Acadians in Nova Scotia include Truro dyke, Minudie dyke, Grand-Pré dyke, Amherst Point dyke, Fort Anne dyke, Port William, Wolfville dyke, Wellington dyke, and Selma dyke.

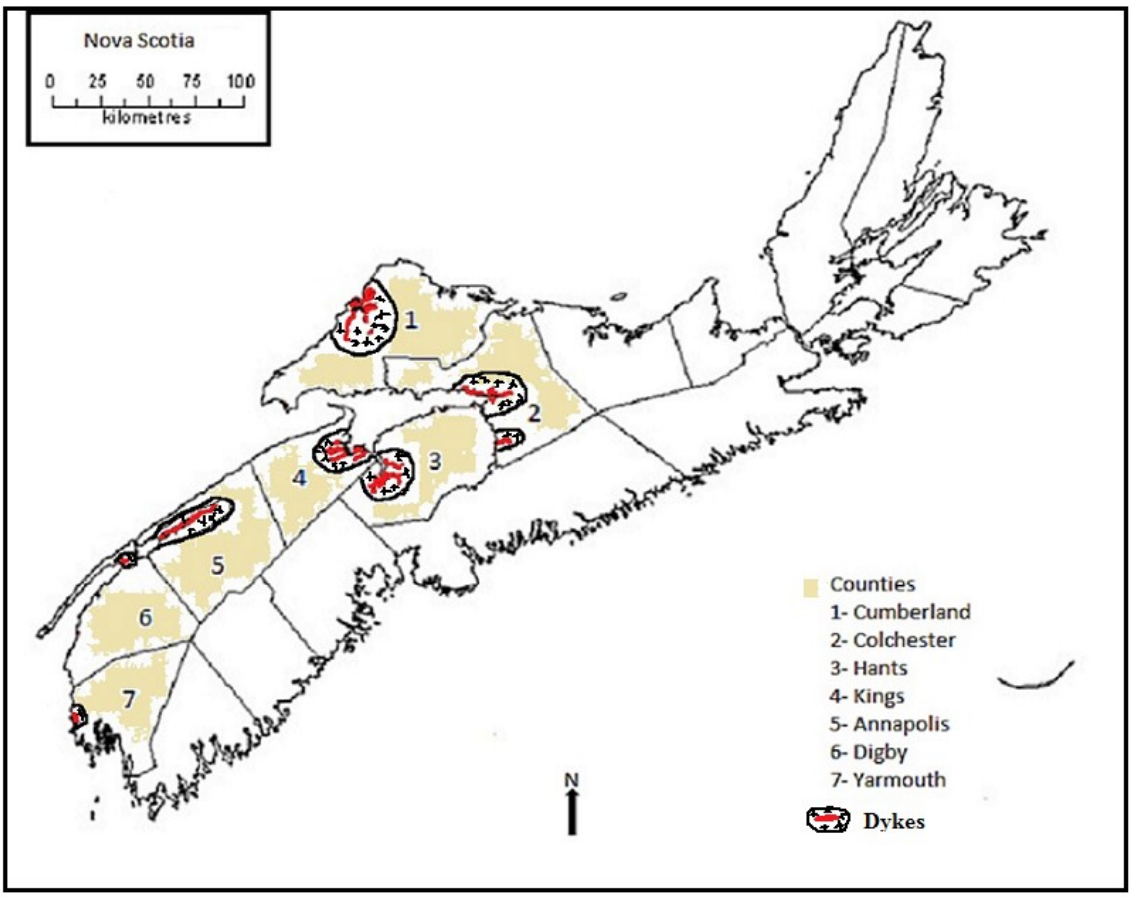

Figure 1.1: Seven counties with dykes (red areas) and dykelands in Nova Scotia. Adapted from the Nova Scotia Department of Agriculture (Source: NSDA, 2010)**.**

Dykes protect both provincial Crown and private properties (NSDNR, 2009). The Truro dykes, for instance, protect residential properties, roads, and other commercial properties that provide jobs to many Truro residents. Since the protected properties also generate taxes for the province, economic values can be associated with these dykelands. Maintenance of these dykes was done by the Acadian farmers themselves at the various locations. Periodic storms (1869, 1893, 1923, 1927 and 1931) flooded dykelands along the Bay of Fundy and caused severe damage (Bleakney, 2004, p.18) to farmlands and other properties. Over time, the utility of building and maintaining dykes became a

concern because of the lack of human resources and the fear of future floods (NSDAM, n.d.).

Beginning in 1947, different programs were put in place by the federal and provincial governments to assist farmers with the maintenance of the dykes and dykelands to save both agricultural lands and other properties (NSDAM, 1987). The programs ensured that various modifications in the structures and heights of the dykes were in place. There were also changes in the use of materials in the construction and maintenance of dykes in the province. The continuous modification and maintenance led to less destruction in the 1977 storm that hit the coast of the Bay of Fundy (Robinson, van Proosdij & Kolstee, 2004). The federal government stopped assisting in the maintenance of dykes in 1970 and as a result, the maintenance of these dykes became a shared responsibility between the provincial government and land owners (Robinson, van Proosdij & Kolstee, 2004). This made dykeland farming more expensive and less attractive for some farmers (NSDNR, 2009).

1.3 Statement of Research Questions and Objectives

The objective of this study is to identify the values and services provided by dykes and dykelands in the province and identify how different stakeholders perceive and value these services as individuals and as groups.

The research questions for the study are:

1. What are the values and services that dykes and dykelands provide in Nova Scotia?

2. How do people perceive and prioritize values associated with dykes and dykelands as individuals and as groups?

1.4 Rationale for the Research

The issue of maintaining all dykes and dykelands in the province has become an important discussion due to the costs and the sharing of responsibility. Although some studies advocate the value of salt marshes and the benefits of restoring dykelands toward more natural ecosystems, it is not commonly done in the case of dykes and dykelands. This study attempts to fill a knowledge gap in dykes and dykelands maintenance by identifying a range of values associated with dykes and dykelands. Out of this study, I hope to catalogue the values that can be used as a baseline in government decision-making concerning dykes and dykelands. The values identified can be validated by future research in order to inform ongoing government decision-making.

As sea level continues to rise and the cost of maintenance becomes more expensive, there will be a need for the provincial government to reconsider the maintenance of all dykes in the province. However, because the dykes and dykelands have become public goods, people's perceptions and values are relevant in such decision-making. The information obtained from this study will provide and enhance knowledge on a range of values associated with dykes and dykelands in the province and people's perceptions. This will serve as a starting point for deeper investigations into values associated with specific dykes and dykelands during government decision-making concerning their maintenance.

1.5 Thesis Style

Remaining impartial in data collection and in the presentation of results is essential in all research. Every study carries a degree of subjectivity which arises in the researcher's data collection, analysis, and interpretations of findings (Mehra, 2002). The act of categorization and semi-quantitative analysis (e.g. counting) is also subject to biases. I tried my best to minimize these biases. As indicated by Fontana and Frey (2005), interviewers carry both conscious and unconscious biases. Throughout the interview design, data collection, analysis, and presentation of findings, I have tried to maintain the rigours of social science research and at the same time pay attention to biases which may occur from my familiarization with the literature on these biophysical features and through site visitations.

It is evident that in most social science research, especially when qualitative data collection tools are used, most researchers base their data on direct quotes or accounts from the participants in the research (Hankock, 1998). Most of my data are represented in a way which reflects how people perceive dykes and dykelands in the province of Nova Scotia. Where appropriate, I draw direct quotes for emphasis. This will help me to present my data to represent how the people I interviewed really feel about dykes and dykelands.

1.6 Thesis Organization

This research is organised into five chapters. **Chapter One** provides a general introduction to the research. It sets out the purpose of the study and the research question. **Chapter Two** provides the literature review. I discuss Acadian history which is

important to this study, introduce values which are key to the research, and finally discuss market and non-market values that can be associated with dykes and dykelands. **Chapter Three** presents the methods used for the study. It describes the rationale behind choosing interviews over other data collection tools, the values table, and the reason for selecting the participants who were interviewed for the research. The challenges of assessing information for the research through literature and participants are also addressed. In **Chapter Four**, my findings on dyke and dykeland values and people's perceptions about them are presented and discussed. It is divided into three parts: peoples' values associated with dykes and dykelands in open-ended conversations, their ratings of identified values and services, and their perceptions of threats to their values for dykes and dykelands. Their perceptions on dykes and dykeland maintenance are also discussed. **Chapter Five** summarizes the research findings, presents recommendations, and suggests areas for future research.

CHAPTER 2 LITERATURE REVIEW

2.1 Introduction

This chapter introduces the geography of the Bay of Fundy, summarizes the Acadian history with respect to their involvement with dykes, and gives an account of the building and maintenance of dykes and dykelands along the Bay. Issues concerning climate change and sea-level rise are discussed. The chapter then describes the present building and maintenance of the coastal dykes and dykelands, and values. I discuss specific values which will be used to portray dyke and dykeland services.

2.2 Geography of Bay of Fundy

The Bay of Fundy is part of the Atlantic Ocean bounded by the State of Maine of the United States and the Canadian provinces of New Brunswick and Nova Scotia. It is a huge estuarine tidal system and extends in a north-eastern direction from the Gulf of Maine. It is known to have the highest tides in the world. Tidal ranges of 6 m at its opening to 16 m at its upper reaches are common (Canadian Hydrographic Survey, 1998). Due to the great tidal range, the area covered by the tides (the intertidal range) is quite large: nearly a third of the Minas Basin is intertidal (Cranford, Peer & Gordon, 1985). In certain areas of the Minas Basin, the horizontal distance between low and high tides exceeds a kilometre.

Certain physical aspects of the Bay of Fundy make it unique. It is delta-shaped, about 300 km long, and measures up to 80 km wide at its mouth. It has two tidal cycles a day with the highest tide occurring along northwest Nova Scotia which is normally 3.5 m with

flood water travelling up to about 280 km to the head of the Bay. At the Minas Basin, the tide reaches its peak of about 16 m which has led to the Bay of Fundy being known as one of the world's greatest natural wonders (Cranford, Peer & Gordon, 1985; Canada Hydrographic Survey, 1998; Aretxabaleta, McGillicuddy Jr, Smith, & Lynch, 2008). About eighty-five percent (85%) of the original tidal marshes along the Bay have been dyked and drained (Connor, Chmura, & Beecher, 2001).

2.3 The Origin of the Acadians

The history of Acadians has become an important and integral part of Nova Scotia's history. Their unique cultural practices with respect to agriculture and religion have contributed to the Nova Scotian heritage in particular and the Canadian heritage as a whole. The building of dykes to turn marshlands to farming lands made Acadians famous (NSDAM, 1987).

The early Acadians were a group of French settlers who arrived from La Rochelle in France and settled in Eastern Canada in the 1600s (NSDAM, 1987). The initial settlers included French noblemen, clergy, labourers, and artisans. Many of them died in the course of the journey from France and the hard living conditions and environmental changes that they had to endure upon arrival. The men worked in the fur and fishing trades and were possibly expected to return to France after a period of time. They developed a unique way of life including language, customs, and beliefs. After a time, these initially transient workers established more permanent settlements. An indication that the French were deciding to establish a permanent colony was the departure of the Saint-Jehan ship from La Rochelle which included women and children (Hebert, 1997).

The settler farmers explored the Bay of Fundy to find an appropriate area for settlement. They named where they finally settled "Acadie" meaning paradise and the people became known as Acadians (Yarmouth and Acadian Shores, 2012). Throughout the early 1600s, the Acadian colonies alternatively came under the control of the French or the British due to wars and subsequent treaties until the treaty of Utrecht in 1713 made Acadia permanently British (NSDAM,1987). The Acadians lived and worked hard together to sustain themselves and a large part of this was the collective building of dykes (Figure 2.1).

Figure 2.1: Dyke building in Acadia 1640-1650. The Acadians used simple tools to build and maintain the dykes and aboiteaux (Source: Consentino, 1998**).**

2.3.1 Settlement

When the French colonists arrived in 1604, they settled at Port Royal under the leadership of Pierre du Gua de Monts and Samuel de Champlain (Marsh, 1988). In 1610, a colony was formed by the French with the two main aboriginal people of Acadia - the Mi'kmaq and the Maliseet (Marsh, 1988). Around 1630, Sieur Isaac de Razilly was appointed governor of Acadia and had the opportunity to establish a new settlement.

Razilly, in 1632, moved about 315 settlers from the French Atlantic coast to La Hève (the south shore of present day Nova Scotia), of whom about 300 were men (Marsh, 1988; Hebert, 1997). The capital of Port Royal was then moved to La Hève under the leadership of Razilly to keep the Acadians close to the shore. This was because he was more interested in sea-borne trade than agriculture (Marsh, 1988).

In the 1670s, the colonists who remained in Port Royal left to find other places for settlement. They found Beaubassin (present day Amherst, NS) and Grand-Pré more suitable for their economic activities (NSDAM, 1987). These lands were abandoned because they were dominated by salt marsh and the original inhabitants did not know how to reclaim marshlands for agricultural and settlement purposes. Due to their dyke-building and maintenance practices, they were known as "défricheurs d'eau" meaning clearers of water (Hatvany, 2002). This was mainly due to their ingenuity of reclaiming marshlands for farming. The new settlers dyked and cleared large tracts of idle salt marshes along the Bay of Fundy and turned them into farmlands. The construction of dykes became an important practice for creating fertile farmlands.

2.3.2 The Acadian Activities and Way of Life

In 1635, when Menou D'Aulnay succeeded Governor Razilly after the Governor's sudden death, he moved the capital from La Hève back to Port Royal (Hebert, 1997). He was convinced that the future of the colony was dependent on agricultural development, and welcomed more people to the colony. The first census conducted for the Acadian population in 1671 showed there were 400 Acadians. In 1701, their numbers increased to 1,400, then 2,500 in 1711 and over 13,000 in 1755 (Marsh, 1988).

Agriculture became the main economic activity of the Acadians. Although it took them several years to complete building dykes because the workers used small tools in their construction, they preferred that to clearing of trees in the uplands. Farming and livestock breeding were the two main sources of livelihood for the Acadians (Lexar, 2007). Agriculture prospered and food was in abundance during this time. In addition to crop farming and livestock production, the Acadians also took to hunting, fishing and trapping, and soon became self-reliant, depending less and less on non-Acadians for survival. Between the 1630s and 1755, about 200 hectares of woodland had been cleared for gardens and small agricultural plots in addition to dykelands (Hatvany, 2002). With their self-sufficiency in food, the Acadians were noted to have developed strong trading relationships with New England settlements for manufactured products such as fabrics, cooking pots, clay pipes, gunpowder, and rum (Nova Scotia Museum Info, n.d.).

2.3.3 Deportation of the Acadians, Post-Deportation and Resettlement

In 1621, the English government changed the name of Acadia to Nova Scotia and moved in Scottish settlers (Marsh, 1988). By this time, the French Acadian population was multiplying and their culture was emerging. The British therefore ordered Robert Sedgwick to attack Acadia and destroy their settlements. In 1654, Sedgwick carried out the attack and destroyed most of the Acadian settlements (Marsh, 1988).

To live in peace and prosper, the Acadians in 1730 swore an oath of allegiance to the British but were able to negotiate an understanding in principle that they would not fight against the French or the natives. However, when the French and Indian war broke out in 1754, the Acadians were again asked to swear another oath of allegiance but this time to

fight against the French on the side of the British. The majority refused to sign this new oath of allegiance, so the then British Governor, Charles Laurence, decided to deport the Acadians (Delaney, 2005). The British started deporting the Acadians from Grand-Pré and other places along the Bay of Fundy.

The deportation included even those who pledged to remain neutral. They were spread to the 13 American colonies and many ended up back in Europe because the majority of the American colonies did not want them (Hebert, 1997; Yarmouth and Acadian Shores, 2012). Many families were separated, some lost their lives, and others all their possessions. Although the deportation took place over many years, the British were unable to get rid of all the Acadians from their settlements. Some of the Acadians moved into the woods and some into other parts of Eastern Canada (e.g. Quebec, PEI and New Brunswick) and Louisiana to keep themselves away from the British.

Several years after a series of deportations, most of the Acadians had to find other places for resettlement. Having been away for so many years from France, they had no passion to return. Some of the Acadians helped the British to settle in and continue the dykeland culture in Nova Scotia and others went to New Brunswick and Prince Edward Island (PEI). Between 1765 and 1785, most of the Acadians resettled in the area of Louisiana (Hebert, 1997). By 1812, they had built dykes to drain wetlands and encourage development (Tibbetts, 2006). The presence of other nationalities influenced the Acadian traditions and culture. The name of the people and their diluted culture in Louisiana was then changed to Cajun (Hebert, 1997; Marsh, 1988.). However, those who remained in Nova Scotia could not identify themselves as a cohesive group. They lived as isolated

groups yet faithfully preserved the traditions of their ancestors. Their manner of speech, dishes, celebrations, beliefs, songs, and stories were passed on to generations in their smaller groups. Gradually they expressed themselves as a people sharing a common language, culture, and belief system (Marsh, 1988). Their name Acadian has remained unchanged.

2.4 Dykes and Dykelands

Dykes are barriers built to prevent ocean tides from flooding the lands along the coast. Tidal marshes in some countries are dyked and drained to prevent tidal flooding and establish suitable conditions for agriculture. The dykes in Nova Scotia were built and maintained manually by the Acadian landowners and decisions concerning them were traditionally made by the oldest resident at each location (NSDAM, 1987). The Acadians built dykes with sod and soil using simple tools, of which the most common were spades (Figure 2.2) and forks.

Figure 2.2: A type of dyking spade used by Acadians in building dykes. It was a simple yet effective tool. This dyking spade was made by Charles A.D. Siddall (length 104 cm) (Source: MacKinnon, 2004).

An integral part of any Acadian dyke is the aboiteau (Figure 2.3). It became a central part of Acadian identity (Le-Blanc, n.d). The word aboiteau has been identified to have no modern English or French equivalent (Hatvany, 2002). The aboiteau is a long wooden

sluice or culvert which was used to drain the salt marsh (Lexar, 2007). An aboiteau discovered in Grand-Pré in 2006 showed that the Acadians used white pine to build the main sluice and red pine for some of the supporting structures. The aboiteau dated to the time of the early Acadian settlement in Grand-Pré area (Robichaud & Laroque, 2008). These adaptable structures allowed fresh water to flow out from the marshlands during low tides and prevented salt water from entering the dykelands during high tides (NSDAM, 1987). With time, the salt marshes were thus drained and de-salted to become dry arable land for growing crops and raising animals.

A B

Figure 2.3:Traditional aboiteaux made of wood to keep the salt marshes dry for farming (A- Truro and B- Port William).

The Acadians dyked and reclaimed more than 5,261 hectares of salt marsh for agricultural purposes with simple tools (Hatvany, 2002). Nova Scotians are not the only people who built dykes to create agricultural lands. Coastal settlers in other Canadian provinces and countries such as the United Kingdom, France, Spain, Korea, the Netherlands, and Germany have also created agricultural lands by building dykes (Connor, Chmura, & Beecher, 2001). Maintenance varies across provinces and countries. In British Columbia, increasing the height of dykes against rising water level is part of

the regular surveillance and maintenance of dykes. Some governments believe that protection in advance is better than to wait for flood events (Government of British Columbia, 2001). In Vietnam, maintenance programs include the planting of mangrove forests parallel to the dykes to provide protection and reduce the otherwise high maintenance costs. It is expected that by 2020, all dykes in Vietnam will be protected by mangrove forest (Danh, 2012).

2.4.1 Construction and Maintenance of Dykes and Dykelands

The Acadians were expert craftspeople in building and maintaining dykes. These dykes were solely maintained by the Acadians until the early 1940s when the federal and provincial governments took over the responsibility for building and maintaining dykes (NSDAM, 1987). During the 1800s, the dykes and dykelands were maintained in a manner similar to municipal units (NSDAM, 1987). Thus, commissioners were appointed among the owners to manage the affairs of the dykes and dykelands. Spring and fall were the busiest times for the maintenance of dykes. The dykeland owners were responsible for the maintenance cost. Payment was in the form of money, extra work, material, or a combination of all three.

In 1869, however, a violent storm flooded the dykelands along the Bay of Fundy which caused extensive damage to properties and people lost their lives (Robinson, van Proosdij and Koltse, 2004). Dykes and dykelands were still maintained by landowners after the storm. Throughout the 1930s, Fundy dykelands faced a number of challenges. Violent storm surges flooded and destroyed the dykes and the farmlands (NSDAM, 1987). This

prompted the federal government to take over the building and maintenance of dykelands.

During World War II, the government was forced to help dykeland farmers as a result of manpower shortage and other challenges they were facing (Bleakney, 2004). Dr. E.S. Archibald, who was the head of the Central Experimental Farm in Ottawa, established the first formal programme to support dykeland farming (NSDAM, 1987). He worked on dykelands in Truro in his youth and was familiar with dykeland farming. He addressed the need to study problems related to dykelands in Nova Scotia and New Brunswick. In September 1943, Dr Archibald invited dykeland owners, agricultural officials, and engineers to Amherst, Nova Scotia, to discuss the regional situation of dykelands (NSDAM, 1987). The Maritime Dykeland Rehabilitation Committee (MDRC) was formed in 1943 (Bleakney, 2004). The committee comprised four dykeland owners, four engineers, one soil specialist, and a federal government representative. The committee was to examine all aspects of dykeland building and maintenance.

With time it became apparent that some of the dykes protected more than agricultural lands. An agreement was made in 1948 on the cost of repairs of dykelands and this cost was to be distributed equally among the dykeland owners, the provincial government, and the federal government (Bleakney, 2004). This was known as the “three way programme” (NSDAM, 1987). When the people realised the extent and relevance of the programme, the name changed to the “Emergency Programme” (NSDAM, 1987). Due to the pressure that dykeland owners applied to politicians in Halifax and Fredericton, additional provincial funds were put in place to support the building and maintenance of dykes.

A later agreement tackled the problem of dykeland on a larger scale: The Maritime Marshland Rehabilitation Act (MMRA) was passed in Ottawa in June 1948 (NSDAM, 1987). This agreement covered all three Maritime Provinces - Nova Scotia, New Brunswick and Prince Edward Island. The MMRA had staff people who carried out investigations in six divisions: 1) Survey and Drafting, 2) Drainage, 3) Soil Mechanics, 4) Seeding, 5) Construction, and 6) Workshops. These divisions developed the means to provide protection of dykelands at a lower cost. Side-by-side with the work of the MMRA, Nova Scotia and New Brunswick, in collaboration with federal Department of Agriculture, conducted a study on Maritime dykeland farms. The survey, known as "Haase Report," was carried out between 1949 and 1950 (NSDAM, 1987) and provided a good review of tidal agriculture along the Bay of Fundy.

The Government of Nova Scotia gradually took over the maintenance of dykes and dykelands from the federal government between 1967 and 1970 (Robinson, van Proosdij & Kolstee, 2004). There were major renovations in the dyking system during these years. The maintenance became a shared responsibility between the provincial government and landowners in partnerships known as marsh bodies, each embodied in an act of legislation. Currently, the Nova Scotia Department of Agriculture is responsible for maintaining the dyke walls (i.e., raising, vegetation management, and rock replacements). The maintenance of internal dyke roads and the acquisition of land required for the construction of dykes and aboiteaux remain the responsibility of landowners (Robinson, van Proosdij & Kolstee, 2004).

Over time, there has been a departure from the use of traditional materials in the construction of aboiteaux in the Bay of Fundy area. Historically, wood was the main material used in the construction of aboiteaux (Robinson, van Proosdij & Kolstee, 2004) but this has changed over time. The Truro dyke aboiteau, for instance, was built with a concrete sluice and rock fills (NSDAM, 1987). The new materials are being used because the soils contain large quantities of gravel and could support the weight of concrete aboiteaux. The majority of the wooden aboiteaux have been replaced with high-density polyethylene pipe and concrete (Figure 2.4 and 2.5). There have been modifications in the structures and heights of dykes since the government took over the building and maintenance of dykes (Robinson, van Proosdij & Kolstee, 2004).

Figure 2.4: Modern aboiteau made of polyethylene plastic pipe (Source: Nova Scotia Department of Agriculture, 2007).

Figure 2.5: Modern materials (concrete) used in the construction of aboiteaux (Source: Nova Scotia Department of Agriculture, 2007)

There are currently 241 km of dykes and 260 aboiteaux protecting 17,400 hectares of land in Nova Scotia (NSDA, 2010). These dykes are maintained under an annual budget of $1.3 million for operating the Land Protection Section (NSDAM, n.d). This budget covers salaries, supplies, and materials used in maintaining dykes. It also takes care of the annual mowing, weed control, and replanting of damaged grass cover on the dykes. Aside from the annual budget, an additional $40,000 is allocated to protecting the exterior of the dykes with armouring rocks in areas where the tides erode the face of dykes (G. Post, Department of Agriculture, personal communication, February 12, 2000).

With shrinking budgets, dyke maintenance now depends on specific dyke condition instead of being an annual routine and hence the aboiteau superintendents must decide on how to allocate resources for maintenance. G. Post (Department of Agriculture, personal communication, February 12, 2012) indicated that there are 60 km of dykes at serious risk because they lie below the high-tide line, and there are 10 km of dykes in critical need of rock protection (Figure 2.6). The general maintenance of the dykes and aboiteaux

has not only been labour-intensive, but also very expensive (Robinson, van Proosdij & Koltse, 2004).

Figure 2.6: Dykes that require maintenance but are delayed due to lack of resources (Source: Post, G., 2011)

Recently, some restrictions to the use of dykes for recreational purposes have been put in place to reduce repair and maintenance cost. Increase in non-agricultural human activities around the dyked areas and the lack of knowledge and information on dyke maintenance have often led to inappropriate use of the dyke walls for recreational purposes such as cycling, walking, running, and horseback riding, all of which disturb the integrity of the grass that stabilizes the dyke. These restrictions, however, do not apply to dykelands.

2.4.2 Location and Activities

In Nova Scotia, the dykes are predominantly found in the Grand-Pré area. However, with time, the dykeland culture spread to other areas of the province. Currently there are seven major dykeland areas in the province: Grand-Pré, Amherst, Kentville, Port William, Truro, Windsor and Wolfville comprised of one or more dykes. These are the well-

known ones that are reasonably well maintained in the province. There are other minor dykelands, some of which are privately owned. These dykelands provide both agricultural and non-agricultural services to the communities and the province.

A recent inventory conducted by the Department of Agriculture (NSDA, 2010) indicated that agricultural assets on most dykelands were less in value than non-agricultural assets. It was estimated that only 3% of assets found on dykelands are agricultural (Table 2.1). The remaining assets were classed by the NS Department of Agriculture as commercial businesses, forest, wetlands, government infrastructure, non-profit land, and residential. Other dykelands which are not actively used for agriculture include the Selma, Belleisle, Wickwire, Noel Shore, Onslow, and Martock dykelands in the province.

Table 2.1: Inventory of assets on seven major dykeland areas in Nova Scotia
(Source: Nova Scotia Department of Agriculture)

Marsh Area (Dykeland)	Agriculture	Commercial Business	Forest, Wetlands, Ducks Unlimited	Government Infrastructure	Non-Profit Land	Residential	Total
Amherst	919,300	2,116,100	408,900	654,600	-	1,664,800	**5,763,700**
%	15.9	36.7	7.1	11.4	-	28.9	100%
Grand-Pré	2,011,100	258,000	-	445,700	-	874,000	**3,588,800**
%	56.0	7.2	-	12.4	-	24.4	100%
Kentville	414,200	1,239,200	248,500	11,015,000	-	1,332,800	**14,249,700**
%	2.91	8.70	1.74	77.30	-	9.35	100%
Port William	307,300.00	809,600.00	335,200	628,800	-	2,952,100	**5,033,000**
%	6.11	16.09	6.66	12.49	-	58.65	100%
Truro	563,100	59,284,100	278,900	21,067,900	1,368,600	7,685,600	**90,248,200**
%	0.62	65.69	0.31	23.34	1.52	8.52	100%
Windsor	187,700	14,541,100	34,400	13,857,800	-	7,810,600	**36,431,600**
%	0.52	39.91	0.09	38.04	-	21.44	100%
Wolfville	623,800	4,413,400	744,300	1,937,800	-	4,485,300	**12,204,600**
%	5.11	36.16	6.10	15.88	-	36.75	100 %
Total	5,026,500	82,661,500	2,050,200	49,607,600	1,368,600	26,805,200	167,519,600
%	**3.00**	**49.35**	**1.22**	**29.61**	**0.82**	**16.00**	**100.00**

2.5 Climate Change and Sea-Level Rise

Climate change and its impacts have become important issues of discussion worldwide. Research has shown that the earth's climate has become warmer over the past century and is predicted to increase in the coming years (IPCC, 2007; BC Ministry of Environment, 2011). It is more evident in the past two decades that global warming has resulted in rising temperatures, melting glaciers and sea-level rise (Meehl et al., 2005; Nicholls & Cazenave, 2010). This poses a growing threat to low-lying coastal

communities (Singh, Walters, & Ollerhead, 2007; IPCC, 2012). Coastlines are expected to undergo physical changes which may include erosion and beach migration (Meier et al., 2007).The coast of Atlantic Canada has been identified as highly vulnerable, especially the Bay of Fundy with its high tides. Unfortunately, the majority of Nova Scotia dykes and dykelands can be found along the Bay of Fundy. There is therefore a great need to understand climate-change impacts and develop strategies to ensure that coastal infrastructures are protected during floods and storm surges (Fisher, 2011).

2.6 Values

The word "value" is a complex term, highly abstract and defined in different ways. It is defined across a broad spectrum of ideas from monetary perspectives to emotional expressions. It is sometimes used to indicate the usability or desirability of something to humans (Richardson, 1994). The Oxford English dictionary also defines value as "the worth, usefulness, or importance of things; relative merit or status according to the estimated desirability or utility of things" (Stevenson, 2007, p.3495). Value normally refers to more general assessments of what is desirable (Najafi &Shariff, 2011). Value differs among individuals and communities based on how they understand and explain it (Dietz, Fitzgerald & Shwom, 2005). Frequently, what one person may consider as highly valuable may not be the same for another person. Values are subjective, and depend on what benefits people derive from - and the qualities that they associate with - the service, item, or object. According to Brown (1984), values can be assigned to things by the expression of words or ordinal scale.

To realize how people value dykes and dykelands, it is important to understand how they relate to dykes and dykelands and how those features influence their daily lives. Some people may have general values and others specific values based on how they are involved with dykes and dykelands.

The dykes in Nova Scotia may have influenced a number of communities and the lives of people in several direct and indirect ways and at different times depending on their way of life. The values people place on dykes and dykelands may not necessarily be based on their immediate wants or desires. In their decision-making or valuing, they may consider how the dykes and dykelands impact other people's lives. People's valuation may also change over time as they consider different end uses of dykes and dykelands. For example, according to Dietz, Fitzgerald, and Shwom (2005), our values may change when we are required to make decisions concerning environmental issues which we may not have previously thought about to reflect our values.

Dziegielewska (2009) divides total value into two main parts: use and non-use, or market and non-market values. Market or use values are values to which we can easily attach monetary values and these may be direct or indirect. The direct use values are those goods and services we derive directly from a resource. Example of use values of dykes and dykelands include farmlands, and protection of roads, railroads, residences, and businesses from floods and storm surges.We can assign monetary values to these benefits directly using cost-benefit analysis or other economic techniques such as contingent valuation method (Tüker, Öztürk, & Pak, n.d.).

Non-use values are final-value components or services that are related or unrelated to the current or potential use (Dziegielewska, 2009). Non-use values are those that are difficult to quantify in monetary terms. They are normally valued qualitatively (e.g., expressions). For dykes and dykelands, such values will include existence, bequest, cultural artefacts, historical values, and sense of place and place attachment. Total value is a summation of all the values people attach to a given good or service which includes both use and non-use values.

2.7 Values and Services for Dykes and Dykelands

The building of dykes by the Acadians introduced a new way of farming whereby wetlands were converted into arable land. The dykelands were used for the production of crops and the rearing of animals. This created livelihood and employment for some residents in the province.

Another major economic importance of dykelands is the class-two soil it provides for agriculture. There are seven soil classes in Canada (Scott, 2008), the first or which are those most suited for agricultural production. Class-one soil is the highest, but there are no class-one soils in Nova Scotia (Scott, 2008). The highest soil quality for agriculture in Nova Scotia is the class-two type which has very few limitations as to what can be grown. Dykeland soils are classified under the class-two soil type for agricultural production in the province (NSDA, 2010). They make up ten percent of the highest quality farmlands in Nova Scotia (Nova Scotia Agricultural Land Review Committee, 2010). Relatively flat and rock-free, dykeland soils have silty, clayey, loamy soil texture

with about four feet of the same soil type (Rodd, McRae, Harnish, & Kolstee, 1993; Zheljazkov, Astatkie, Caldwell, MacLeod, & Grimmet, 2006).

Common crops that do well on dykelands include forage, wheat, barley, and corn (NSDAM, 1987). Forage crops are the most common crop produced on these dykelands for exports (NSDAM, 1987). As of 2010, Nova Scotia had about 70,821 hectares of forage crops. This is about 65% of the total cropland in the province with an annual value exceeding 50 million dollars, making it the highest value crop (NSDA, 2010). With about 24.8% of forage growing on dykelands, it reinforces the importance of dykelands in the province (Jones, n.d.).

However, root crops (e.g. carrots, parsnips, beets, onions, and turnips), soybeans, chives, sunflowers, salad greens, and cabbage have also been identified as doing well on dykelands (NSDAM, n.d). Dykelands offer an advantage as they may not be influenced by drought due to the heavy soil type (Rodd, McRae, Harnish, & Kolstee, 1993). Also, the practice of crop rotation leaves dykelands fertile for farming for several years without the application of fertilizer. Almost all the dykes yield other non-farming benefits. Dykes protect roads, railroads, residences, or commercial properties all of which generate direct or indirect tax revenues for the government as well as jobs, businesses, etc. It is estimated that Nova Scotia dykes protect over 600 commercial and residential buildings, more than 120 km of power lines, 80 km of paved roads and trails, and 25 km of railways (NSDNR, 2009) from floods and storm surges. An incident of heavy rainfall and high tides may put these coastal communities and assets at risk (Figure 2.7).

Both the natural salt marsh and dykelands have advantages and disadvantages. Salt marshes or wetlands have been identified as economically and ecologically beneficial (Barbier, Acreman & Knowler,1997; Mitsch & Gosselink, 2000; Woodward & Wui, 2001). Ecological values of salt marsh may include water filtration, lifecycles of waterfowl and other wildlife, moderating the effect of drought, floods, storm surges and erosion, and educational opportunities for researchers (Ducks Unlimited Canada, n.d. ; Richardson, 1994; Woodward & Wui, 2001). Ducks Unlimited (n.d.) has indicated that wetlands, including natural salt marshes, serve as a habitat for about 600 species of wildlife and help to sequester and store greenhouse gases.

Salt marshes are also known to provide services such as nutrient removal. However, these nutrients, which are mainly from agricultural runoff and sewage treatment plants, are damaging to root systems in salt marshes (Deegan et al., 2012). In their landmark study, Deegan et al. (2012) showed that excess nutrients led to weakened root systems of the salt marsh vegetation making it easily susceptible to bacterial degradation with subsequent conversion of the salt marsh into mud flats.

Carbon sequestration occurs in natural marshes but it is limited in dyked marsh or dykelands (Connor, Chmura, & Beecher, 2001). If the world moves towards reducing greenhouse gas emissions and leans towards a more sustainable way of life, natural salt marsh might be a better option for carbon sequestration. Connor, Chmura and Beecher (2001), in a study to examine carbon accumulation in tidal salt marshes of the Bay of Fundy, observed that marsh soils have a carbon storage capacity that increases with rising sea level, while agricultural soils, such as those in dykelands, have a fixed amount over

time. However, Craft, Reader, Sacco and Broome (1999) observed that constructed marshes accumulated carbon at rates similar to those of natural salt marshes. They suggested that it may not be appropriate to restore all dykelands to natural marshes on account of carbon storage.

Global climate change has been predicted to have an adverse impact on the dynamics of many ecosystems. Dykelands and salt marshes will not be exempted (Gate, 1993). Almost 10% of the active farmland in the province's dykelands is threatened by hurricanes, storm surges, and various ravages of global warming (Nova Scotia Agricultural Land Review, 2010). According to J. Smith, "in case of storm surges, the big rocks used on the dykes prevent the high tides from washing the soil away and causing destruction to these properties" (Nova Scotia Department of Agriculture, personal communication, July 31, 2011).

It is anticipated that the cost of raising dykes to withstand storm surges and rising sea level will be expensive (MacAulay, 2012). Raising the dykes might still be a better option compared with leaving the dykes as they are and hoping that any destruction due to storm surges will be minimal. It may be easier and possibly cheaper to raise dykes to respond to sea-level rise than to clean up after dykes have failed to protect both private and commercial properties along the coast. Recent floods from heavy rainfall (over 100 mm) and storm surges in Colchester County resulted in floods in Truro dyke areas which damaged properties (Lunn, 2012; Staff~ The Truro Daily News, 2012). These are real threats that improperly maintained dykes could impose in light of climate change.

Figure 2.7: Newspaper reports on the impact of recent flooding on some communities in Colchester County (Sources: Chronicle Herald and Truro Daily News)

In the 1600s when the Acadians settled in Nova Scotia, dyking was a unique part of their culture. Although uplands were available for clearing, they showed more interest in the marshes. With time, people became interested in and were attracted to the marsh ecosystem, its riches, and the wealth of the place (Hatvany, 2002). An attachment to dykes and dykelands is not limited to Acadians. The extent to which people are attached to the social and cultural aspects of dykes and dykelands differs. Although the concept of place is difficult to define, it is generally accepted as including the ways that people feel about places in general and how they assign value to it (Najafi & Shariff, 2011). Some people might feel an attachment to the place because that is where they earn a living, others might also think their heritage is rooted in the place, and yet to others the attachment may be simply for pleasure.

The cultural geography of the Acadians has been related to the settlement landscape rather than to the material culture. The settlement landscape includes not only the built-up structures, but also cemeteries, land division systems and settlement, and field patterns that are common in the province. Bleakney (2004) observed that Grand-Pré, a typical settlement of the Acadians, has its own exceptional physical and biological features in the environment. It is a symbol of ties that unite the Acadians. The Acadian cultural resource and landscape define an exceptional sense of place of Grand-Pré. According to Bleakney (2004), although the construction of the dykes changed the landscape, the dykes themselves have become an important part of Canada's heritage. The dykes transformed the landscape of Nova Scotia and therefore have something historically and sociologically unique about them.

Most likely there is a link between the historic environment and the Acadians' sense of place. People have different perceptions about places depending on how they have been exposed to that environment (Kaltenborn, 1998). Poria, Butler and Airey (2003) suggest that people who see a place as bound up with their own heritage may have significantly different perceptions from others, and are more likely to place high value on the place. Place may bring out hidden memories through the material existence of the past (Foote, 1997 as cited in Creswell, 2004). The Acadians in particular may have different attachments regardless of their location. Their perceptions and levels of attachment may also vary due to their proximity to the early settlement areas and demographics.

As indicated by Poria, Butler and Airey (2003), one of the growing components of tourism is heritage. Heritage tourism promotes the folkloric aspects of communities and

enhances both national and international recognition (Boudreau & White, 2004). The recent (2012) recognition of Grand-Pré as a World Heritage Site by UNESCO indicates how the dykes and dykeland culture have played a role in the development of the province and Canada as a whole (Parks Canada, 2012). People took great pride in the building of dykes and the home of the Acadians for which Grand-Pré has gained World Heritage Site recognition. In short, the Acadians not only built dykes for agriculture, but in doing so, also shaped the culture and religion of the people in the province (NSDAM, 1987). For example, the simple and valuable tools used in building dykes and aboiteaux as well as some of the artefacts such as cooking utensils and jewellery from early 1600s to the present now represent a part of the cultural heritage for Acadians and non-Acadians.

Finally, the dykes attract tourists. Grand-Pré now stands as an important heritage site. The various dykeland areas have at least a park, museum, church, restaurant, or gift shop that attracts tourist to experience the Acadian heritage. There are three main components of a tourist site: museum, gift shop, and restaurant (Boudreau & White, 2004). Grand-Pré has all three components whereas other famous Acadian settlements have at least two. The Grand-Pré museum provides information on the history of Acadians and their way of life. It has a gift shop that sells souvenirs for visitors and a restaurant which specializes in traditional Acadian cuisine. Most people in Nova Scotia and other Maritime provinces today celebrate the Acadian ancestors. Various exhibitions are held in honour of the Acadian ancestry with Grand-Pré placing emphasis on the impact of the dyking culture.

The range of activities enriches people's knowledge of the history of the province. Grand-Pré stands as an example of how the lines between socio-cultural values and economic values become blurred. In addition to emphasis on culture and history, the various exhibitions and the tourism that they promote indirectly generate local employment and revenue for the province. Both the abandoned and the actively used dykes and dykelands may have some socio-cultural values which may be better understood by people's expressions.

CHAPTER 3 METHODS

3.1 Introduction

The study attempts to identify what values can be associated with dykes and dykelands and how individuals perceive these values. This chapter outlines the methods used in the selection of participants, data collection, and analysis.

3.2 Study Design

Identifying people's perceptions and how they feel and relate to things is mainly done using interviews. Interviews have been used by many researchers to identify people's values and perceptions through spoken exchange of information (Hay, 2005). The data collection tool used for this study was individual face-to-face, semi-structured interviews. Interviews encourage a unique form of natural discussion because of the interaction that occurs between the researcher and respondent (Kamberelis & Dimitriadis, 2005). Fontana and Frey (2005) advocate that "interviewing is one of the most common and powerful ways in which we try to understand our fellow humans" (p. 697). Interviews, depending on the type, can help participants to explain whatever answer they provide to a question (Kamberelis & Dimitriadis, 2005). Respondents are therefore able to clarify their responses.

The interview guide was designed based on both primary and secondary sources of information through the literature and a minimum of two site visits to selected dykeland complexes. The interview questions took into account the fact that some respondents would be more familiar with aspects of specific dykes and dykelands, and other

respondents would have a more general appreciation. It was necessary to talk to different categories of people to try to elicit a diversity of responses and also reflect on a broad range of opinions. Interviewing people who have a connection with dykes helped identify what value they place on their existence and maintenance.

Because the research involved identifying people's perceptions of dykelands in the province, semi-structured individual interviews were deemed the most appropriate. This form of interviewing provides flexibility and allows for obtaining more-detailed responses than structured interviews (Hay, 2005). Also, semi-structured interviews help respondents to express the importance of their personal experiences and perceptions about events in their own words (Hay, 2005). This adds credibility to the data gathering and also saves the researcher from collecting too much irrelevant information.

The interviews were conducted from January to August 2011. In the interview guide was a values table which was designed for participants to indicate on a scale of 1 to 3 (*1-Not Important, 2-Somewhat Important and 3- Very Important*) how they value a list of services provided by dykes and dykelands in the province, as derived from the literature and site visits. The rationale behind the values table was to cross-check if the information provided by respondents on important values at the beginning of the interview was the same after they had been provided with a generic values list. The mix of qualitative and semi-quantitative (closed-ended) approaches was to allow triangulation to gauge the similarities and differences in responses. Similarities in both data greatly enhance the reliability of the findings (Creswell, 2004).

The primary approach for analyzing the values table responses was frequency and cross-tabulation analyses. This complemented the responses from the open-ended questions which were analyzed using averages and content analysis.

Codes and themes were created from the interview transcripts using spreadsheets and NVivo 9 qualitative software (Welsh, 2002; QSR International, 2012). The software helped to organize the data in a convenient way. It also assisted in performing qualitative data analysis by evaluating and interpreting texts. Also, the qualitative data were analyzed using a detailed content analysis of transcripts. Where appropriate, the responses from the interviews were analyzed using simple descriptive statistics such as averages, percentages and frequencies. This was helpful in making comparisons between the open-ended and the closed-ended (values table) questions (Creswell, 2009).

3.2.1 Study Area

The study was centred on some of the dykeland areas in the province of Nova Scotia (Figure 3.1). The province is defined by coastline of about 13,300 km (Government of Nova Scotia, 2011). It is estimated that 70% of Nova Scotians live near coastlines (Fisher, 2011). The dykes are predominantly found along the Bay of Fundy coast. The dykes are scattered across seven counties in the province: Cumberland, Colchester, Hants, Kings, Annapolis, Digby, and Yarmouth. The areas marked red on the map (Figure 3.1) indicate dyked areas on the province.

Due to financial and time constraints, I visited five out of the seven counties at least twice for data collection and reconnaissance before designing the interview questions. It was important for me to familiarize myself with dykes and to gain deeper understanding of

the communities and the people who live in and around dyke areas. In counties where there were two or more dyke areas, at least two were visited to identify how dykelands are being used and what services they provide to people in the area and to the entire province. I visited the dykes in the Hants, Kings, Colchester, Cumberland, and Annapolis counties (Figure 3.1).

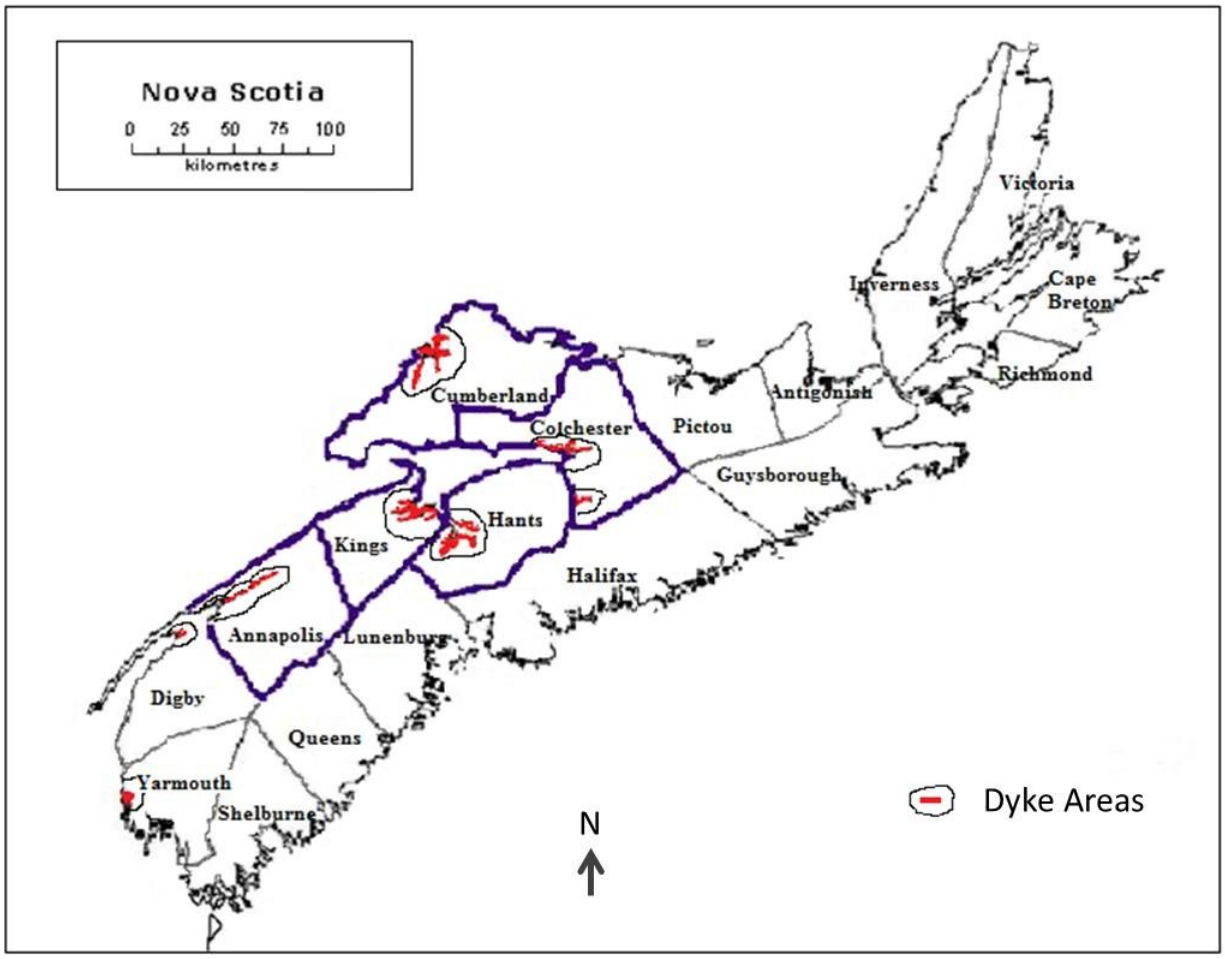

Figure 3.1: The five counties in Nova Scotia with dykes that were visited for the study. Map adapted from the Nova Scotia Department of Agriculture (Source: NSDA, 2010).

In most counties visited, the services the dykes provided were not difficult to identify, especially the service of protecting the farmlands and properties along the coast from flooding (Figure 3.2 and Figure 3.3).

Figure 3.2 : Port William dyke protecting major road, residential, and commercial properties.

Visits to the museums in these areas provided information on the socio-cultural values of dykes and dykelands. Some dykelands showed major agricultural (Figure 3.3) and recreational uses (Figure 3.4) which included a golf course (1 in Figure 3.4), Port William Dyke trail (2), community field (3), and a museum with an artefact collection of Acadian settlement (Fig 3.5).

Figure 3.3: Port William dykelands being prepared for farming early spring, 2011.

Figure 3.4: Recreational use of dykes and dykelands in Truro and Port William (1: golf range, Truro 2: A trail on Port William dyke 3: Soccer field in Truro).

Figure 3.5: Artefact collection of some Acadian settlements on dykelands at the Grand-Pré museum.

Dykelands in Selma (East Hants County) and some neighbouring communities like Maitland were predominantly used for dairy cattle production (Figure 3.6). Sites visited did not only include actively used dykes and dykelands but also areas that some Nova Scotians identified as unused dykelands.

Figure 3.6: Selma dykelands in late spring, 2011

3.3 Interview Design

The interviews included two sections composed of open-ended and closed-ended questions mainly dealing with respondent's perceptions on dyke and dykeland values. The first section comprised open-ended questions (Appendix 4), for which participants were asked to provide answers based on their understanding of dykes and dykelands. This, however, was not to test for their level of knowledge but to gather general information on perceptions and interests in dykes and dykelands. At this point, participants had the opportunity to discuss dykes and dykelands values without me providing any information on values. Respondents were asked what they do for a living and their relation to dykes and dykelands. This was to help gather information from diverse groups of people and help in categorization of respondents based on their occupation. Respondents were also asked if they had any interest in - and if so what was important to them about - dykes and dykelands. After they had indicated what their interests were, they were asked to discuss dykes and dykelands from economic, ecological and socio-cultural perspectives. Not all respondents discussed all three categories under study. Their perceptions leaned towards how they were connected to dykes and dykelands. For instance, a respondent who owned a property on a dykeland only talked about the economic aspect of the dykes and dykelands. How people felt about the maintenance of dykes in the province and how their values were threatened was also elicited from the respondents. Interviews were conducted one-on-one and face-to-face by me only.

The second section of the interview provided participants with a list of 19 possible values that were identified through literature and site visitations (Appendix 4). They were asked

to indicate how important or unimportant those values were to them on a rating scale of 1 to 3 with 1 indicating not important, 2 somewhat important, and 3 being very important.

3.3.1 Participant Selection

The study was, in theory, open to all residents of Nova Scotia above the age of 18 who were interested in dykes and dykelands. The initial plan was to interview any Nova Scotia resident who was willing to participate in the study because all adult residents are potential taxpayers and it is the tax payer's money that is used to maintain the dykes.

Finding people who were interested and willing to participate was very challenging. After a few interviews were conducted, I realized that people who had no knowledge of dykes and dykelands could not provide any new information apart from what was given to them as an introduction to the study. I had to provide detailed information on dykes and dykelands before they could respond to the interview questions. When the interviews were completed, I observed that the information that some respondents had given was exactly what I had provided them. In view of this, I decided to interview people who would likely be more informed about dykes and dykelands. Participation was therefore limited to people who had some prior knowledge about dykes and dykelands either by family ties, occupation, residency, or some other familiarity. Some of the participants referred me to other individuals who might be interested and willing to participate in the study.

To obtain data on dykelands from different stakeholders in the province, six main respondent categories were created: government departments, academia, farmers, coastal residents and business owners, curators, and environmental non-governmental

organizations (ENGOs). I initially planned to interview at least three people from each category to get different perspectives in responses. This was done to ensure good representation of the diverse groups to be interviewed. However, this was not fully achieved due to unavailability of respondents and time constraints on the study. Although the initial categories did not work out as planned, all respondents had at least a fair knowledge of dykes and dykelands. Participants were therefore regrouped after the data collection into four main categories based on their occupation, namely: researchers, government, landowners, and ENGOs.

3.3.2 Data Recording

Each interview was recorded using an audio recorder. Interviews lasted between thirty and ninety minutes. The audio files were then transferred to a computer and Express Scribe software (NCH Software, 2011) was used in transcribing the data. This software has the feature of slowing down the audio while playing. Attaching foot pedals improved the speed in the transcribing process. The transcribing stage was one of the most challenging stages in the research. In particular, four interviews conducted in coffee shops at the request of the interviewee were very difficult to hear due to the background noise. The interviews were conducted between January and August, 2011. The transcribing was done between August and December, 2011.

3.3.3 Data Collection Observations

Initially, I planned to visit all dykeland areas and search for significant differences between active and idle dykelands. I was unable to do so due to financial and time constraints. However, I had the chance to visit most of the dykes and dykeland areas to

observe the activities that go on in those areas. Considerable information was gathered through informal communication with both participants and others who showed interest in the study. The information from personal communications and site visits provided further insight into the values and services provided by dykes and dykelands.

Out of the 30 semi-structured interviews conducted, 15 of the interviewees had relevant information and answered every question in detail. Thirteen of them had what I would call a rather basic level of prior understanding. A couple of respondents had very limited information because they had not thought of dykes and dykelands from a values perspective. However, the participants were able to complete the values table. A couple of respondents implied that some of the questions were "*million dollar questions*" [Interview 030; Interview 029] because they had no precise response, and they skipped such questions. Participants demonstrated a general lack of knowledge on questions that were monetary. In general, participants answered most of the questions even if they were uncertain about their responses.

Different stakeholders have used terms interchangeably which makes it difficult for people to relate to dykelands, marshes, wetlands, and salt marshes. The Nova Scotia Department of Agriculture has defined marshland as "any land that is subject to periodic tidal flooding" (Agricultural Marshland Conservation Act, 2000). On the other hand, a wetland is "a poorly aerated area, or ecosystem which serves as a transition zone between the land and a water body, therefore having properties of both dry land and water source" (Government of Nova Scotia, n.d.). It was observed that more information was needed from respondents before designing the interview questions. In future research, there

should be a clear distinction of the definition of marshlands, dykelands, and wetlands for respondents. A study like this should begin with a focus-group discussion to provide input into design of the interview script.

3.4 Data Analysis

The validity of qualitative data is normally low because the data collection, analysis, and reporting of the results is influenced by the researcher. Smith and Glass (1987) point out that analyzing qualitative data requires a reduction of the amount of data collected into smaller themes and categories while maintaining relevant information, characteristics, and meaning. It has also been observed that organizing and processing qualitative data is essential before data analysis (Berg, 2001). Once all audio files were transcribed, the open-ended questions and the notes gathered during the interviews were organized using NVivo9 software (Welsh, 2002). The responses to the values table were analyzed using SPSS statistics 19 software (IBM SPSS Statistics 19, 2011). The results were presented in graphs and tables.

3.4.1 Open-ended Content Analysis

Individual responses to open-ended questions were compiled and analyzed using NVivo9 to find themes and then exported into Excel. The content of each interview script was systematically analyzed based on selected themes identified (Hay, 2005). Themes identified from the interviews included: interest in dykes and dykelands; perceptions of important values to participants; the role of the provincial government and the general public in the maintenance of dykes and dykelands; and threatening issues pertaining to

the sustainability of dykes and dykelands. Occasionally, responses were grouped using the occupational background of the respondents and quotes from them were used.

3.4.2 Closed-Ended Analysis

Responses provided on the values table rated by respondents were analyzed using SPSS (IBM SPSS Statistics 19, 2011) software for frequencies and cross-tabulations. Respondents' cultural and occupational backgrounds were used with the values to identify how various groups perceived dykes and dykelands. Averages and frequencies were used to describe differences between ratings and participants' values.

3.4.3 Correlations

A series of statistical tests was conducted on the closed-ended questions (values table) to determine if there were any correlations between participants' gender, background, and occupational group and their perceptions on the values identified. Statistical tests such as Pearson's correlation coefficient and regression analysis were conducted to search for significant differences but none was observed. The initial analysis indicated that the response data did not meet the required assumptions for the statistical analysis. Regrouping of the data provided less than the minimum of five counts needed for the statistical analyses.

3.5 Ethical Considerations

All interviews were conducted by me and participants were allowed to decide on the time and place of convenience to undertake the interviews. Potential participants who did not want to participate in an interview were exempted without any further follow-up. During

the initial contacting of participants, I ensured that those who were uncertain about participating were not persuaded into the study. Consent forms which talked about the study and the details of participation were given to participants (Appendix 2). They were given enough time to read through and ask questions before affixing their signatures.

I tried to avoid questions that were sensitive, as required by the Dalhousie University ethics approval. Participants were asked to answer only those questions they were comfortable with and to stop whenever they felt the need. Throughout the research, I tried to ensure the highest level of confidentiality and respected the rights of all participants. However, anonymity was impossible since snowball sampling was used. Respondents have not been identified in the thesis or any report. The completed questions were locked in a safe place where only I have access. All materials (both audio and transcripts) will be kept for five years after publication and then securely shredded.

3.6 Limitations

Most research studies have limitations. The primary limitation of this study was the sample size which does not allow full generalization of the results. Interviewing 30 people for this kind of research, though not too small a sample size, makes it risky to generalize. Also due to the sample size, statistical techniques such as correlation and regression could not be conducted.

There were a few potential sources of biases within this research study. This was a result of the reluctance of some Nova Scotians to participate in the study and the unavailability of potential stakeholders in the occupational groups I created before collecting data. Due to time constraints, every person who was willing to participate, irrespective of which

category they belonged to, was interviewed. Some of the identified values were categorized under ecological, economic and socio-cultural values when necessary. I admit that the act of categorizing may lead to misinterpretation of responses (Lutero, 2010) because some values and services can justifiably be placed under more than one category.

To ensure a high level of integrity of the research participants, I tried not to let my perceptions influence their responses. However, the introduction of the list of values and services for dykes and dykelands may have influenced how respondents perceived dykes. As a researcher with no previous knowledge on dykes and dykelands before starting this research, I was on neutral ground on most issues concerning dykes and dykelands. This guided me through my data collection, analysis, and thesis writing without undue prejudice.

CHAPTER 4 RESULTS AND DISCUSSION

4.1 Introduction

The issue of maintaining dykes and dykelands has long been of interest to governments, landowners, environmental NGOs, researchers, and other Nova Scotians. On one hand is the maintenance cost and on the other are the direct and indirect benefits of dykes and dykelands. Since not all dykes and dykelands are fulfilling their original purpose, the challenge is whether to continue maintaining all of them (NSDA, 2009). With climate change and rising sea levels, the issue of dyke maintenance has become even more important. Due to budget constraints, dyke maintenance has depended on their condition instead of being routine on an annual basis. Dyke maintenance is now selective depending on each dyke's location. Government is faced with the question as to which dykes to maintain and which dykelands to allow to revert to natural salt marsh. This important question cannot be answered based on casual observations or on anecdote. The objective of this research was to provide insights from some Nova Scotians about the range of values associated with dykes and dykelands and factors to be taken into consideration when making decisions concerning their maintenance.

This chapter presents and discusses the results of the study including the major themes that emerged from the data collected and site observations. The goal is to provide an understanding of how people perceive and value dykes and dykelands, and their expectations for future maintenance. The findings are reported using evidence from the interviews and values tables. I begin with brief demographic information about those who participated in the interviews. I also synthesize interview excerpts from participants on

how they value dykes, what they see as threats, how the threats could affect their perceptions of dykes in the future, and their expectations on dyke-building and maintenance.

The respondents provided information on their general perceptions of the dykes and dykelands in the province, with little emphasis on specific dykes and dykelands. Similar questions were asked during interviews in the research to elicit people's perceptions and opinions on dyke and dykeland values.

4.2 Demographics

Demographic information such as sex, occupation, and cultural background of respondents was obtained from the interviews. Sex was, however, not part of a quota sample control. Out of the 30 people interviewed, 67% of them were males and 33% were females.

Participants' occupation and cultural background (Acadian or non-Acadian) were very important to this research. Interviewing people to find out their perceptions and how they value dykes and dykelands would have been incomplete without talking to Acadians. The respondents comprised 30% Acadians and 70% non-Acadians. Out of the nine Acadians who were interviewed, there were five males and four females.

The respondents were grouped into four occupational clusters using a non-hierarchical approach to identify trends in stakeholders' perceptions on values that can be associated with dykes and dykelands. The clusters were government, landowners, ENGOs, and researchers (Figure 4.1). The initial plan was to interview an equal number of people in

each cluster. This was not possible due to the availability and willingness of participants for the study. The researchers cluster, comprising 40% of respondents, included those whose occupations involved research in either government organizations or universities. Approximately 27% worked in some capacity in government departments such as the provincial Department of Agriculture and Tourism and Parks Canada but were not researchers. Farmers and people who owned property on dykelands formed 20% of the total respondents. These participants collectively were known as the landowners group. Participants working with various ENGOs such as Ecology Action Centre and Coastal Wetland and Environmental Consultants formed 13% of the total respondents known as the ENGO group.

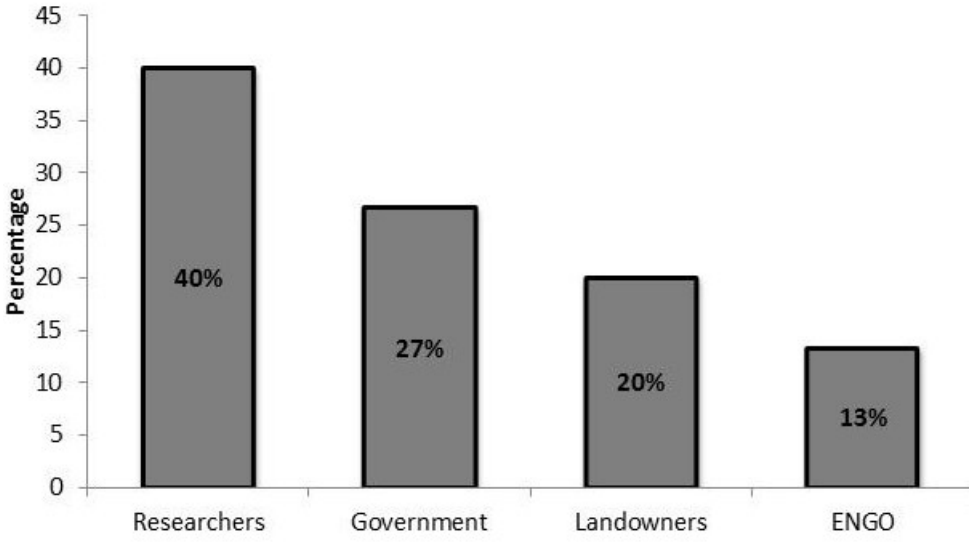

Figure 4.1: Occupational groups of respondents

A couple of participants belonged to more than one occupational group. For instance, two researchers also had businesses on dykelands. These people were categorized in groups where they spent more time and the highest income was earned.

Aside from the demographic information, I also wanted to know more about respondents' occupations and for how long they had been in those specific occupations, whether they had any personal history in relation to dykes and dykelands, how and why they were interested in dykes and dykelands, whether there are specific dykes that are most important to them, and what aspect or attributes are most important to them. The majority of the people interviewed (42%) had been in their occupation for less than 10 years. About 31% had been working in their fields between 11 and 20 years while 17% had been in their occupation for 21 to 30 years. A few participants, constituting 10%, had been in their occupation for more than 30 years, and had either retired or were near retirement.

4.3 History and Relation to Dykes and Dykelands

Respondents were asked if they had a personal history that related to dykes and dykelands. Their histories and relations varied. The connection and interest included: childhood familiarity; marriage, family and friendship relations with Acadians; occupation; education; and personal interest in the Acadian culture. About 53% of the people interviewed indicated they had a personal history that relates to dykes and dykelands due to their being of Acadian descent, marriage, or association with Acadians.

The Acadians I interviewed had a common history which they believed related to dykes and dykelands. Some of the common ways they described their history and relation to

dykes and dykelands was through ancestral connection. One of the Acadians explained that his "*ancestors* [were] *some of the first settlers that came from France"* [Inteview 015]. Another person said " …..*I'm from this area, my ancestors were farmers so I have a lot of farming stories about the dykelands* [and] *family members working and building the dykes"* [Interview 018]. Another respondent indicated: "*my ancestors were planters and the home farm has always been [on a dykeland]"* [Interview 003].

Some respondents had been living or working on dykelands from childhood and as such expressed a strong relation to the dykes and dykelands although they are non-Acadians. For one respondent, his *" personal connection or relation to dykes have been from childhood, living in a family cottage on a dykeland and spending time playing along the dykes"* [Interview 012]. Some respondents had a connection or history that relates to dykes and dykelands through their occupation. For instance, one respondent "*grew up on a family farm which was on a dykeland and* [she and her] *husband also own a dykeland"*. Another indicated: "[he] *pastured cattle, cut hay, grass and harvested cereal grains (wheat, oats and barley) all* [his] *life on dykelands"* [Interview 005].

Although sometimes people develop interest after connecting or having an experience with something, not all respondents demonstrated that. A respondent indicated: ". . . *other than my job, I don't really have a personal connection*" [Interview 029]. Forty seven percent (47%) of the respondents indicated they had no personal history that relates to dykes and dykelands. It is important to note, however, that although some people had knowledge about dykes and dykelands, they had very little or remote connections to the services that dykes provide.

4.3.1 Respondent's Interest in Dykes and Dykelands

Respondents were asked if they had any interest in dykes and dykelands and what their interests were. Their interest was generally based on their knowledge, connection, and day-to-day activity in relation to dykes and dykelands. Respondents' interest in dykes and dykelands issues included agriculture, history, recreation, engineering services, protection of assets, and restoration of natural salt marshes (Table 4.1).

Table 4.1: Respondents' primary interests in dykes and dykelands

Interest	Number of Respondents					Percentage
	Researchers	ENGO	Government	Landowner	Total	
Agriculture	4	0	3	3	**10**	**33**
Historical	4	3	1	1	**9**	**30**
Recreational	2	0	3	0	**5**	**17**
Restoration	1	1	1	0	**3**	**10**
Protection of Assets	0	0	0	2	**2**	**7**
Engineering	1	0	0	0	**1**	**3**
Total	**12**	**4**	**8**	**6**	**30**	**100**

Of the 30 interviewees, 10 (33%) had high interest in the agricultural use of dykelands in the province. Those respondents saw dykelands as productive agricultural land good for planting crops and for pasturing dairy cows. A respondent indicated that " *It is fertile land they do not have to clear and they do not have to pick rocks. So it is productive, produces high yield, and some high-value crops"* [Interview 029]. These people are interested in dykelands because they identify that they provide a livelihood for farmers. According to a respondent who was not a farmer,

> *My interest? Just to maintain and protect the dykes and aboiteaux so that the farmers can maintain their own life, maintain their family farms, provide a living for them and their families and their generations* [Interview 024].

Some respondents who had no business, property, or history that relates to dykes and dykelands had interest in the agricultural aspect.

The historical aspects of dykes and dykelands were also important to some of the respondents, mostly the researchers and ENGO groups. Thirty percent (30%) of the respondents described the historical aspect of dykes and dykelands as something that captures their attention. One respondent said: "*I see them first as a historical component to our province in terms of the role they played throughout history in establishing our society*" [Interview 001]. Another respondent also indicated: "*what is my interest? I think about the historical part of them*" [Interview 025]. It is obvious that the respondents had keen interest in the historical aspect of dykes since they spent much time talking on this subject . A researcher said: "*I learned a bit about dykes and I was interested in how they work and the story of the Acadians*" [Interview 014].

Another aspect of dykes and dykelands that respondents indicated as interesting to them was the recreational use, mostly for members of the government group. Some respondents, based on where they live and how they used the dykes and dykelands, identified how the recreational aspect was interesting. Wolfville dykes were mentioned as a place that people go for recreation. A respondent indicated that "*I'm drawn to the recreational aspect. Just hiking on the dykelands along the Bay of Fundy and I find it very interesting*" [Interview 021].

Two (7%) of the respondents who were landowners were interested in how the dykes and dykelands provide protection to coastal communities as climate change and sea-level rise are inevitable. A respondent indicated: "…*interest in dykes is primarily safety because of the concern we have about preserving the area that is protected by the dykes"* [Interview 002]. The other respondent also said: "I *am interested in learning about climate change and sea-level rise issues concerning dykes and dykelands"* [Interview 010]. Respondents in the landowner group had vested interest because of the protection the dykes provide for their properties. One respondent who belonged to the researcher group was interested in the engineering aspect of the dykes. He said:

> *I have a great deal of respect for the people who came to Nova Scotia in the 1700s and built dykes. Acadian dykes in Kings County always impressed me from an engineering point of view. ….travelling to Holland and seeing dykelands where the soil still contains visible sea shells and the soil here in Kings County are much deeper and better sorted, I find the engineering interesting comparing the two* [Interview 013].

However, not all respondents I interviewed were interested in the values or importance of dykes and dykelands. Some respondents had other interests. They indicated that their interest in dykes and dykelands was to remove dykes and allow natural salt marshes to form. Ten percent (10%) of the respondents indicated they were interested in the restoration of the dykelands back to natural salt marsh. One respondent explained:

Both personally and professionally, I would like to see more of the dykelands return to natural salt marshes because we have lost a lot of natural salt marsh in Nova Scotia and

I just have a personal interest in wetland habitat. I particularly like salt marsh as a place to hang out [Interview 009].

Another respondent said: "*I don't know if I have an interest in dykes and dykelands. I am interested in natural salt marshes*" [Interview 018]. A respondent in the ENGO group indicated that "*my interest with respects to dykelands primarily is identifying dykelands that are potential candidates for removal and restoration back to natural salt marshes"* [Interview 012].

It was anticipated that all respondents in the ENGO group would advocate for the restoration of natural salt marshes, since that was their obvious inclination. However, this was not the case. Three of the four respondents in the ENGO group were interested in the historical aspect of dykes and dykelands in the province (Table 4.1). None of them was interested in the agricultural, recreational, preservation, or engineering aspect. The landowners, not surprising, had no interest in recreation or restoration of salt marshes. Restoration will mean loss of their property and recreational use of the dyke walls could disturb the dykes and result in higher maintenance cost.

Although research has indicated that climate change and its sea-level impacts put low-lying coastal areas at great risk (Singh, Walters, & Ollerhead, 2007), most respondents did not express interest in dykes based on those factors. The historical and agricultural aspects of dykes and dykelands were of high interest to respondents.

4.3.2 Dykes and Dykeland Areas of Importance to Respondents

When the respondents were asked about which dykes and dykelands were important, their responses varied. Some were quite familiar with dykes close to their residences while others thought about the common ones they had heard about or visited. For 33% of the respondents, no specific dykes were important. They believed that once the dyke is protecting farmland, it is important. The remaining 67% indicated specific dykes as important. The dykes mentioned included the Grand-Pré, Truro, Wellington, Tantramar, Avonport, Selma, Maitland, Wolfville, St Croix, and Hantsport dykes. Six of the thirty respondents were from the Annapolis Valley, but most of the common dykes mentioned were located in the Annapolis Valley. About 50% of the respondents who indicated there were some specific dykes of interest to them mentioned the Grand-Pré dykes. This was not surprising because Grand-Pré is known to be the home of early Acadian settlement (Bleakney, 2004). A respondent indicated that "…….. *we have nominated this area to be recognized as a World Heritage Site because it speaks of a universal outstanding value that connects people on the planet as well"* (Interview 024).

4.3.3 What Respondents See as Most Special about Dykes and Dykelands

Participants were asked to indicate which aspect of dykes and dykelands was special to them as individuals. More than half the respondents indentified economic values and services (with much emphasis on agriculture) as a special aspect of dykes and dykelands. Ten (10) of the respondents mentioned agriculture, four (4) soil fertility, and two (2) mentioned income from dykeland services (Table 4.2). Agriculture was not only seen as generating income and providing a livelihood for some people but also as a way of life.

The others described the historical (9), recreational (2), and cultural (1) aspects as being most special to them. A repondent indicated that dykeland is a good habitat for bees and felt that it was special. Only one respondent indicated that protection of land from flooding was special to him. Although the socio-cultural values do not have direct utility or monetary value, respondents could easily relate dykes and dykelands to Acadian history in the province. The agricultural values are what people see all the time and are familiar with since that was the main reason the dykes were built. Some of the participants expressed the view that today's dykelands are inexpensive for producing crops for the future as food-security issues become increasingly important.

Table 4.2: What respondents indicated was most special about dykes and Dykelands.

Special aspect of dykes and dykelands	Frequency	Percentage
Agriculture	10	33%
Historical Aspect	9	30%
Soil Fertility	4	14%
Source of income	2	7%
Recreational Aspect	2	7%
Cultural Aspect	1	3%
Habitat for bees	1	3%
Protection from floods	1	3%
Total	**30**	**100%**

4.4 A Typology of Values Associated with Dykes and Dykelands in Nova Scotia

People place both direct and indirect values on biophysical features. Individual values may differ based on a person's definition and understanding of the meaning of value (Dietz, Fitzgerald, & Shwom, 2005: Kempton, 1995). It is therefore useful to explain the context in which the term value is being used. The word *value* was used as worth, utility, or importance of something (Mish, 2001) for the respondents. It refers to a general assessment of what is desirable to respondents concerning dykes and dykelands. For the provincial government to justify continued maintenance of dykes and dykelands, the full suite of values associated with them should be known.

Some values can be readily monetized, others not. Monetary values can be obtained from the price of, say, farmlands which the dykes make possible, and the price of the agricultural output from the farmlands. There are many other values for which it is difficult and perhaps even inappropriate to assign a present or future monetary price. For example, it is difficult to put market prices on the historical or archaeological values of dykelands for the artefacts that have become buried over the years. It is also difficult to put a price on the sense of place and attachment and to the commitment of people who see the dykes and dykelands as part of their history. In this study, the assessment results were grouped using open-ended and closed-ended responses. Several characteristics were identified that can give some information on how respondents see the dykes. This research made no attempt to study dyke and dykeland values in monetary terms.

4.4.1 People's Perceptions of Dyke and Dykeland Values and Services (Open-ended)

This research tried to identify how people perceive and value dykes and dykelands based on their existing knowledge. The first part of the interview was to provide an opportunity for participants to describe and talk about values and services that they associate with dykes and dykelands. Here respondents were prompted to talk about dykeland values from economic, ecological and socio-cultural perspectives without giving them any examples. Although they had different ways of looking at values under the categories, it expanded their thoughts which yielded a more detailed array of responses. Some of the common values and services (Table 4.3) that emerged from the open-ended questions are discussed in this section.

Table 4.3: Dyke and dykeland values and services identified by participants during open-ended conversations

Values and Services	No of Respondents
Agriculture/farming/ farmlands	25
History and heritage of Acadians	22
Protection and prevention of floods	21
Ecosystem/ habitat	16
Income/revenue	10
Pasture/hay/forage production	9
Plant and animal species	9
Soil fertility	9
Artefacts	8
Cultural significance	8
Place attachment / connection	7
Tourism/eco-tourism	5
Cultural landscape	5
Recreation	4
Generation (past and future)	3
Regulating pesticides and runoff	3
Aesthetics	3
Prevention of coastal erosion	3
Protection against storm surges	2
Employment	2
Dyke building technology	2
Social Interaction	1
Nutrient Management	1

Dykelands are well known for their agricultural use and most of the respondents were familiar with that. Due to the levels of knowledge and information the respondents have on the agricultural aspect of the dykes and dykelands, they provided more information on that. Most of the participants were aware of the agricultural value of dykes and dykelands since they could easily identify with the agriculture. For more than half of the respondents, agriculture or farming was an important part of dyke and dykeland culture. A respondent indicated: "*there is agriculture value for cattle, grain, hay crops, and some*

places have corn" [Interview 018]. Some placed emphasis on food issues. One respondent indicated:

> *I keep coming back to our own activity to produce our own food. I think it is a great place to grow food which means it is important. ……People, whether in Halifax or Fredericton, do not have association with agriculture but they will have to eat. I think it is important to me. I guess people don't know how important it is to the economy if food is produced here instead of buying it from some where else or importing…..why depend on somebody else to produce your food if you can grow it?We can grow our own food, we know what we are eating, keep jobs here, keep farmers here* [Interview 029].

Respondents value the soil fertility on dykelands. Most literature on Acadian dykes and dykelands describes their importance, throwing bright light on the fact that the lands were used to grow crops without the application of fertilizer (NSDAM, 1987). Some of the respondents commented on the dykelands as croplands rich in nutrients which can make more money than growing crops on upland. One respondent explained that the *"marshlands are extremely fertile and keep producing year after year over many centuries. It is* [therefore] *a very valuable asset to have"* [Interview 015]. A respondent said that "[the] *soil is highly fertile soil and over the years has not required a lot of fertilizers to go into it*" [Interview 023]. Respondents identified dykes and dykelands as an important economic asset to the province because they have certain benefits such as high soil pH compared to regular upland farmlands which are more acidic. To one respondent, "*the dykelands do not dry out fast in drought, thus making them particularly*

suitable for farming" [Interview 029]. Another respondent said: "*you have really good cropland and the soil is really rich in nutrients*" [Interview 010]. Some respondents believed that the fertility of dykeland soils results in lower costs of production.

Some of the crops mentioned as being successful on dykelands included soybeans, corn, onions, and carrots; one respondent indicated that "[they] *grow carrots and onions and green corn, winter wheat and soybeans and some hay"* [Interview 027]. Some of the respondents indicated that the dykelands keep improving and more vegetables are doing better than in previous years. It was obvious that those respondents were trying different crops and being successful. They see building of new dykes as a great opportunity to expand productive agricultural lands for diverse crops in Nova Scotia.

Revenue generated from agriculture was seen as an important contribution of the dykes and dykelands by some respondents. Farmers derive direct income from hay, pasture, cereal crops, and vegetables grown on the dykelands (NSDNR, 2009). However, one respondent believed that revenue goes beyond what dykeland owners earn directly from their farms. He believed that buying hay from dykeland farmers to feed his animals that are not raised on dykelands helps him generate revenue. He explained: *"…..generating revenue for him by selling hay and haylage and it is generating revenue for us because once we feed that to the animals, we sell the final product*" [Interview 022].

Employment was not only related to farming by some respondents. A respondent said: "*there is employment to maintain them, there is employment in agricultural use, and there is employment for the interpretive centre to talk about the history of them*" [Interview 006]. Yet another respondent indicated that "[he] *employs two to three people*

every summer on [a] *dykeland property"* [Interview 030]. Clearly, some respondents saw the dykes and dykelands as providing important source of employment in Nova Scotia.

More often than not, respondents related Acadian history to dykeland farming. Most respondents talked about farmlands and agriculture linked to Acadian history. According to one respondent: "*The construction and maintenance of dykes and the farming of dykelands is huge from a historical and cultural standpoint*" [Interview 012]. Another respondent indicated: "*they are of value in terms of heritage and our history*" [Interview 001]. Although not all respondents indicated that dykes and dykelands were important in the province, the majority appreciated their historical and cultural relevance. Most respondents identified the cultural heritage value of the dykes as important. One respondent said: "*they speak, because if you listen to Acadian folklore, songs, culture and inspiration, the aboiteaux and dykelands are resonating with them*" [Respondent 024].

Some respondents, irrespective of where they lived, had a great emotional attachment to the dykes and dykelands. Respondents indicated that the dykes and dykelands provided a sense of connection, which for most people is linked to the Acadian heritage even though some were non-Acadians. A respondent said:

> *there is a long-standing connection. ….the Acadians consider this space as a place of memory, place that triggers collective memory of past events surrounding their deportation. It is also a place that triggers the memory of their ancestors' accomplishments* [Interview 008].

Another respondent indicated that "[she] *thinks people get attached to landscape"* [Interview 021]. The dykes have become important components of culture and everyday

life for many people. Singh, Walters and Ollerhead (2007) suggested that some people hold deep cultural and historical attachment to farming and see dykes and dykelands as part of their way of life. Some respondents also mentioned that there was something unique about the landscape which connects people. According to one respondent: "*I don't know how to describe it but there is something about that landscape which connects with people*" [Interview 023]. Some respondents also indicated that they attributed a great value to dykeland culture and people's connection. He said: "*In some way the most important one is people's attachment to the landscape; people's attachment to the idea of dykelands; people's connection with the amount of work and effort that past generations put into creating the dykelands*" [Interview 019].

Although some dykelands may not be actively used for agriculture any more, the place clearly reminds the residents of the history of Acadian settlement and farming. Some respondents indicated that they found Grand-Pré to be very important because it is the main Acadian settlement with scenic qualities like the dykes, aboiteaux, and church, all part of a unique Acadian culture which attracts a growing number of tourists.

Some respondents attributed aesthetic values to the dykes. They saw the technology of building dykes and the dyke walls as being unique. One of the respondents explained that he

> *grew up on them. .... to me no matter where* [he has] *travelled to in the world, dykelands and marshlands are some of the beautiful landscapes that* [he has] *come across. It doesn't matter whether it is in North America or, whether it is in Europe or whether it is in Asia, dykelands to* [him] *are very beautiful. For most*

> *people* [he] *think*[s] *if they see dykelands, they see it from a distance but for* [him], *it is being close to it from a family point of view, growing up and farming the dykelands* [Interview 023].

Another respondent said this:

> *The place itself was a place that attracted visual artists, writers, and other forms of artists who described the place to represent a place that was aesthetically appealing, a place of inspiration that was appropriate for setting various human experiences* [Interview 008].

A respondent felt that "…. *these dykelands here make this area unique*" [Interview 018]. To such people, it does not matter whether they are actively used for agriculture. The dykes and dykelands remind them of their ancestry. A respondent indicated: "*They see* [dykes and dykelands] *as a legacy that their ancestors built with their future in mind"* [Interview 024].

Some respondents indicated that they see the dykes, aboiteaux, and other materials as important cultural artefacts in the province. A respondent said: "*the older dykes are archaeological artefacts themselves*" [Interview 018]. Occasionally, pieces of broken china or scraps of metal are unearthed in some places of Acadian settlement which tell the story of the Acadians and their way of life (Cabins, 2011). The recent discovery of an aboiteau sluice built by the Acadian settlers (Fowler, 2006) serves as evidence of the presence of artefacts on dykelands. The discovered aboiteau has been added to the artefact collection in the Grand-Pré museum. Some of the respondents believed that there is a possibility of identifying more buried artefacts in years to come. Cultural artefacts

such as the dykes and other farming and household equipment used by the Acadians would be lost if dykes were allowed to revert to salt marshes. A respondent indicated: "*from an archaeological point of view, they are highly important and something that needs to be protected*" [Interview 023].

There were various recreational uses of the dykes and dykelands in the province which respondents found important. Places like the Tim Horton's community soccer field, the golf course in Truro, and the Grand-Pré museum and park are places that respondents discussed as promoting tourism and recreational activities. Respondents also mentioned some dykes and dykelands that they use for recreation. The Wolfville dyke was mentioned as a hiking place by some respondents. Other recreational activities mentioned included bird watching, visiting, camping, relaxing, enjoying the tides, and walking dogs. According to a Wolfville resident, "*Wolfville dyke is well known for culture, for people's recreation, walking around and they take their dogs"* [Interview 002]. Other people who are not residents also travel to dykelands for recreational use. A respondent who lives in Halifax said:

> *[her] dogs love them. [Her] use of dykelands in the last ten years has been greatly influenced by hiking with [her] dog and [she] still uses them. The dykes outside Wolfville, [she] has friends who live in that town and their property extends out on the dykelands where there is this popular hiking trail among the dykes. [She] used to go on probably every month* [Interview 021].

The respondents who recognized the recreational value of dykes were those who lived close to or worked directly on the dykes and dykelands and see people patronizing them

frequently. People who lived away from the dykes and dykelands and did not have any direct connection to the dykes and dykelands did not see the recreational aspect in the same way.

Various plant and animal species have dwelled on the dykelands over many decades (NSDNR, 2009). A respondent reiterated: "*there is a wide range of plants and animals that do very well on dykelands*" [Interview 012]. These plants and animals have established a permanent habitat which might be lost if dykes are not maintained. A respondent indicated that *"there are different plants and animals that are using the dykes and dykelands and that obviously makes them important"* [Interview 025]. Another respondent said: "*we have these plants and animals that depend upon the dykelands that are in some cases unique to that ecosystem"* [Interview 021]. In terms of plant diversity on dykelands, there is natural vegetation of wild plants, some species of which are invasive (NSDNR, 2009). To some respondents, the diversity of plants and animals on dykelands is less than those on salt marshes. There are more non-native species on dykelands than native species.

One person also mentioned that "*dykelands are a mixed habitat or mixed plant community*" [Interview 013]. Some of the animals mentioned included coyote, red fox, skunk, bees, and bald eagle. A researcher interviewed indicated that "*It is a dry area for bees to nest in. A lot of them nest in the ground"* [Interview 014]. There were other people who said they found the dykelands to be a good habitat for bald eagles. According to a respondent:

> *Where can you go and watch a hundred eagles on any day during this time of year? It is just amazing, an amazing sight. I have seen a lot of variety in the wildlife within the dykes immediately adjacent to Wolfville* [Interview 003].

Dykelands have been identified as one of the thirteen ecosystem types in Nova Scotia (Government of Nova Scotia, 2009). Some respondents indicated that dykelands were unique ecosystems whereas others did not. A respondent indicated that a dykeland is a "*very unique ecosystem with a great diversity on it*" [Interview 028]. Some respondents were of the view that salt marsh ecosystem was a better option than dykelands. Other respondents did not feel the same. A respondent explained: "*The change in salt marsh ecosystem to dykelands has happened already; the only change that can occur there is dyking more land*" [Interview 022].

One of the common services most respondents mentioned was on flood-related issues. Some respondents showed much interest in the flood prevention services provided by dykes in the province. Some were interested specifically in the prevention of farmlands from flooding. A respondent indicated: "*the dykes were put in there for a reason and I think the initial reason why the dykes were put in is still applicable today in terms of preventing flooding for agricultural purposes*" [Interview 001]. Another respondent mentioned: "*dykes keep the valuable cropland dry and they keep them from flooding*" [Interview 010]. There was also much concern for coastal communities and infrastructure that are protected by the dykes from floods. Some of the respondents looked at protection beyond agricultural assets. A respondent indicated:

> *I seem to be more concerned about flooding. If you drive into Amherst on LaPlanche street, there are a lot of shops and things that are below the waterline so if the dykes broke at Amherst you would have serious flooding of houses, businesses etc.* [Interview 004].

One respondent also said: "*It protects families, it protects the homes along there. . .. If the dykes were not there, there would be more floods in the area, roads will be threatened, homes will be threatened, farmland will submerge and so on*" [Interview 024].

Another respondent also asserted that:

> *What we are seeing around the Bay is dykes are no longer protecting agricultural land but in fact protecting in some cases critical infrastructure….. expensive infrastructure. You look at Windsor, Truro, Amherst; those are all major urban centres that are not flooding because of the presence of dykes. If the dykes were not there, those areas will be flooding* [Interview 002].

This was in relation to how high the tides can be and past experience of storms and floods in the province. Although the dykes exist, several flooding incidences in the province have raised concerns among people in various communities about what the rising sea level can lead to in the province. The evidence of extreme weather increasing in magnitude and frequency as well as an increase in population and assets at risk (IPCC, 2012) validates the concerns raised by the respondents. People are concerned about the assets and communities that rely on the dykelands for their livelihood. Respondents were not only looking at protection of farmlands and infrastructure but also species on dykelands.

Some respondents also believed that there are various plant and animal species dwelling on dykelands and being protected by them. A respondent indicated: "*There are species that have come to the area because there are various protections for them and they are able to thrive*" [Interview 024]. Not all respondents interviewed found the diversity of plants and animals on dykelands to be important. Some stakeholders believed there is greater plant and animal diversity on natural salt marshes than exists on dykes and dykelands. In view of this, it did not matter what the dykes were protecting. They believed that the dykes are inhibiting natural developments in those areas. A respondent indicated:

> *ecologically, I mean the potential to remove those dykes and restore the area behind them back to self-sustaining natural ecosystems because currently if you have a dyke in place, all the land behind it is artificially being maintained as a different habitat whether it is hay field, pasture, or crop lands* [Interview 012].

This, however, did not mean that such respondents did not value the services of flood prevention and storm protection that dykes provide. They believed that people should not have built on those lands but if they do because of the dykes, that should not make the dykes important from a protection perspective. The same respondent indicated: "*we should be seriously considering no longer maintaining them and either actively removing and restoring to wetlands or just ceasing to maintain the dykes and letting nature take its course*" [Interview 012].

Some respondents were interested in best management practices on dykelands. For instance, a respondent said: "*we don't want to use fertilizer that can go back into the*

streams" [Interview 011]. Other people also mentioned that dykes prevent agricultural runoff. There were also a few respondents who mentioned that the dykes prevent coastal erosion.

4.4.2 Rating of List of Values and Services that Can be Considered for Dykes and Dykeland in the Province (closed-ended)

Nineteen values associated with dykes and dykelands were identified through site visitations, formal and informal communications, and literature. After respondents had talked about dykes and dykelands during the open-ended portion of the interview, they were then asked to rate the dyke and dykelenad values and services on a provided list. The values were not measured in monetary terms but simply identified by name (Figure 4.2) as being potentially important to people in relation to dykes and dykelands. At this point respondents were asked to indicate the importance of the listed values and services to them as individuals. Here some respondents tried to explain their ratings for some values and services on their level of importance.

Hay Production	*Acadian Heritage*
Employment	*Animal Species*
Farmlands	*Cultural Artefact*
Recreation	*Soil Conservation*
Roads	*Sense of Place and Place Attachment*
Tourism	*Storm Protection*
Residences and Businesses	*Plant Species*
Bequest Value	*Flood Prevention*
Revenue from farming	*Ecosystem Type*
Existence Value	

Figure 4.2: Identified values and services checklist considered for dykes and dykelands

Generally, the value most respondents (87%) rated as very important about dykes and dykelands was flood prevention (Figure 4.3). Different stakeholders interviewed showed concern for coastal communities who depend on the dykes for protection and livelihood. As indicated by van Proosdij (2011), climate-related disasters such as storm surges and floods are significant threats to coastal regions. It is therefore not surprising that flood prevention was considered the most important service considering the fact that flooding has been happening in the province. A respondent explained: "*It is important because we have buildings in all these places. I know it is important currently. If it was my property, will I want it to be flooded? Probably not*" [Interview 23]. To another respondent: *"if the dykes were not there, large parts of the province will be flooded*" [Interview 028]. However, 10% of the respondents indicated that flood prevention was not important, whereas 3% indicated it was somewhat important. Dykes serving as a protection against storms was rated by 73% of respondents as very important, with 20% rating it as somewhat important and 7% rating it as not important. Most likely, respondents were more farmiliar with the occurrence of floods compared with storm surges.

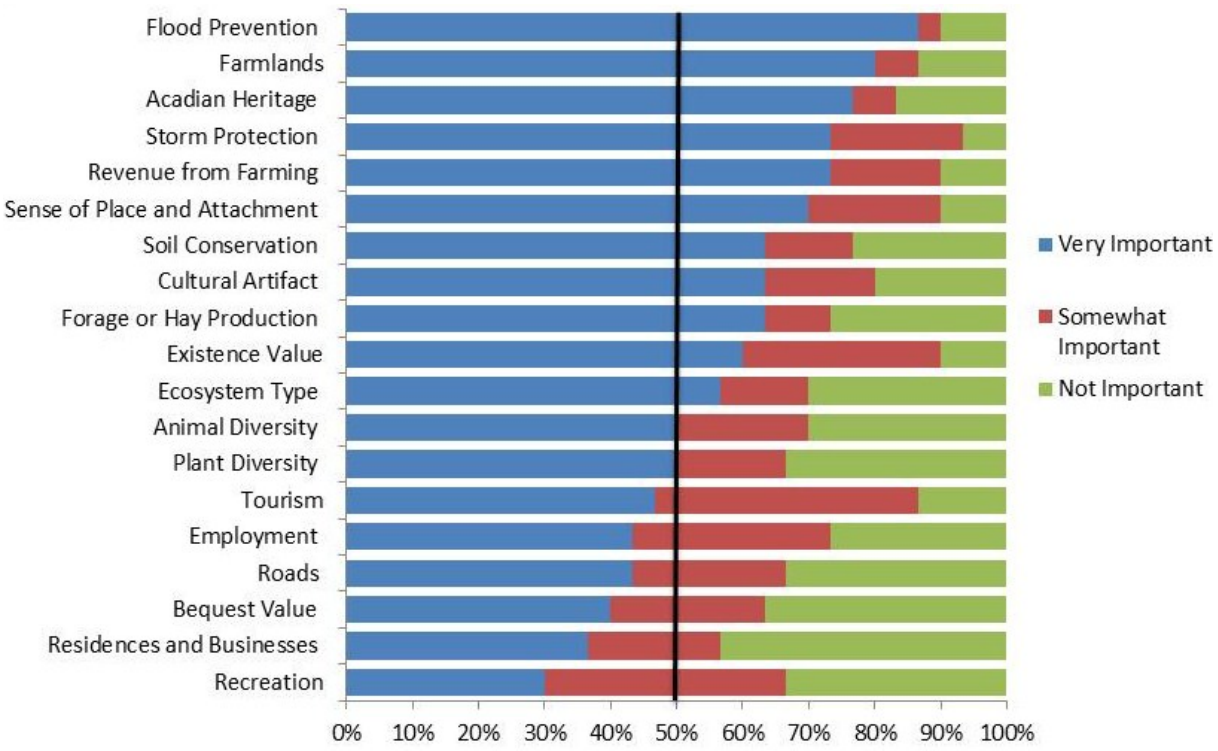

Figure 4.3: Participants' ratings of the values and services associated with dykes and dykelands.

Farmland was the next value after flood prevention, rated as very important by 80% of the respondents with only 10% rating it as not important (Figure 4.3). Most respondents were familiar with the ongoing use of dykeland for farming. Many farmers still depend on the dykelands for their agricultural production. Farmland may be lost in case of flooding, and would be lost for sure in salt-marsh restoration. The high rating of farmlands was not surprising since dykes and dykelands in the province are well known for their agricultural purposes.

Not only did some respondents rate farmlands as very important, but also 73% of the respondents rated revenue from farming as very important. Hay became a highly profitable dykeland cash crop in the province between 1600s and early 1900s (NSDAM, 1987). When respondents were asked to indicate if the use of dykelands for hay

production was important to them, 63% indicated it was very important whereas 27% felt it was not important with 10% indicating it was somewhat important. A respondent who rated hay production as very important said: "*very important because of the dairy industry*" [Interview 002]. Others indicated that forage and hay production was not important, explaining as in this example: "*At one point in time, it would have been very important. We had lots of horses*" [Interview 023]. Another respondent also said "*I guess it was very important but it is not as important now*" [Interview 004].

Respondents also indicated that Acadian heritage was something they valued about dykes and dykelands. This was represented by 77% of the respondents interviewed. It was, however, not surprising since most respondents were familiar with Acadian history and cultural heritage in the province. The majority of the respondents had some background or history that related to dykes and dykelands through marriage, occupation, Acadian descent, or cultural affiliation.

From the values rated, 21 respondents representing 70% indicated sense of place and place attachment as very important to them. All Acadians, unsurprisingly, rated sense of place and place attachment as very important. Respondents not only rated sense of place and place attachment high but also 63% rated cultural artefacts as very important. A respondent explained: "*I will say 3 for what they found on the marsh* [dykeland] *here and some others*" [Interview 029].

Sixty-three percent (63%) of the respondents indicated that soil conservation was very important to them. One respondent who rated soil conservation as very important explained: "*you do not lose soil on dykelands because the land is flat and when shaped,*

the soil does not wash from the system" [Interview 028]. Some respondents who did not rate soil conservation as very important also explained: "*organic soils are not building. Dyke is preventing sediments from settling. Probably losing soil*" [Interview009]. Another respondent also explained: "*soil from a farming point of view even with the dykes in place, we are not necessarily conserving soil*" [Interview 023].

Also, 57% of the respondents rated the dykeland ecosystem as very important. A respondent indicated: "*it is a very unique ecosystem*" [Interview 028]. Plant and animal species and diversity were rated by half of the respondents (50%) as very important. The remaining 50% considered plant and animal diversity as either somewhat important or not important. A respondent explained: "*dykes are preventing species diversity. The dyke itself is not maintaining species diversity, they are reducing diversity*. *What is behind the dykes is invasive species that come in because we are managing that system*" [Interview 009]. Another respondent also said: "*the plant species that exist are not important, they are invasive species*" [Interview 023].

Sixty precent (60%) of the respondents rated existence value as very important and only 10% percent rated it as not important. Bequest value was not very important to respondents as compared with existence value. About 40% of the respondents rated bequest value as very important with 38% indicating it was not important. A respondent explained: *"I come across a few landowners that think it is not important but then they don't want to let it go, they want it to be there for future generations. From my perspective, I think it is a waste"* [Interview 002]. Although a few respondents indicated

that they did not know what bequest value was, it was unclear whether other respondents understood existence value well.

While respondents placed high value on flood protection, they placed less value on residences and businesses.This was the value that 43% respondents rated as not important. A respondent explained; "*they are not allowed to build on them*" [Interview 004]. Another respondent said: "*the houses there should not have been there*" [Interview 023]. A respondent also explained: "*in my opinion, they should have never built on dykelands. I think it was a big error*" [Interview 028]. Another respondent also indicated: "*I have told you that there has been building done which I don't think should have been so. My feeling is that, generally, the value of dykes to residences and businesses should be low*" [Interview 003]. Clearly, to such respondents those who built there knew those places were at risk. It is, therefore, not the responsibility of society to pay for and protect such infrastructure from floods. Such respondents did not value the non-agricultural employment and income from other businesses that are situated on dykelands. Although the private and commercial businesses operating on dykelands generate income and provide employment to residents, people rated it low. Only 43% of the respondents rated employment as very important to them. By contrast, it was apparent that farmlands were important to them because of food production.

The recreational value of dykes was the least important value to respondents. Nearly equal numbers of respondents rated the recreational value of dykes and dykelands as either very important (30%), somewhat important (37%), or not important (33%). A respondent who rated recreational value as not important said: "*I do not see why it is*

important to maintain it for that purpose" [Interview 029]. This may be a result of the Department of Agriculture and marsh bodies discouraging people from using the dykes for recreational activity because it damages the dyke walls, thus making maintenance more costly. A respondent in the government group indicated: "*In Grand-Pre,* [they] *have paid attention to recreational activities not interfering with agricultural use. Agricultural use is the prime objective*" [Interview 008]. Those who lived or worked close to the dykes knew the regulations concerning the recreational use.

More than 50% of the respondents considered thirteen out of the nineteen values very important, including: flood prevention, farmlands, Acadian heritage, storm protection, revenue from farming, sense of place and place attachment, soil conservation, cultural artefact, existence value, ecosystem type, forage or hay production, plant diversity, and animal diversity. However, fewer than 50% of the respondents indicated high importance for six of the identified values and services: tourism, roads, employment, bequest, residences, and businesses.

When respondents were given the opportunity to add more values and services that could be considered for dykes and dykelands, or indicate whether some equally important ones were omitted, they had nothing more to add. The respondents were satisfied with the list of values presented. A common comment by the respondents was that the list was thorough. One of the respondents said: "*actually that was pretty comprehensive*" [Interview 021]. It should be noted that this was, however, not necessarily an exhaustive list of all the values and services associated with dykes and dykelands in the province.

4.4.3 Occupational Groups and their Rating of Dykes and Dykeland Values

Respondents were grouped using their occupational background to determine whether occupation might influence how one perceives dykes and dykelands values. The cross-tabulation of the occupational groups and their rating of the values table and the three broad categories showed different trends (Appendix 5).

Considering the problems associated with floods in most parts of Nova Scotia, it is not surprising that flood prevention was rated the highest across various occupational groups (Appendix 5). All the landowners rated flood prevention and storm protection as very important. Members of this group derive direct benefits from the dykes and dykelands either as farmers or as property owners. It is likely that they have experienced various forms of flooding in the past, and are aware of the devastation that comes with a flood. Surprising, however, was that 75% of the respondents in the ENGO group also rated flood prevention and storm protection as very important, especially since they are of the view that natural salt marshes rather than dykes provide better prevention from floods.

Still, 75% of the ENGO group did not see soil conservation as very important. They valued highly the protection being provided to coastal communities and infrastructure. In all, it is the landowners and ENGO members who placed a higher economic value on dykes and dykelands, followed by researchers, and lastly respondents associated directly with the government sector. Eighty-three percent (83%) of respondents from landowner, 67% from researchers, and 62% from the government groups rated soil conservation as very important. Plant and animal diversity were rated the same way by respondents from both government and ENGOs. Seventy-five percent (75%) of respondents in the ENGO

group rated plant and animal diversity as not important whereas 50% from the government group rated them as very important (Appendix 5). I observed with the researchers group that 50% of the respondents rated animal diversity as important whereas the other 50% rated it somewhat important and not important. With the exception of the ENGO respondents, almost 50% from all other occupational groups rated plant diversity and animal diversity as very important.

Farmland was rated by the majority of respondents across the occupational groups as very important. All respondents in the ENGO category rated the farmlands as very important. However, one landowner respondent, a farmer, rated farmland as not important. I did not ask or do a follow-up with the respondent, but perhaps this particular landowner is now more interested in the use of the dykeland for non-farm uses such as commercial or residential development. Eighty-seven percent (87%) of respondents from the researchers, 75% from the government, and 66% from the landowner groups rated farmlands as very important. Revenue from farming was another important value to respondents across occupational groups.

The point here is that farming, which was the original intended purpose, is still seen as important although this has come at the expense of productive natural salt marshes. All respondents in the ENGO group rated revenue from farming as very important. Seventy-five percent (75%) of respondents from researchers, 66% of the landowner group, and 62% of the government group rated the revenue from farming as very important. Forage and hay are the most common crops grown on dykelands. Eighty-three (83%) of landowners rated hay and forage production as very important compared to 67% of

respondents from researchers, and 50% of respondents in the government and ENGO groups.

Nearly 50% of respondents in the researchers group did not see the indirect benefits from dykes and dykelands in terms of employment, and the protection of roads, residences and businesses as very important. In contrast, about 50% of respondents from the ENGO group rated the protection of roads, residences and businesses as very important and the other 50% as not important. It was anticipated that landowners will place high value on employment benefits associated with dykes and dykeland acitivities. However, only 50% of the landowners rated it as very important.

Unless people have close historical ties, especially one through family, respondents' occupational backgrounds were not expected to have much influence on their rating of socio-cultural values. At least 50% of respondents associated dykes and dykelands with Acadian heritage. Across the occupational groups, 87% , 83% and 75% of respondents from the government, researchers and ENGO groups, respectively, rated Acadian heritage as very important (Appendix 5). Sense of place and place attachment was another value that was rated as very important by 50% or more of respondents across all occupational groups. Seventy-five percent (75%) of the respondents from the researchers group, 76% from the landowner group, and 75% from the government group rated sense of place and place attachment as very important. The ENGO group rated sense of place and place attachment as either very important (50%) or somewhat important (50%). With the exception of the ENGO group where only 25% of respondents rated tourism as very important, 50% of all other occupational groups rated it as very important (Appendix 5).

Across all occupational groups, 50% or more of respondents rated farmlands, revenue from farming, Acadian heritage, cultural artefacts, sense of place and place attachment, flood prevention, and storm protection as very important. On the other hand, 50% or less of the respondents across all occupational groups rated residences and businesses, employment, recreation, and tourism as very important. ENGO respondents were more enthusiastic about farmlands and revenue from farming compared with all other values. Biodiversity-related values were irrelevant to them as salt marshes provide a much better option. There were, however, few differences between how various occupational groups perceived dykes and dykelands values.

4.4.4 Similarities and Differences in Before and After List of Values Responses

While it was not my intent to focus the research on respondents' changed perceptions of dyke and dykeland values through the course of the entire interview (i.e., before and after closed-ended questions), I did observe such changes.

People's perceptions and what they value may differ depending on the method of values elicitation. Dietz, Fitzgerald and Shwom (2005) observed that a true reflection of our values will depend on the context in which we have the opportunity to reflect. The respondents were asked in different ways to indicate how they valued dykes and dykelands. They were given an opportunity to outline their own personal interests, express what was special or important to them, and discuss dykeland values under three categories (economic, ecological and socio-cultural) before they were presented with the list of values and services I used in the closed-ended questioning.

An interesting outcome of the study was a difference in how respondents valued dykes and dykelands between early parts of the interviews and the later part which included ratings on the list of values and services. The results indicate that people's expressions of values changed when they were presented with specific information that they had not considered prior to being presented with the list of values and services.

In the initial conversations, people kept referring repeatedly to the same values in which they had an interest. In general, their interests and what was important to them about dykes and dykelands leaned towards the economic and socio-cultural values, with much emphasis on agriculture and Acadian history and heritage. Respondents were asked questions in various ways throughout the interview to identify what they value or what is important to them about dykes and dykelands in the province, but they hardly mentioned values and services such as soil conservation, storm protection, plant and animal diversity, bequest and existence values, etc. Protection against storm surges and flood prevention especially were mentioned only a few times before respondents were asked to identify values under the three categories. When they were prompted to talk about dykes and dykeland values under the three main categories economic, ecological and socio-cultural, they provided more-detailed information trying to cover all three categories. Furthermore, when the list of values and services was introduced to the respondents to guide their thinking on how important each value or service identified was to them, some of their perceptions changed and others remained almost the same.

The open- and closed-ended responses both indicated that farming and the historical and heritage values of dykes and dykelands were fundamental to all respondents. Most

publications on dykes and dykelands talk about the direct economic benefit to agriculture (Singh, Walters, & Ollerhead, 2007; Zheljazkov, Astatkie, Caldwell, MacLeod, & Grimmet, 2006) and Acadian history (NSDAM, 1987, & Bleakney, 2004). Therefore, it is not surprising that under all circumstances where participants were asked to discuss how important dykes and dykelands were to them, they described the economic and socio-cultural values and placed emphasis on agriculture and Acadian history.

Table 4.4: Comparison of list of values and services before checklist and after checklist

Before List (Open-ended)	No. Respondents Discussing the Theme	Vs	After list (Closed ended)	No. Respondents Saying "very important"
Agriculture/farming/ farmlands	25		Farmlands	24
History and heritage of Acadians	22		Acadian Heritage	23
Protection and prevention of floods	21		Flood Prevention	26
Ecosystem/ habitat	16		Ecosystem type	17
Pasture/hay/forage production	9		Hay/ forage production	19
Plant and animal species and diversity	9		Plant and Animal species and diversity	15
Artefact s	8		Cultural artefact s	19
Place attachment / connection	7		Sense of place and place attachment	21
Tourism/eco-tourism	5		Tourism	15
Recreation	4		Recreation	9
Protection against storm surges	2		Storm protection	22
Employment	2		Employment	13
Income/revenue	10		Revenue from farming	22
Soil fertility	9		Soil conservation	19
Generation (past and future)	3		Bequest value	12
Cultural significance	8		Existence value	18
Regulating pesticides and runoff	3		Roads	13
Cultural landscape	5		Residences and businesses	11
Aesthetics	3			
Prevention of coastal erosion	3			
Dyke building technology	2			
Social Interaction	1			
Nutrient Management	1			

It was quite interesting to observe how some values and services became very important to most respondents although they were not so in the beginning of the interviews. For instance, flood prevention was hardly mentioned prior to prompting respondents to cover the ecological, economic and socio-cultural values. After being prompted, about 21 of the respondents mentioned prevention of floods and 26 rated flood prevention as very

important on the list of values and services (Table 4.4). Also, only two of the respondents mentioned protection from storm surges in the open-ended conversation whereas 22 of them rated it as very important on the list of values and services. The huge difference may be attributed to the fact that most respondents were more familiar with occurrences of floods than storm surges in the province. Once they saw the values table, respondents reconsidered the way they saw the dykes. Some of the respondents started justifying their ratings by explaining how humans and plant and animal species on dykelands may be endangered in the case of floods and storm surges. Respondents paid much more attention to services like flood prevention and storm protection than they had in the earlier stages of the process and described them in light of climate-change uncertainties and the likelihood of sea-level rise.

At this point, the threats of climate change and sea-level rise became an issue of concern for most respondents. Most respondents were aware of global warming and the prediction that global sea level will rise up to an appreciable extent (IPCC, 2007; Nicholls & Cazenave, 2010). They paid much attention to protection of land from storm surges and flood prevention after several questions had been asked. The change in values, with the flood prevention becoming more important than the other values, can be attributed to the fact that respondents had little time in the initial stage of the interview to think through, in a comprehensive and systematic way, how they value dykes and dykelands. As indicated by Dietz, Fitzgerald and Shwom (2005), when people are approached to make decisions, they frequently make quick decisions without taking time to think things through. A respondent who said early on that dykes are not important and believed that

restoration of the dykelands is a better option said the following after going through the table of values:

> ……*struggling with a few points now. I can see them from a number of different perspectives now. Talking about roads and residences and those businesses, dykes should not be important to those things but the reality is that we are living in a lot of cases where they are very important because without the dykes those roads, residences, and those buildings will be under water* [Interview 012].

Clearly, this respondent's perceptions changed when confronted with a wider range of perspectives and there was time to think more comprehensively about the values and services. When respondents realized that dykes protected some communities and other critical infrastructures, their perceptions changed. They indicated that they had not thought of dykes and dykelands from all those perspectives. People appeared to put more preference on the environmental benefits. As indicated by researchers, values concerning the environment are rapidly evolving with people showing concern (Kempton 1995; Minteer & Collins, 2012). They did not only consider their immediate wants or desires but showed concern and thought about what was relevant. The uncertainties and the possibility of increased impacts of climate change on the coastal environment prompted most respondents to reconsider the values of dykes and dykelands. A respondent indicated:

> *there are a lot of roadways and residential areas that if it was not for the maintenance of the dykes, they would not be there: they would be under water or at least at a severe storm event. They perform an agricultural economic benefit by*

protecting important or critical infrastructure and people's homes along the shorelines [Interview 012].

To another respondent: "*The overall cost to fix things like the Trans Canada, CNR, RCI, all these other things would be hugely expensive*" [Interview 018]. Such respondents appreciated the service of flood prevention of farmlands but rated residences and businesses as not important. It is therefore not surprising that some people rated the service of flood prevention higher than the others on the list after considering other uses or services of dykes and dykelands in the province. Flood prevention and storm protection were services that respondents identified as very important but most people related it to agriculture, thus indicating that people should not have built there and the fact that they did should not make it very important. About half of the respondents talked about flood-related issues related to agricultural land, infrastructure, or both. However, only13 rated roads, residences and businesses as very important.

Creswell (2004) suggests that the closer we are to something, the more attached we are to it. It was, however, observed that sense of place and place attachment was rated as very important by people who did not live very close to the dykes. Only seven respondents mentioned cultural connection and place attachment in the open-ended section. However, 21 of the respondents rated sense of place and place attachment as very important (Table 4.4). Also, about 18 of the respondents rated existence value as very important yet none of them mentioned existence value in the open-ended section of the interviews.

While the aesthetic, soil fertility, prevention of coastal erosion, dyke-building technology, and regulating pesticides and runoff values and services of dykes and dykelands were not

on the values list, some respondents mentioned them during the open-ended section (Table 4.4). It was surprising that these respondents did not add those to the list of values and services when they were asked to add more values and services if they felt there were omissions.

Some values were important to respondents using both elicitation methods. There was not much difference between how respondents described many values such as farming, Acadian history and heritage, sense of place and attachment, artefacts, ecosystem type, and plant and animal species. Recreation and employment came up on both open and closed-ended responses but were not important to most respondents. Other values and services that could not be compared include revenue from farming on the list and revenue or income indicated by respondents. Respondents refered to revenue from other sources and not only farmlands. Soil conservation was on the list of values and services but was not identified as important in the open-ended section. Although no respondent mentioned soil conservation in the open-ended section, soil fertility and nutrient management were mentioned.

Respondents sometimes used different terms to mean the same thing. With the exception of flood prevention and storm protection, some values and services that were not considered important by most respondents earlier in the open-ended section were not rated as very important in the closed-ended questioning by most respondents. Most of the values and services that respondents provided were similar to what was on the list of values and services provided for rating. However, responses from both the open-ended and closed-ended sections could not be compared side by side because all respondents

had different perceptions in the open-ended section whereas they all provided a full set of responses in the closed-ended section.

I observed that rating of the values was easier for respondents than answering the open-ended questions on how they value dykes and dykelands. It is, however, unclear if respondents rated the values and services with a clear understanding of the values or just attributed numbers to satisfy me as the researcher. Some respondents justified their ratings whereas others did not.

Researchers have pointed out that differences in responses are obtained when open-ended and closed-ended questions are used in data collection (Ivis, Bondy & Adlaf, 1999; Reja, Manfreda, Hlebeo & Vehovar, 2003). They indicate that closed-ended questions yield higher percentages in responses with respondents restricting themselves. Open-ended responses, on the other hand, provide more-diverse responses. Different methods of soliciting information from respondents provided different responses. This research supports the notion that closed-ended and open-ended responses produce different responses with wider diversity in the open-ended responses. Finally, I observed that there were many inconsistencies in the information provided by the respondents throughout the research on their values and perceptions based on how they were guided in terms of what information they were provided with using both open-ended and closed-ended questions (Ivis, Bondy and Adlaf, 1999).

4.5 Perceptions of Dykes and Dykelands Maintenance

Decisions concerning the building and maintenance of dykes and dykelands are made by the Resource and Stewardship Division of the Nova Scotia Department of Agriculture

and the marsh body comprised of the landowners. The acquisition of dykelands and maintenance of internal dykeland roads is the responsibility of the landowners or marsh body (Figure 4.4). The Department of Agriculture is responsible for the building and maintenance of the dyke walls, grass cover, aboiteaux, and rock fills which are the most expensive aspects of dyke building. This is, however, not clearly explained to the general public. From personal communication with different stakeholders concerning building and maintenance of dykes, I realized that most people believed that the provincial government is responsible for the building and maintenance of dykes. They did not know, however, how much money and effort goes into it.

Figure 4.4: Internal dykeland roads maintained by landowners or marsh body in Truro (A) and Grand-Pré (B)

When respondents were asked what they thought should be the role of the provincial government in the maintenance of dykes and dykelands, the majority of them indicated it should continue to be the responsibility of the provincial government. Some, however, were uncertain as to who should be responsible. A respondent indicated: "*I guess you should talk to someone at the Department of Agriculture about that*" [Interview 009]. Another respondent said: "*to be quite honest, I don't know what the role of the provincial*

government is, so I can't answer that question. Maybe I should, but I don't" [Interview 003].

Some respondents also indicated that they thought the maintenance should not only be at the provincial government level but that the federal government should help. A respondent indicated: *".... dykes protect agricultural land. I don't think it is up to just the provincial government. There is a federal-provincial relationship there"* [Interview 018]. Another respondent indicated: "*I think* [the provincial government] *has a role to play in all three categories. I think there should be government funding to do cultural research. The government should be investing in the archaeology of the dykes*" [Interview 021]. According to another respondent: "*the* [provincial] *government's role is protecting or preserving the dykes. We need the dykes maintained because if it is not, we are going to lose our farms*" [Interview 020]. Another respondent explained:

> *It is the responsibility of the provincial government to maintain all dykes in the province. It is believed that there are individuals who are very aware of the importance and significance of the dykelands across the province and throughout the world wherever they are and they will take measures required to maintain them* [Interview 024].

A respondent indicated: "*Provincial government is a custodian of all the dykelands and they have a responsibility to protect our culture and civilization which has occurred*" [Interview 011]. Another respondent also said: "*….try to keep them up in good condition so that they will be of value to future generations* [to] *also operate on the dyke in order to maintain a living"* [Interview 005].

Some respondents believed that the landowners have a role to play in making dykes and dykelands worth maintaining by making maximum use of the land. If provincial funds are being allocated to dyke maintenance, it is important that those lands be put to maximum use. A respondent indicated: "*these farmers have to work together to continue to use the land for agriculture*" [Interview 015].

Other respondents also believed that there should be public education on the value of dykes and dykelands in the province. A respondent explained that there should be knowledge-sharing to help communicate the values of dykes and dykelands to the provincial and federal governments. These respondents were of the opinion that the importance of the dykes and dykelands has not been well promoted and that increased public support might be forthcoming with proper publicity and education. A respondent indicated: "*there is a whole public awareness piece missing about the value of dykes and dykelands here. There should be more awareness about the values around the dykes*" [Interview 020].

Some respondents believed that the provincial government is doing a great job with the maintenance and should continue to support the dyke system. A respondent indicated: "…we *have to continue to maintain them the way they have in the past. I have been satisfied that they have done a good job in trying to keep the salt water away from our soil"* [Interview 005].

Although some respondents placed high value on the dykes, they believed that their values are threatened by various economic factors such as low prices for agricultural produce which may cause farmers to withdraw from agricultural activities on dykelands.

Others believed that climate change and sea-level rise, lack of government support to maintain all dykes as a result of budget constraints, and lack of education on dykes and dykelands are threatening to the values that are most important to them. However, about 21% of the respondents expressed that their values are not threatened in any way although they may change in the future.

4.6 Threats to the Future of Dykes and Dykelands Values

Generally, dykes are seen as important biophysical features along the coast. People place high value on them based on where they are located and the services they provide to those who live on and around them. It is known that values are subject to change with time (Inglehart, 2008). Although agriculture is now being diversified with many new crops doing well on the dykelands (NSDAM, n.d), how people value agriculture is subject to change. If the public does not see the importance of farming in the future, the value of dykes and dykelands may change.

As indicated by Inglehart (2008), intergenerational value changes occur when younger generations grow up in a condition different from what shaped the older generation. The way people perceive the socio-cultural values of dykes and dykelands may change as a result of generational gaps. If the dykes and dykelands were needed for survival as was in the case for the early settlers, then they are likely to be more highly valued than the natural salt marsh they replaced. However, when the need for dykes and dykelands is not immediately obvious or is obscure, then the agricultural value declines (Inglehart, 2008).

Various factors may influence farmlands such as climate and alternate land use for infrastructure (Reddy, 2007; Nova Scotia Land Review Committee, 2010). Farmlands are

currently shrinking in Nova Scotia due to land use for commercial, residential, and recreational purposes. Small-scale farmers are unlikely to survive as a result of high costs of production and may be forced to give up on their farms. Although in Canada some farmers may not only see farming as a business but as way of life, others do not. A dykeland owner mentioned that he rents out part of his farmland to other farmers because he does not have enough resources to farm the entire land. A landowner respondent blamed *"…. lack of profit in this particular day and age. Unless farmers get a decent return from working on the dykelands, they are not going to be using it and once they stop it, ...weeds will grow*" [Interview 005]. The value people hold for farmlands are subject to change once the dykelands are not used for agriculture. Another respondent said: "*For me, if I have to prioritize the most important value about the dyking system, it is the fact that it is protecting an agricultural resource*" [Interview 006].

On the question of values being threatened, most of the respondents indicated that they feel their values are threatened by climate change and sea-level rise. A respondent said: *"the sea-level rising is certainly an area of concern"* [Interview 024]. Some of the respondents also indicated that lack of resources to support dykes and dykelands is threatening their cultural values. Those respondents believed that there should be funding to support studies on the historical and archaeological aspects of these dykes and dykelands. A respondent explained that there should be funding for students who want to do research and field work. Also, there should be assistance provided to farmers who may uncover Acadian artefacts when working on their fields. He indicated: "*if we had all the funding and resources needed, we could have had several research projects happening because there are tremendous archaeological resources out there and lots of stories to*

tell and share" [Interview 020]. Also, lack of government support and proper maintenance of the dykes to effectively protect coastal communities from floods and storm surges was threatening the values that were most important to them. One respondent indicated: *"storms, hurricanes….there is a challenge there to maintain the dykes high enough and strong enough to withstand any kind of natural disaster"* [Interview 015]. A respondent said:

> *New Orleans is under water and we have the potential of that happening here. The dykes work well when they are actually maintained. Without the dykes, farming will not be happening in those areas. More and more of what we are seeing around the Bay of Fundy is dykes no longer protecting agricultural lands but in fact protecting critical infrastructure* [Interview 012].

There have been several instances of flooding in the province and more is expected to happen as a result of climate change. As indicated by Proosdij (2011), sea-level rise and storm surges have a significant impact on dykes and dykelands. Most respondents believe there are more than enough signs indicating the increased occurrences of storm surges and floods. The recent breach of part of a dyke along the North River in the province is an indication of inconsistent maintenance that can aggravate disasters (Figure 4.6). In the month of September, 2012, two episodes of serious flooding happened in Colchester County. The first flooding occurred as a result of 100 mm of rain. Two weeks later, there was another flooding incident resulting from a 35-mm rain and high tides. According to CBC news, the September 10, 2012, flooding was the third instance of serious flooding in Truro in the past ten years (Lunn, 2012). Unfortunately, a fourth flood occurred two

weeks later after the announcement. Many residents in central Nova Scotia were moved out of their homes and work places. Both commercial and residential properties were destroyed as a result of the flood (Figure 4.5). If the dykes are breached or removed, their properties and roads could be washed out and residents will be cut off from other communities (Figure 4.6). This affirms why people feel threatened by climate change and its consequences.

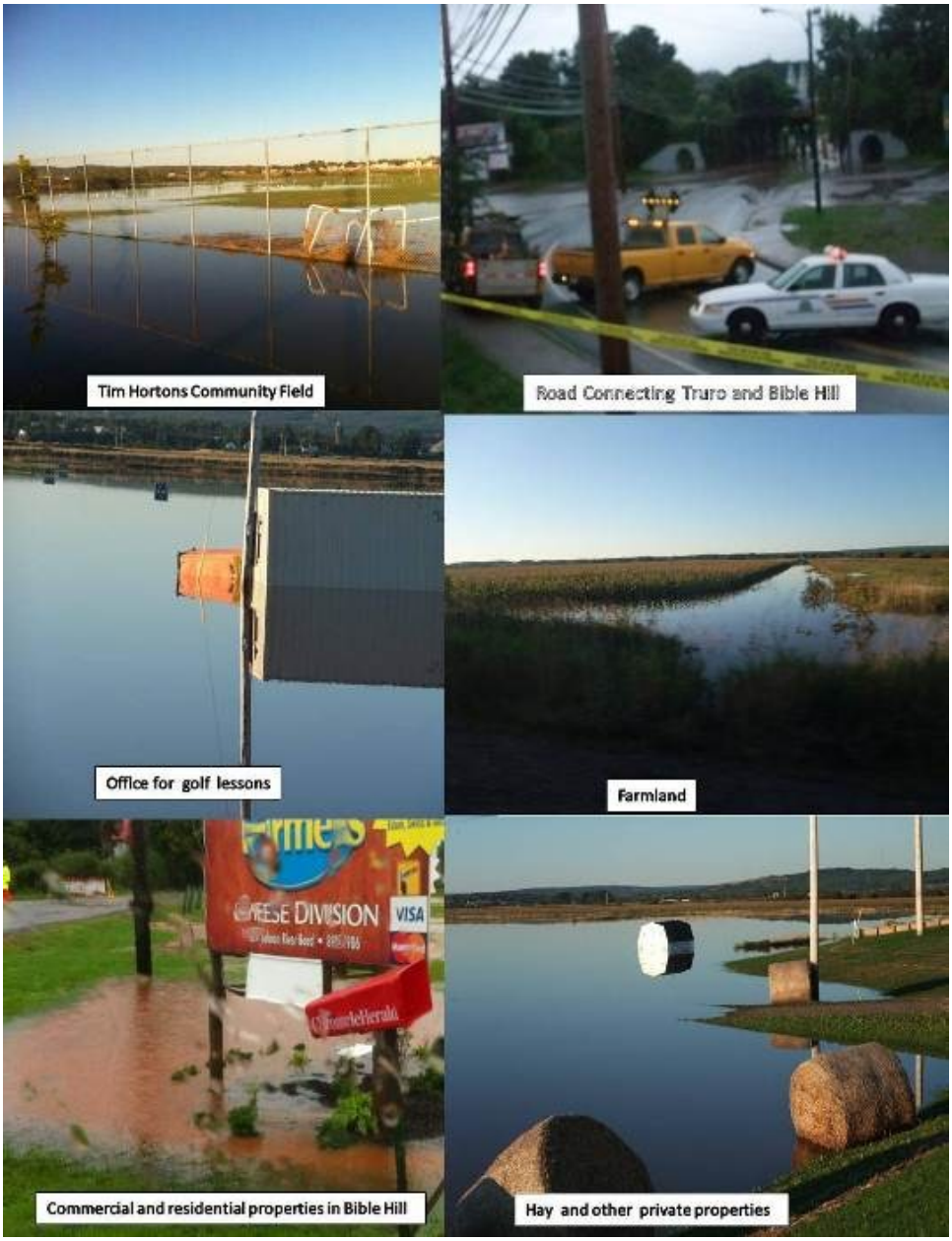

Figure 4.5: Private and commercial properties affected by flooding in Colchester County on September 10, 2012.

Figure 4.6: Damages caused by heavy rains in Central Nova Scotia, September 10, 2012

Although some people were much concerned about the climate-change issues, others felt that allowing dykes to revert to salt marshes was a better option for the province since dyke maintenance is costly. They also indicated that dykelands are not natural ecosystems and they inhibit occupation by marshland plant and animal species. According to one respondent, *"the fact that dykes are preventing most native plants from growing on dykelands and enhancing invasive species is threatening to coastal development"* [Interview 013]. A respondent indicated also that "*we have these dykelands and we are maintaining these dykelands because that is what we have always done"* [Interview 012].

4.7 Possibility of Future Change in How Respondents Value or Consider Dykes and Dykelands

When participants were asked to indicate whether how they value or perceive dyke and dykeland values may change in the future, most of them said they will. About 63% of the respondents said their values may change in the future due to factors such as climate change, government influence, and agricultural and historical issues concerning building and maintenance of the dykes in the province. Only 37% said their values will not change irrespective of what happens in the future. People have different levels of attachment and are likely to place different values on things based on how they are connected to it. Some of the respondents, both Acadians and non-Acadians, indicated that the dykes and dykelands were part of their ancestry and form an important part of their culture as Nova Scotians.

It is apparent that a respondent who places high value on dykes because of the affiliation with a job might change his or her value on retirement when he or she stops working with dykes and dykelands. A respondent indicated: "*I only pay attention to them because I work with them. Before I took this appointment, I had nothing to do with the dykes and dykelands"* [Interview 29].

4.8 Final Observations

From the information gathered through the open-ended question for respondents to express their values for dykes and dykelands, 23 themes emerged. The values and services included: Agriculture; history and heritage of the Acadians; prevention of flood; ecosystem, habitat; pasture, hay, forage production; plant and animal species; artefacts;

place attachment or connection; tourism and ecotourism; recreation; protection against storm surges; employment; income or revenue; soil fertility; cultural significance; generational (past and future); regulating pesticides and runoff; aesthetic value; prevention of coastal erosion; social interaction; and nutrient maintenance. Of all the 23 themes, only four were mentioned by more than 50% of the respondents. The remaining 19 were mentioned by less than 34% of the respondents. Social interaction and nutrient management were mentioned by one respondent each.

In the second section of the interview (closed-ended), the rating of the identified value clusters was different. Of all the nineteen values and services identified for rating, there were thirteen which 50% or more of the respondents considered very important. These included flood prevention, farmlands, Acadian heritage, storm protection, revenue from farming, sense of place and place attachment, cultural artefact, forage and hay production, soil conservation, existence value, ecosystem type, plant diversity, and animal diversity. Other values and services such as tourism, roads, employment, bequest value, residences and businesses were rated by less than 47% of the respondents as very important, with recreation being the least important.

The two methods of eliciting information (open-ended and closed-ended questions) identified some differences and similarities in how the respondents perceive dykes and dykelands. Twelve (12) of the values and services from both open-ended and closed-ended mapped onto each other directly. Three (3) of the values and service had similar implications with different wording. However, eight (open-ended) and three (closed-ended) values and services were unique to each method. There were no significant

differences in values and services such as farmlands, Acadian history and heritage, flood prevention, habitat, and the dykeland ecosystem. Interestingly, storm protection was mentioned by only two of the respondents in the open-ended, but rated by 19 respondents as very important in the closed-ended section. Generally, values and services that did not matter to respondents in the open-ended section were not rated as very important by most respondents in the closed-ended responses. The open-ended responses provided a wider variety of responses which complemented the closed-ended list of values and services.

From the study, I observe that when people are guided with information, it is easier for them to make informed judgements. People's perceptions are therefore dependent on how they are guided during interviews. This was observed when people were asked in different ways to think about dykes and dykelands. Generally their responses leaned towards agriculture, history, flood prevention, and, to a lesser degree, ecosystem services. However, when they were presented with a list of values that could be considered for dykes and dykelands, their values changed. They demonstrated that they had a better understanding of how dykelands should be viewed since they had not thought of dykes and dykelands from that wider perspective. Respondents were more comfortable to talk about dykes and dykelands based on how they relate to or use them. The interviews served to reveal other aspects of dykes and dykelands that they had not previously considered. The threat of climate change to decrease agricultural viability and the expressions for clear government policies concerning the maintenance of dykes were very strong.

Conclusion

5.1 Summary

Coastline issues have been of much concern in recent years because of climate change and sea-level rise projections, and what that means to coastline activities. Nova Scotia is largely defined by its coastline and along this coastline are biophysical features that provide various services to individuals and the entire province. The recent flooding in the province indicates how vulnerable coastal communities are to climate change and its potential impact on sea-level rise.

Dykes and dykelands are important features of the Nova Scotia coastline, providing essential services to coastal residents since the early arrival of the Acadians in the 1600s. Although the primary rationale behind dyke construction was for agriculture, over time dykes and dykelands have become an important part of people's history, heritage, and socio-cultural environment. Dykes have become valuable in the protection of coastal properties and lands and provide habitat to numerous plant and animal species. But times have changed. There are growing concerns about whether dykes and dykelands continue to be important, whether the maintenance cost exceeds the benefits, and whether the provincial funds allocated to maintaining dykes and dykelands gives society an acceptable level of benefits.

The purpose of this research was to address some of these questions. The goal was to identify some values that can be associated with dykes and dykelands, find out how people perceive those values, and determine the importance of maintaining them in the province.

Generally, the majority of the respondents indicated that agriculture, flood prevention, and historical and heritage values of dykes and dykelands were highly important in both open- and closed-ended responses. Most of them indicated that dykes and dykelands were important to them because of the provision of quality land for agriculture. More than fifty percent rated forage or hay production, farmlands, and revenue generation as very important. Most of them specifically indicated that the dykes serving as protection against floods and storms was very important. Irrespective of respondents' cultural or occupational background, they did not see the use of dykelands for building commercial and private properties as important.

The respondents mentioned that the dykes have become an important part of the history of Nova Scotia. They were aware of the fact that the dykes were built by Acadians and are relevant to both Acadians and non-Acadians. They indicated that the dykes serve as cultural artefacts and most people had some attachment to them. They believed that the cultural and historical value of modern dykes will not be the same as those built by the Acadians. This is not surprising because the whole culture of dykes and dykelands revolve around Acadian history and heritage. Although respondents valued dykes and dykelands from a socio-cultural perspective, bequeathing them to future generations collectively was not considered very important. More than half the respondents found the conservation plant and animal species to be important.

The open- and closed-ended approaches used in gathering information identified some similarities and differences in how respondents valued dykes and dykelands. However, the combination of the two approaches helped to identify more values and services. The

results indicated that people's perceptions change to some extent when provided with more information. Values and services that were identified through the study included: farmlands, hay and forage production, revenue, employment, protection of roads, residences and businesses, recreation, tourism, existence, bequest, Acadian heritage, cultural significance, historical artefact, sense of place and place attachment, plant and animal diversity, soil conservation, storm protection, flood prevention, ecosystem, soil fertility, regulating pesticides and runoff, aesthetic value, prevention of coastal erosion, promotion of social interaction, and nutrient maintenance.

As development takes place in various forms in any given society, people's values are subject to change. This research has introduced people to values they had not thought of as well as demonstrating what society sees as important and some reasons why people think certain values should not be a priority when decisions are being made concerning coastal dykes and dykelands.

5.2 Recommendations

Through this study, gaps were identified in education, policy, and public information that might improve people's abilities to realize the values and services of dykes and dykelands in the province.

5.2.1 Education

From the interviews conducted, I observed that the clarity and definition of dykelands, wetlands, and salt marshes are important in data gathering through surveys. Respondents had varying understandings of what exactly dykelands are in the province. Most of the

respondents used the term differently based on their personal circumstances. Their use of terms suggests that they do not discriminate between dykelands, wetlands, and marshlands. In many scenarios, participants explained how they understood these terms based on how other people have defined them. Even within the Department of Agriculture, the terms have been used differently by different people. Most of the respondents used marshlands to represent salt marsh and wetland or marsh to represent dykelands. A clear definition of these terms should be provided to the general public. Once people know what each term means, it will give them a better understanding of any specific feature being discussed and will help people identify the values they place on them. This will enhance the explanations and information relevant to Nova Scotians on coastal features. As indicated by one of the respondents, "*basically, different terminologies are used for the same thing: they are all wetlands*" [Interview 012].

There is also the need to undertake further research on the identified and other values and services that can be associated with dykes and dykelands, and educate people on these values. It will enable people to make informed decisions concerning which ones to hold on to and which to allow to revert to natural salt marshes during public consultations before restoration projects take place.

5.2.2 Policy

The uses of dykes and dykelands have not been limited to agriculture but also to other ecological and socio-cultural services. The dykelands in the province are used in various capacities. Although dykes and dykelands are seen as a very important part of the history of Nova Scotia, the decision to maintain them all poses challenges. Throughout the

interview, most of the respondents, including the Acadians, indicated the high value they place on dykes and dykelands in the province in different ways. What is threatening to their values was mainly changing climate and sea-level rise. They also indicated that dykes that are not serving any direct purpose and are not being maintained are better off "allowing nature to do its own thing". A respondent indicated: "*it should go back to mother nature if they are not being farmed*" [Interview 027]. One person said: "*we are fighting nature by trying to maintain dykelands but* [her] *experience is that nature always wins*" [Interview 021].

If the dykes and dykelands were allowed to revert to salt marsh, then the expectation of the respondents is for the government to develop other means of protecting those coastal communities that are vulnerable to sea-level changes and floods that may be caused by climate change. Some respondents were of the view that dyke and dykeland maintenance is important for the protection of land and other properties (e.g. artefacts) which are difficult to put immediate monetary value on. Dykes which date back to the early Acadian settlers may have different value than those constructed after their deportation by other people. For these reasons, the decisions concerning removing dykes and allowing dykelands to revert to salt marsh should be on a case-by-case basis.

Some respondents indicated that policies on maintaining dykes should be carefully designed to ensure that breached dykes do contribute to destruction of communities, properties, and important history. They should be examined regardless of where the dykes and dykelands are located. In cases where there are no simple, immediate, or

obvious economic values, the ecological and socio-cultural values should be weighed against the amount of money required for maintenance.

5.2.3 Publicity of Information

It was difficult to obtain information concerning dykes and dykeland maintenance in Nova Scotia. Most people working with the Department of Agriculture are not permitted to release facts and figures which would have been helpful for this type of research. From the study, I observed that few people have much knowledge about the resources that government puts into the maintenance of dykes and dykelands. Much of what people know is based on the information they have been exposed to through their work or other activities.

Available information on dykes and dykelands were mainly from brochures, public and private websites, and other publications. Because of the interviews, many respondents realized other values of the dykes and dykelands. The interviews were not only useful for information gathering but also provided education and information on the various uses of the dykes and dykelands to the respondents. It is therefore suggested that the government increase the available resources in libraries and other places about progress on dyke and dykeland maintenance other than just the history of dykes.

Decisions to build, maintain or abandon dykes require information on the values associated with them. Dykelands and salt marshes are different ecosystems with different values. The identified values of dykes and dykelands and people's perceptions should enable decision-makers to make sound decisions on which ones to maintain and which

ones to allow to revert to natural salt marshes which may be less expensive to maintain compared with dykes.

5.3 Summary

This research explored people's perceptions on values associated with dykes and dykelands. Dykes and dykelands over the past years have provided various services to the province beyond agriculture. People place different values on coastal infrastructures and the benefits they derive from the coast. Lack of regular maintenance may result in loss of most of these services and the values that society places on the dykes and dykelands. We cannot ignore the fact that our coastlands are changing and that these changes are likely going to influence how people value dykes and dykelands. With the increasing threat of sea-level rise, there is a need to pay closer attention to coastal ecosystems and structures. However, the cost of maintaining the human-constructed ecosystem and the values thus derived should be examined frequently.

The value of dykes and dykelands should not be looked at only in monetary terms. The socio-cultural and ecological aspects are important in ways that are not always measurable in monetary terms. The possibility of dykelands reverting to original natural salt marshes is uncertain since the land has been altered for a long time. Decisions concerning building dykes, maintaining them, and reverting dykelands to salt marshes need to be carefully made taking into consideration the market and non-market values society attaches to them. There is a need for more education on dykes and dykelands and the services they provide to society. It is important to make information concerning dykes and dykelands available to the public which will help people assess how important they

are and make informed decisions. Policy-makers should incorporate public perceptions and values concerning their maintenance to ensure that those that are actively being used are well maintained.

5.4 Reflections

In this study, I experienced that qualitative research is an evolving process. My understanding about dykes and dykelands and my thoughts of their significance in the social history of Nova Scotia have evolved with every step of the study, from design through data gathering and analysis, especially through the face-to-face interviews. Against my own background, one of the biggest challenges was reconciling the different sources of information and perceptions about dykes and dykelands. From time to time, I obtained different information and a different understanding of the entire dyking system. Different information from various stakeholders meant that I had to ensure the consistency of the information gathered and as a result I had to go through different learning phases. It was difficult to choose between comparing dykes to saltmarshes and conducting cost-benefit analysis on dykes and dykelands.

As the research progressed, and looking back, I realized that certain questions should have been asked to give me a better understanding on how the respondents valued dykes and dykelands. Also, halfway through the interviews, I realized I should have given respondents my definition of terms such as salt marsh, dykeland, marsh, and wetlands so that our conversation would have the same reference point. Maybe, using a values table before and after other data collection methods such as field trips, diaries, and focus-group discussions would have been a better way to find out and compare how people value

dykes and dykelands. The limited financial resources did not make it possible for me to use some of these instruments to increase my data collection or to do follow-ups with the face-to-face interviews.

Although there are some deficiencies in the research, on the whole most respondents seemed happy that dyke and dykeland values were being studied. Many of them acknowledged that they had not thought of dykes and dykelands from the perspective of my research. Some acknowledged that my conversations with them have helped them develop even greater appreciation for the economic, ecological and social-cultural history of dykes and dykelands than ever before. This implies that new knowledge and information was shared between the researcher and respondents.

5.5 Limitations of the Study

Although there was great effort to maintain the rigours of social science research, a few biases may have cropped up unintentionally based on the information I received from respondents, the literature, and other stakeholders. The good thing, though, is that I had no prior knowledge about dykes and dykelands and therefore held no strong preconceived ideas about them.

However, there might be some biases associated with the approaches used in collecting, analyzing, and reporting the data. It is possible that some important information was lost during transcribing of the audio tapes. The attempt to transfer qualitative data into semi-quantitative data for comparison between open-ended and closed-ended questions might have resulted in either double counting or omission of vital information. Also the aggregation and approximation of some responses may influence the results reported. The

availability of information on dykes and dykelands may influence how certain aspects of the values were examined. Due to time and financial constraints, the research was limited to people who had some knowledge on what dykes and dykelands are. The total number of respondents and other factors may limit generalizing the results in this study.

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Appendix 1: Letter of Introduction

Hello,

I am Grace Asiedu, a Master of Environmental Studies candidate at Dalhousie University in Halifax, Nova Scotia. I would like to invite you to be part of a research study I am undertaking concerning dykelands in Nova Scotia. This study is part of my requirements for a master of environmental studies degree. If you accept my invitation, you will be one of some thirty people whom I wish to interview about dykeland values.

I would like to interview you in person on values associated with dykes and dykelands in Nova Scotia. The interview is anticipated to take an hour or less to complete and will focus on your perceptions on the importance of maintaining dykes in the province. Please note that this is not to test your knowledge but rather to understand your perceptions on coastal dykelands. No preparation is required for this interview. The interview will be audio recorded and transcribed. You will be given the chance to review your transcript and make modifications if you wish. All information collected will be treated with the highest level of confidentiality in a locked cabinet and password protected computers where only the researcher and supervisors will have access. In my final publications, quotes will be reported as anonymous. A copy of the final report will be available to you upon request.

Your participation in this research will help you think about other values that you might not be aware of concerning dykes. It may also benefit you indirectly by helping the provincial government make good decisions concerning coastal dykelands. Furthermore, this research will create new knowledge on dykes and dykelands in Nova Scotia.

If you have any questions or concerns about this study, you may contact me via email or my research supervisors Prof. Stephen Clark (sclark@nsac.ca; 902-893-6702) and Dr Peter Duinker (peter.duinker@dal.ca; 902-494-7100).

I look forward to hearing from you.

Thank you,

Grace Asiedu
(gasiedu@dal.ca; 902-789-8840)

Appendix 2: Research Consent Form

Title of the Research:

Citizens' perceptions of values associated with dykes and dykelands: The case of Nova Scotia

Principal Investigator:

Grace Asiedu
Master of Environmental Studies Candidate
School for Resource and Environmental Studies
Dalhousie University, Halifax, NS
Email: gasiedu@dal.ca
Phone 902.789.8840

Academic Supervisors:

Dr. Stephen Clark

Department of Business and Social Sciences
Nova Scotia Agricultural College, Truro, NS

Dr. Peter Duinker
School for Resource and Environmental Studies
Dalhousie University, Halifax, NS

Introduction

You are invited to take part in a research project being conducted by Grace Asiedu**,** a graduate student of the School for Resource and Environmental Studies at Dalhousie University as part of a master's degree program. The research is under the supervision of **Dr. Stephen Clark** (Nova Scotia Agricultural College) and **Dr. Peter Duinker** (School for Resource and Environmental Studies, Dalhousie). Your participation in this study is voluntary and you may withdraw at any time. The study is described below. This description tells you about the risk, inconvenience, or any discomfort which you might experience. Participating in the study may not benefit you directly but we might learn something which will be beneficial to others. Please note that, this is not to test your knowledge on dykes and dykelands.

Purpose of Study

The purpose of this study is to identify values associated with dykes and dykelands maintenance in Nova Scotia, and to find out people's perceptions on the non-market values of dykes and dykelands maintenance in Nova Scotia.

This study involves integration of people's opinions and data from the literature to develop a values framework for dykelands maintenance in Nova Scotia. I will be asking you questions on three main value sets (economic, ecological and socio-cultural) associated with dykelands. This is to help me understand how people perceive dykelands and what values they attach to them. The work will hopefully serve as a guide for policy-makers on decision-making concerning coastal dykelands.

Study Design

The study will be based on semi-structured face-to-face interviews to identify people perceptions about dykelands maintenance in Nova Scotia. Each participant will be interviewed for a maximum of an hour. Between 25 and 30 people who have knowledge on dykes and dykelands will be interviewed using face-to-face semi-structured interview technique. The interview will include both open-ended and closed-ended questions. The closed-ended section will comprise of a values table for participants to indicate whether the value identified is important, less important or not important will follow the questions.

With permission from study participants, interviews will be audio recorded, coded, transcribed and analyzed using computer software to find common themes. The results will be shared in a thesis once all the research is completed. It is intended that two

manuscripts will be submitted to scholarly journals for publication. A two page summary of the study results may be sent to you and other study participants upon request.

Who can participate

You may participate in this study if you are over 18 years, a resident of Nova Scotia and have knowledge on dykes and dykelands.

Who will be conducting the research

Grace Asiedu is the principal investigator for this research. She will conduct the semi-structured interview, code and transcribe the audio files and analyze the transcript. Only she will have access to the audio files and transcript. The academic supervisors (Dr. Peter Duinker and Dr. Stephen Clark) may be called upon to assist with the analysis of portions of the files or transcripts. In all cases, confidentiality and anonymity will be maintained.

What will you be asked to do

If you decide to participate in this study, you will be asked to have an interaction with the principal investigator for a maximum of an hour. The interaction will be based on your perceptions about dykes and dykelands and the values that can be associated with them. You will be given a values table to indicate whether the value identified is important, less important or not important. You may also add values that were not listed if you wish. Due to time and logistical constraints, I will be able to allow you one week to review the transcript of the interview and make corrections if you wish.

Possible risk and discomfort

There is no deception related to this study. The probability of risks involved in this study is very low and may be related to your emotions due to past experience with dykes and dykelands. You are advised to wear weather appropriate clothing and footwear if you prefer to be interviewed outside your home or office. You may decline questions or opt out of the interview at any time you feel uncomfortable for any reason without penalty.

Possible benefit

You may not benefit directly from this research but information obtained from you may guide policy makers in making sound decisions concerning coastal dykes and dykelands in the province. You may also gain awareness of some of the values that you were not familiar with. Furthermore, you will have time to reflect on your perceptions about dykes and dykelands maintenance in the Nova Scotia. The information obtained will contribute to existing knowledge on dykes and dykelands in the province and beyond. As a participant in this research, a copy of the final report will be available to you upon request.

Compensation

Your participation is completely voluntary. No incentives will be provided for your participation in this research study.

Anonymity and confidentiality

Quotes will be reported anonymously to ensure that your right of anonymity is respected. Confidentiality will be maintained because the transcripts will only be seen by the Student Researcher and research supervisors. The recordings and transcripts will be securely locked in a storage cabinet in the School for resource and Environmental Studies under the supervision of Dr. Peter Duinker when not in use. The audio files and transcripts will be securely kept for ten years after which they will be destroyed. You will be given a code before the interview to keep you anonymous. All information obtained in this study will be kept strictly **confidential** and **anonymous.**

Conflict of interest

There are no potential conflicts of interest related to this research as the researcher has no relation to dykes and dykelands and the participants.

Questions

If you have any questions, please do not hesitate to contact the principal investigator, Grace Asiedu (contact information on first page of consent from). If you decide to participate, I will provide you on-going basis with new information that might affect your participation in this study. If you will like a copy of the result, please do not hesitate to contact me on the above telephone number or email address.

Problems and concern

This research has been reviewed and approved by the Dalhousie University Research Ethics Board. If you have any questions or concerns about this study or any aspect of your participation, you may contact Catherine Connors, Office of Research Ethics Administration on **(902) 494 1462; catherine.connors@dal.ca** or my supervisors Prof Stephen Clark, Nova Scotia Agricultural College, at **(902) 893 6702; sclark@nsac.ca** and Dr Peter Duinker, School for Resource and Environmental Studies, Dalhousie at **(902) 494 7100; peter.duinker@dal.ca**.

Signature Page 1 of 1

Researcher: Grace Asiedu

Title of the Research: Citizens' perception of values associated with dykes and dykelands: The Case of Nova Scotia

Consent to participate in this study: I have read the explanation about this study. I have been given the opportunity to discuss it and my questions have been answered to my satisfaction. I hereby consent to take part in this study. I understand that my participation is voluntary and that I may refuse to answer any question or withdraw from the study at any time.

_____ _____

Signature of Participant Date

_____ _____

Signature of researcher obtaining consent Date

Consent for audio-recording: I understand that the interview will be audio-recorded by the researcher.

_____ _____

Signature of Participant Date

_____ _____

Signature of researcher obtaining consent Date

Consent for use of direct quotation: I hereby consent to allow the researcher to use direct quotations from my responses in the interview in writing and presenting study results. With my consent, I understand that these quotations may refer to my town but not my name.

_____ _____

Signature of Participant Date

_____ _____

Signature of researcher obtaining consent Date

Appendix 3: Debriefing

Thank you very much for taking some time out of your busy day to participate in this research study. The purpose of this study was to find out people's perceptions about the value of dykes and dykelands maintenance in Nova Scotia. This information will be used with data from the literature to develop a values framework which can serve as a guide for policy-makers in making decisions concerning coastal dykelands in Nova Scotia.

The interview questions were to help me identify how you as an individual perceive dykes and dykelands and to help you elaborate on your views. The values table you were asked to complete was to elaborate more on the potential benefits of dykes and dykelands and to allow you to add other benefits that have not been discussed. This was to give you a better understanding of three broad values discussed previously.

Presently, dykes are maintained by the provincial government. Some of these dykes are well kept while others are not maintained to the expected standard. There is therefore a need to find out whether there are other values associated with the dykes aside from the agricultural values. There may be ecological values such as wildlife habitat associated with dykelands. Also dykes form an important part of Acadian history and heritage. They may also protect some cultural artefacts that were buried as early as the early 1600s till present. It is however believed that, your perception as a tax payer is important in identifying what values are associated with dykes and dykelands maintenance in Nova Scotia.

Your participation in this research is very much appreciated. After all the interviews have been completed and transcribed, I will contact you if you need a copy of your transcript. You are welcome to make clarifications and modifications before the data analysis.

After the data analysis, the knowledge will be shared in a thesis to the School for Resource and Environmental Studies, a conference presentation at the Department of Agriculture biennial conference, and journal articles.

If you have any questions, do not hesitate to contact Grace Asiedu (gasiedu@dal.ca; 902. 789. 8840) or Dr. Stephen Clark; 902. 893. 6702; sclark@nsac.ca and Dr. Peter Duinker (peter.duinker@dal.ca 902. 494.7100).

For more information related to dykes and dykelands, you may refer to the articles and sites below.

Thank you very much for your participation.

Appendix 4: Interview Questions

INTERVIEW QUESTIONS FOR DYKELANDS MAINTENANCE IN NOVA SCOTIA

Code:…… Sex:….. Date:……..

What do you do for a living?

How long have you been doing this?

Do you have an Acadian background or relation?

Do you have any personal history that relates to dykes and dykelands?

-Acadian
-Farming on dykelands
-Property near a dyke or on a dykeland
-Family member dwelling
- Maintenance or policy concerning dykes and dykelands.

What is your interest in dykes and dykelands?

Are there specific dykes and dykelands that are important to you?

What aspect or attribute is important or special to you, or what do you value about the dyke(s) and/or dykeland(s) you mentioned?

My research study is looking at dykes and dykeland values in three categories- ecological, economic and socio-cultural. I want us to have a discussion on all them. Which would you like to comfortably talk about first?

Which of the 3 values is most important to you?

What is important to you about the value(s) you talked about?

The following chart is a list values that might be considered for dyke and dykeland services in the province. On a scale of 1-3, (1) being not important and (3) very important, please indicate the importance of each value or how important each value is to you as an individual. You may add more values at the bottom of the chart if you think some key ones are missing.

VALUE	Not Important (1)	Somewhat Important (2)	Very Important(3)
Forage/Hay production			
Farmlands			
Roads			
Residences and Businesses			
Revenue from farming			
Employment			
Recreation			
Tourism			
Existence value			
Bequest value			
Acadian Heritage			
Cultural artefacts			
Sense of place and place attachment			
Plant diversity			
Animal diversity			
Soil conservation			
Storm protection			
Flood prevention			
Ecosystem type			
Others			

Is there anything that is threatening to the values that are most important to you? Yes/No

How do you think the values you deem most important may change in the future?

What do you see as the role of the provincial government in the maintenance of dykes in the province?

Do you think more effort and money should be put in the maintenance of dykes? (If yes, who should pay for them?)

What do you think should be the public contribution towards the maintenance?

Do you have any other things to say concerning the building and maintenance of dykes in Nova Scotia?

Appendix 5: Occupational Groups and their Ratings of Dykes and Dykeland Values

Occupational Group		Not Important	Somewhat Important	Very Important	Total
Hay and Forage Production					
Researchers	Count	4	0	8	12
	% of Total	**33**	**0**	**67**	**100**
Landowner	Count	0	1	5	6
	% of Total	**0**	**17**	**83**	**100**
Government	Count	3	1	4	8
	% of Total	**38**	**13**	**50**	**100**
ENGO	Count	1	1	2	4
	% of Total	**25**	**25**	**50**	**100**
	Count	8	3	19	30
	% of Total	**27**	**10**	**63**	**100**
Farmlands					
Researchers	Count	1	1	10	12
	% of Total	**8**	**8**	**83**	**100**
Landowner	Count	1	1	4	6
	% of Total	**17**	**17**	**67**	**100**
Government	Count	2	0	6	8
	% of Total	**25**	**0**	**75**	**100**
ENGO	Count	0	0	4	4
	% of Total	**0**	**0**	**100**	**100**
	Count	4	2	24	30
	% of Total	**13**	**7**	**80**	**100**
Roads					
Researchers	Count	5	3	4	12
	% of Total	**42**	**25**	**33**	**100**
Landowner	Count	0	1	5	6
	% of Total	**0**	**17**	**83**	**100**
Government	Count	3	3	2	8
	% of Total	**38**	**38**	**25**	**100**
ENGO	Count	2	0	2	4
	% of Total	**50**	**0**	**50**	**100**
	Count	10	7	13	30
	% of Total	**33**	**23**	**43**	**100**
Residences and Businesses					
Researchers	Count	6	1	5	12
	% of Total	**50**	**8**	**42**	**100**
Landowner	Count	2	1	3	6
	% of Total	**33**	**17**	**50**	**100**
Government	Count	3	4	1	8
	% of Total	**38**	**50**	**13**	**100**
ENGO	Count	2	0	2	4
	% of Total	**50**	**0**	**50**	**100**
	Count	13	6	11	30
	% of Total	**43**	**20**	**37**	**100**
Revenue from farming					
Researchers	Count	1	2	9	12
	% of Total	**8**	**17**	**75**	**100**
Landowner	Count	1	1	4	6
	% of Total	**17**	**17**	**67**	**100**
Government	Count	1	2	5	8
	% of Total	**13**	**25**	**63**	**100**
ENGO	Count	0	0	4	4

	% of Total	**0**	**0**	**100**	**100**
	Count	3	5	22	30
	% of Total	**10**	**17**	**73**	**100**
Employment					
Researchers	Count	3	4	5	12
	% of Total	**25**	**33**	**42**	**100**
Landowner	Count	1	2	3	6
	% of Total	**17**	**33**	**50**	**100**
Government	Count	3	2	3	8
	% of Total	**38**	**25**	**38**	**100**
ENGO	Count	1	1	2	4
	% of Total	**25**	**25**	**50**	**100**
	Count	8	9	13	30
	% of Total	**27**	**30**	**43**	**100**
Recreation					
Researchers	Count	4	5	3	12
	% of Total	**33**	**42**	**25**	**100**
Landowner	Count	2	1	3	6
	% of Total	**33**	**17**	**50**	**100**
Government	Count	2	3	3	8
	% of Total	**25**	**38**	**38**	**100**
ENGO	Count	2	2	0	4
	% of Total	**50**	**50**	**0**	**100**
	Count	10	11	9	30
	% of Total	**33**	**37**	**30**	**100**
Tourism					
Researchers	Count	0	6	6	12
	% of Total	**0**	**50**	**50**	**100**
Landowner	Count	1	2	3	6
	% of Total	**17**	**33**	**50**	**100**
Government	Count	2	2	4	8
	% of Total	**25**	**25**	**50**	**100**
ENGO	Count	1	2	1	4
	% of Total	**25**	**50**	**25**	**100**
	Count	4	12	14	30
	% of Total	**13**	**40**	**47**	**100**
Existence Value					
Researchers	Count	2	4	6	12
	% of Total	**17**	**33**	**50**	**100**
Landowner	Count	0	1	5	6
	% of Total	**0**	**17**	**83**	**100**
Government	Count	1	1	6	8
	% of Total	**13**	**13**	**75**	**100**
ENGO	Count	0	3	1	4
	% of Total	**0**	**75**	**25**	**100**
	Count	3	9	18	30
	% of Total	**10**	**30**	**60**	**100**
Bequest Value					
Researchers	Count	3	4	5	12
	% of Total	**25**	**33**	**42**	**100**
Landowner	Count	2	0	4	6
	% of Total	**33**	**0**	**67**	**100**
Government	Count	3	3	2	8
	% of Total	**38**	**38**	**25**	**100**
ENGO	Count	3	0	1	4
	% of Total	**75**	**0**	**25**	**100**
	Count	11	7	12	30
	% of Total	**37**	**23**	**40**	**100**

Acadian Heritage					
Researchers	Count	1	1	10	12
	% of Total	**8**	**8**	**83**	**100**
Landowner	Count	2	1	3	6
	% of Total	**33**	**17**	**50**	**100**
Government	Count	1	0	7	8
	% of Total	**13**	**0**	**88**	**100**
ENGO	Count	1	0	3	4
	% of Total	**25**	**0**	**75**	**100**
	Count	5	2	23	30
	% of Total	**17**	**7**	**77**	**100**
Cultural Artifacts					
Researchers	Count	2	2	8	12
	% of Total	**17**	**17**	**67**	**100**
Landowner	Count	2	1	3	6
	% of Total	**33**	**17**	**50**	**100**
Government	Count	1	1	6	8
	% of Total	**13**	**13**	**75**	**100**
ENGO	Count	1	1	2	4
	% of Total	**25**	**25**	**50**	**100**
	Count	6	5	19	30
	% of Total	**20**	**17**	**63**	**100**
Sense of Place and Attachment					
Researchers	Count	1	2	9	12
	% of Total	**8**	**17**	**75**	**100**
Landowner	Count	2	0	4	6
	% of Total	**33**	**0**	**67**	**100**
Government	Count	0	2	6	8
	% of Total	**0**	**25**	**75**	**100**
ENGO	Count	0	2	2	4
	% of Total	**0**	**50**	**50**	**100**
	Count	3	6	21	30
	% of Total	**10**	**20**	**70**	**100**
Plant Species/Diversity					
Researchers	Count	3	2	7	12
	% of Total	**25**	**17**	**58**	**100**
Landowner	Count	1	2	3	6
	% of Total	**17**	**33**	**50**	**100**
Government	Count	3	1	4	8
	% of Total	**38**	**13**	**50**	**100**
ENGO	Count	3	0	1	4
	% of Total	**75**	**0**	**25**	**100**
	Count	10	5	15	30
	% of Total	**33**	**17**	**50**	**100**
Animal Species/Diversity					
Researchers	Count	2	4	6	12
	% of Total	**17**	**33**	**50**	**100**
Landowner	Count	1	1	4	6
	% of Total	**17**	**17**	**67**	**100**
Government	Count	3	1	4	8
	% of Total	**38**	**13**	**50**	**100**
ENGO	Count	3	0	1	4
	% of Total	**75**	**0**	**25**	**100**
	Count	9	6	15	30
	% of Total	**30**	**20**	**50**	**100**
Soil Conservation					
Researchers	Count	2	2	8	12
	% of Total	**17**	**17**	**67**	**100**
Landowner	Count	0	1	5	6

	% of Total	**0**	**17**	**83**	**100**
Government	Count	2	1	5	8
	% of Total	**25**	**13**	**63**	**100**
ENGO	Count	3	0	1	4
	% of Total	**75**	**0**	**25**	**100**
	Count	7	4	19	30
	% of Total	**23**	**13**	**63**	**100**
Storm Protection					
Researchers	Count	1	3	8	12
	% of Total	**8**	**25**	**67**	**100**
Landowner	Count	0	1	5	6
	% of Total	**0**	**17**	**83**	**100**
Government	Count	1	1	6	8
	% of Total	**13**	**13**	**75**	**100**
ENGO	Count	0	1	3	4
	% of Total	**0**	**25**	**75**	**100**
	Count	2	6	22	30
	% of Total	**7**	**20**	**73**	**100**
Flood Prevention					
Researchers	Count	1	0	11	12
	% of Total	**8**	**0**	**92**	**100**
Landowner	Count	0	0	6	6
	% of Total	**0**	**0**	**100**	**100**
Government	Count	1	1	6	8
	% of Total	**13**	**13**	**75**	**100**
ENGO	Count	1	0	3	4
	% of Total	**25**	**0**	**75**	**100**
Total	Count	3	1	26	30
	% of Total	**10**	**3**	**87**	**100**
Ecosystem Type					
Researchers	Count	3	3	6	12
	% of Total	**25**	**25**	**50**	**100**
Landowner	Count	1	0	5	6
	% of Total	**17**	**0**	**83**	**100**
Government	Count	3	0	5	8
	% of Total	**38**	**0**	**63**	**100**
ENGO	Count	2	1	1	4
	% of Total	**50**	**25**	**25**	**100**
Total	Count	9	4	17	30
	% of Total	**30**	**13**	**57**	**100**