Social and Cultural Values Mapping

as a decision-support tool
for climate change adaptation

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**The Institute
of Island Studies**

UPEI UNIVERSITY
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ISLAND

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Institute of Island Studies
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The Institute of Island Studies (IIS) is a research, education, and public policy institute based at the University of Prince Edward Island (UPEI), Charlottetown, Canada. With an emphasis always on Prince Edward Island, the work of the Institute focuses on the culture, environment, and economy of small islands all over the world.

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Abstract

Social and cultural values mapping as a decision-support tool for climate change adaptation

Planning, adaptive action and emergency preparedness can help reduce the damage done by rising sea levels, storms, coastal erosion and other impacts of climate change. The damage caused by climate changes affects more than geographical features and infrastructure; it also affects all of the values that people attach to the physical environment. However, adaptation plans and strategies are typically developed using scientific and economic data that capture only physical value while ignoring the associated social and cultural values.

To make comprehensive plans that can help people and societies cope with climate changes, we need a method to document and display human values attached to the physical landscape so that these can be taken into account. Geographic Information Systems (GIS) can be used to display and analyze these social and cultural values that are attached to geographic space. GIS can also be used to bring various knowledge fields together, displaying the social knowledge and values of residents together with scientific data on the predicted impacts of climate change. Maps that show both kinds of knowledge are tools that can assist local governments in planning and prioritizing effective adaptation strategies. In addition, the process of collective map building reassures people that their knowledge and values are respected. This helps develop trust and collaboration in governance, which are essential for effective community-level climate change adaptation.

Governments and community groups on small islands such as Prince Edward Island are the vanguard of climate change adaptation because small islands are among the most vulnerable places on the planet to the effects of climate change. These jurisdictions will need tools that help them to improve their resilience, develop adaptation mechanisms, and communicate their needs to national and international governing bodies.

In this paper we report on a pilot study of social and cultural values mapping performed on Prince Edward Island in January - March 2010. We conclude that this methodology has potential as a tool to support decision-making for climate change adaptation, and it can be implemented and modified as required by a variety of stakeholders.

Key Words: Climate change, values mapping, small islands, local governance, social values, cultural values

Introduction

Nicholls et al. (2007) note that coastal areas are now experiencing negative impacts of climate change and this is highly likely to increase. Among coastal areas, islands are most exposed because of their high ratio of coastline to geographic area. Among islands, those relatively small in area will be more exposed, and also most vulnerable owing to limited and sensitive natural resources and often limited human resources (Byrne & Inniss, 2002). As climate change progresses, all islands may be exposed to impacts such as sea level rise and changing precipitation patterns. Some may also experience other impacts including more frequent and destructive storms, salt water intrusion and coastal erosion (IPCC, 2007). Many islands are vulnerable to such changes because of their geography, geology and past histories of human development. Their ability to cope with climate change will depend greatly on how their human populations govern themselves.

Prince Edward Island (PEI) is one of many small islands facing serious challenges related to climate change. For at least two decades researchers have discussed the potential impacts of climate change on PEI and Atlantic Canada (Stokoe 1988; P. Lane & Associates, 1988) and issued warnings that adaptive action is necessary (Shaw et al., 1998; Giles, 2002; McCulloch et al., 2002; Forbes et al., 2002; Vasseur & Catto, 2008). The Government of PEI (2008a) climate change strategy focuses primarily on mitigation of carbon releases, but it also promotes adaptation, beginning with actions to increase public awareness of the issues.

Islanders are often distinguished by a fierce sense of place and attachment to natural ecosystems (Stratford, 2007), which may make them more likely to act to protect these resources. Prince Edward Islanders typically have close bonds with their limited land base (Government of Prince Edward Island, 2009). They often prize their marine environment, not only as a transportation route and source of food and livelihood, but also as an integral part of personal and community identity and culture (Novaczek et al., 2009). Losses of coastal land and infrastructure associated with climate change will therefore have more than financial implications. Adaptation will require social action, not just engineering. Integrating peoples' community knowledge and values into decision-making can encourage them to work together on climate change adaptation (Walsh, 2009).

The vulnerability of any socio-ecological system to the impacts of climate change will reflect the degree to which it is exposed to physical hazards, its sensitivity to those hazards and the resilience of the system (Adger, 2006; Smit & Pilifosova, 2003; Smit & Wandel, 2006). Exposure and sensitivity are often large-scale phenomena largely beyond community control. In contrast, increased resilience – the ability to return to "normal" after an upset or disturbance – often results from the interactions of humans and their environment at a very local and personal level. Strengthening this resilience is an important way to reduce the vulnerability of human communities to climate change.

In the past, governments attempted to manage human economic activities as if people were separate from their supporting ecosystems. Increasingly, we hear calls for more holistic approaches to governance – approaches that consider social and environmental factors together.

Such a holistic approach is certainly appropriate when building a community's resilience and its capacity to adapt to climate change. A holistic and proactive approach to support community well-being in times of stress has been recommended by Walsh (2009). This would entail development of frameworks and processes for inclusive decision-making that can take into account the full scope of climate change impacts.

Documenting the social and cultural values attached to the coastal zone is one way of ensuring that these values can be systematically considered alongside economic and biological factors, when developing strategies and action plans for adaptation to climate change. This paper discusses a pilot study in mapping social and cultural values attached to the coastal zone of Prince Edward Island. The purpose was to adapt and test this methodology as a support tool for community-level planning, and to help build resilience and adaptability with respect to climate change and other environmental threats.

The Impacts of Climate Change on Island Communities

On a small island, coastal erosion and flooding are dramatic and immediate, and the reaction to such environmental changes on Prince Edward Island was an important part of public discourse even before climate change became an issue. Today, flooding and coastal erosion are influencing coastal habitats and built infrastructure with increasing frequency on many small islands worldwide (Nicholls et al., 2007). Where they are acutely vulnerable to erosion and flooding, the people on small islands can be highly motivated to work together and identify survival strategies. Prince Edward Island and other small islands are therefore useful sites for testing new tools and creative approaches for collaborative decision-making.

Indeed, because of their manageable scale and clear boundaries, small islands are active sites for research. Frequently they are seen as case studies or microcosms that can shed light on issues experienced in mainland jurisdictions (Baldacchino, 2007; Ma, 2011). Increasingly, the need to do research on islands to investigate potential climate change impacts and human responses is being recognized (Lewis, 1990; Byrne & Inniss, 2002; Kelman & West, 2009).

On Prince Edward Island public concern over coastal erosion and flooding was evident during government consultations in 2005 (Government of Prince Edward Island, 2005). As the climate continues to change, losses of coastal land, habitats and infrastructure are predicted to continue and intensify. Prince Edward Island is especially vulnerable to climate change owing to its highly erodible soils and friable sandstone bedrock. Since colonial times, this natural vulnerability has been exacerbated by land clearance, industrial agriculture and road construction that have had significant negative impacts on soil tilth, erosion, groundwater contamination, river and estuary health, riparian zone and coastal erosion, and biodiversity (Liao, 2008). PEI officials have researched the problem of soil erosion on farms for at least half a century (Agricultural Institute of Canada, 1954; Government of PEI, 1979), but erosion mitigation policies have taken decades to enact, erosion remains a significant problem, and climate changes will likely result in even more challenging conditions.

A review of published studies concerning climate change in Atlantic Canada reveals that the attention of governments is strongly focused on the potential economic impacts. However,

coastal spaces and the human activities that they support are valued by island residents for reasons more than economic. It is well known that people engaged in fisheries and farming in particular often have deep spiritual and cultural connections to land and sea (Pocius, 2000; Salvo, 2008). For these people, coastal sites are integral to personal and collective identity. A loss of access to land and sea resources and activities can be emotionally devastating, even leading to traumatic stress, depression and suicide (Shaw, 2008; Price & Evans, 2009; Price, in press). The serious impacts on indigenous peoples' cultural integrity and community health that resulted from their loss of access to historic resources are well known. In Prince Edward Island, many people have extremely strong attachments to the landscape (Horne, 2007) and visible heritage (MacDonald, 2011; Government of PEI, 2008b). Rural islanders' attachment to place develops as a consequence of cultural and social, place-based experience (Quality of Island Life Co-op, 2009; Trout River Environment Committee, in progress). Islanders' appreciation of their environment does not come from textual documents, but through their senses: the smell of fresh air; the taste of clean water; the tang of salt sea spray; the sounds of birdsong and spring peepers; the sight of pleasing viewscapes. All these can evoke powerful feelings of connection and attachment to place.

We expect that the erosion and flooding of coastal sites that are valued by local residents for personal, social and cultural reasons will continue to evoke strong responses of grief and stress. Where sites are associated with community social, cultural and religious celebrations, the losses may place the continuity of cultural practices at risk. Community leaders need to understand residents' values and priorities in order to design adaptation strategies that will maintain social well-being. Whereas data are often readily available to describe the ecological and economic values to be considered when devising adaptation strategies, the less tangible social and cultural values are more challenging to measure and locate in geographic space. Our pilot study, adapted from Brown's (2005) social and cultural values mapping method, was undertaken to address this gap.

As a research location, Prince Edward Island offers diverse habitats and human cultures making it an ideal test site for values mapping. As a province, PEI has the additional benefit of jurisdictional powers and responsibilities. This means that local survey data and maps that are important for this type of research are locally available from government offices.

It is important to note that Prince Edward Island is not homogeneous. For example, literacy rates vary among regions of the province (Natural Resources Canada, n.d.), as do rates of employment, income and level of education. Both social and ecological conditions are constantly shifting over time, and each influences the other as part of a single socio-ecological system (Fischer-Kowalski & Haberl, 2007; Walker et al., 2002; Simonson, 2007). Therefore, no single methodology or single sampling point in time can provide an accurate representation of conditions on the island. Our goal is to develop and test practical methodologies that can provide social and cultural data to enhance local decision-making and governance. The methodologies must be cost-effective so that they can be repeated in many communities, at appropriate intervals.

Study Area: The North Shore of Prince Edward Island, Canada

The research area selected was along the north shore of PEI between New London Bay and Tracadie Bay (Fig.1). This area is internationally recognized for its spectacular beaches. Tourism infrastructure dots the coastline except where development has been restricted since the 1930s by the creation of Prince Edward Island National Park (MacEachern, 2001). The local economy revolves around fisheries, agriculture and increasingly, tourism.

The attractions of the north shore go beyond scenery and beaches. This is the iconic landscape of Prince Edward Island that is inscribed in the history, psyche and identity of Islanders. The north shore is rich in archeological artifacts of aboriginal peoples as well as more recent, European immigrants. It is also the native landscape of PEI's most notable writer, Lucy Maud Montgomery, and the setting for her world famous Anne of Green Gables books and of the movies based on those stories. These and many other literary descriptions show that the north shore is the focus of deep and complex layers of human cultural attachment (MacDonald, 2011).

Coastal erosion has always been a feature of life on the north shore, and forced abandonment of coastal infrastructure has been recorded since at least 1880 (McCulloch et al., 2002). In one instance in 1977 a landowner lost 25 m of land in a single storm event (Genest, 1989). Rates of erosion are highly variable, ranging from a slow but persistent average of 1 meter per year in some places, to 2.5 -3.5 meters a year (or more) in others (Forbes et al., 2004). Rates of erosion in 2010 were double the average for 1960-1980 (D Jardine pers. comm. April 2011) and erosion rates are predicted to at least double again between 2010 and 2100. Conservative estimates are for sea level to rise by 0.7 - 1.3 meter by 2100; the height of storm surges to increase to 4 meters above chart datum, and the frequency of such surges to increase (McCulloch et al., 2002). This trend is already apparent and escalating faster than predicted.

The pace of coastal development continues to be rapid on PEI. As of 2011, 37% of all built properties, representing 60% of the tax base, lay within 500m of the sea (B. Thompson pers. comm. April 2011). As noted by Vasseur and Cato (2008), there are no policies in place on PEI to limit coastal development, in spite of the growing risks of flooding and erosion, and growing public concern over the impact of coastal development on treasured viewscapes (for example see http://www.landtrust.ca). The newer coastal subdivisions increasingly feature not just modest summer cottages but multi-million-dollar seasonal homes. Clearly there is an urgent need for improved awareness of the risks of such development and for land use regulations that can prevent the installation of expensive infrastructure in what will eventually be flood zones. However, telling Islanders "what to do on their own land" has historically been avoided by PEI governments. Despite numerous government commissions, land use planning frameworks and regulations are negligible outside of the urban centers (Government of PEI, 2009).

There has been an increasing degree of public outcry calling for PEI to move faster in the direction of sustainability (Bardati et al., 2009). The PEI climate change strategy (2005) recommended complete LIDAR mapping coverage of PEI to support active coastal monitoring and management. (Light Detection And Ranging (LIDAR) is an optical remote sensing technology) LIDAR data for all of PEI are now publically available.

The 2009 Commission on Land Use Planning and Local Governance set out recommendations for improved land use planning, and an implementation manager was hired to begin that process. Tools to support and encourage public engagement in future land use planning and other climate change adaptation strategies are under development as of 2011.

Study Site Selection on the North Shore

We selected a study site within the north shore geographic area using the following criteria: sufficient population density and distribution, diversity of geographic features, diversity and representative nature of economic activities, and the presence of a municipality and an active watershed group with whom we could develop active partnerships.

The selected site encompasses the drainage area of the Brackley and Covehead Bays. The area includes five rural communities, federal (National Park) land, and private land lying within and outside of the incorporated North Shore Municipality. The population is a blend of full-time and seasonal residents. PEI's three main private sectors—fisheries, agriculture and tourism—are well represented here, as are urban commuters and retirees.
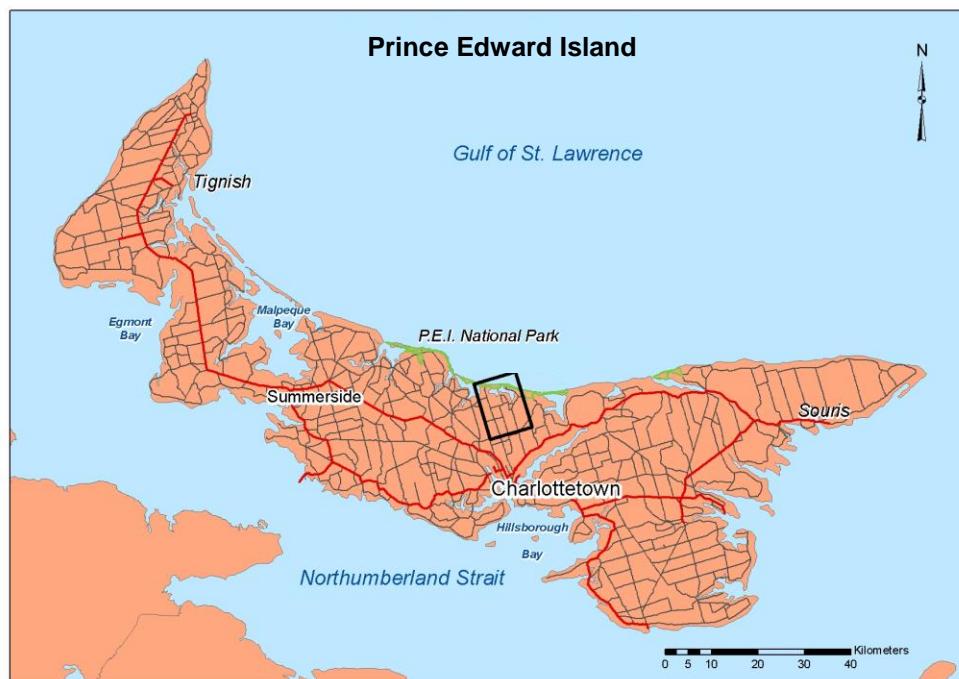
Figure 1: Map of Prince Edward Island showing the Study Site (rectangle, see also Figure 2).

Figure 2: Map showing close-up of the study area on the North Shore of PEI.

Introduction to mapping social and cultural values

What are landscape values?

Landscape values are the social and cultural values that people attach to places. They can be mapped simply as "special places", or as places that have one of at least twelve attributes (Table 1). People may prioritize valued places according to their level of importance or attach other attributes to these places such as a time period when they were especially valued, or a relationship that shaped the person's feelings about a place. People may consider places important because of their value to themselves or to others; in the past and for the future; for specific reasons or for no reason in particular. The essence of the data gathered through values mapping is the number and location of valued places. The greater the number of people who participate in mapping any given area, the richer the resulting map of values will be.

Social and cultural values are not designed to identify sources of public revenue or democratic intent. Many of the people who map values in the coastal zone are not full time residents or even Provincial residents. Landscape values are not property appraisals or financial estimates, although there may well be a correlation between densely mapped areas and higher property values. Participants will map both high-traffic areas and no-traffic areas, both land that should be used for human activity and land that should be preserved. A map that shows values attached to places is not necessarily a statement of intent or an expression of political will by the people living in that area. It is simply a tool that helps us to understand coastal landscapes in terms of human values, and predict how people may respond to changes affecting their valued places.

In response to the observation that "there are not … any systematic ways of linking values information, obtained from social science research methods, with landscape ecological data obtained from biological and physical science research methods" (Zube 1987:44), Greg Brown (2005) developed a tool to support natural resource management which he calls "landscape values mapping". Values mapping has been used in the United States for conservation planning on forest park land (Brown & Reed, 2000; 2009), and adapted to other purposes such as coastal development planning (Landscape Values and PPGIS Institute, n.d.). By definition, values mapping is a geospatial charting of diverse human values in relation to place. Its overarching purpose is to allow a better understanding of the relationships between people and their natural and built environments, expressed as values; and to enable geospatial analysis of these values.

In concrete terms, the mapping process makes visible the type and number of values assigned to any particular location, so that we can identify those places that many people agree are important. It captures and communicates local, place-based values and demonstrates to citizens, the research community, policymakers and prospective developers why residents consider certain places in their area to be valuable. Places that are deemed culturally important may then be featured in research and planning projects, or placed on a priority list for climate change adaptation planning.[1]

When mapping social and cultural values, people work individually or collectively to place symbols on maps. The symbols signify the value or values attached to particular locations (see Table 1). Participants may be community leaders or persons with expert knowledge, participants in local interest groups and government agencies, or a random selection of year-round residents, summer residents and tourists. All participants work with the same list of values, although these may vary from study to study according to the context and goals of the research. For instance, some values mapping projects focus on development and planning, whereas others focus on the effect an urban landscape had on the feelings of participants (Japan Foundation, 2011).

Three basic approaches for mapping values are recorded in the literature: face-to-face workshops, mail-out surveys, and digital values mapping using public participation geographic information systems (PPGIS). The face-to-face approach has been tested in Nova Scotia, New Brunswick and PEI (SGSL Coalition, 2009), working with small groups of residents in a workshop setting. The results demonstrated that working with paper-based maps is an interesting exercise for community participants. Furthermore, data collected using paper maps were successfully entered into a Geographic Information System (GIS) database. However, the participants were limited in number and selected by local watershed groups. They did not represent a random selection of local citizens, nor did they reflect local demographics very well.

A mail-out survey can be sent to randomly selected households and can involve many more participants than a workshop. Each participant works with his or her map at home, and may choose to plot the values of a single person or a household. The survey instrument includes detailed instructions and the contact information for researchers who can be asked to provide assistance.

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[1] For an example of values mapping research leading to planning restrictions around certain forms of development see Parks Victoria (http://parksvictoria.net).

In the case of digital values mapping, persons who have access to the required technology view maps on a computer screen and place value symbols onto these virtual maps. This can be a cost-effective way of collecting data from computer literate elements of a local population. It also facilitates the input from people without permanent homes in the study area such as renters, visitors, and tourists. It requires the development of sophisticated online tools that are tailored to the needs of researchers.

Mapping Social and Cultural Values on PEI

Data Collection Methods

The objective of this pilot project was to test a mail-out survey approach to values mapping. We wanted to sample a larger, random and more representative group of coastal residents than was possible using face-to-face workshops.

Packets of materials developed for our survey included a letter of introduction and invitation to participate; detailed instructions; a list of values illustrating codes to be placed on the map; an explanation of the meaning of each value, with examples; sticky vinyl dots bearing value codes that could be placed on the map; a colour map of the survey area with selected local features identified (e.g. roads, streams, cemeteries, community halls, intertidal flats); a brief questionnaire that asked for the participant's gender, age, occupation and education; and a pre-addressed stamped envelope for returning the completed survey to researchers at the University of Prince Edward Island (UPEI). The questionnaire included space where people could write comments about the survey and about the places they had mapped.

Between January 20-22, 2010, these survey packets were sent to 200 randomly selected households in our Study Area. Our sample size was constrained by the cost of producing and mailing the survey packages. Within four weeks of sending out the surveys, researchers called each survey recipient to ask if they required any explanations or replacement materials.

To select random survey participants we used a map of civic addresses which is available on the provincial government's website.[2] We developed a list of all civic addresses in the study area and removed those associated with businesses, ending up with 1,011 residential addresses. Using a sampling extension for ArcGIS designed by Hawthorne Beyer, we selected a random sample of 200 of these residential addresses.[3] Our method of basing the selection on civic addresses meant that surveys were sent to seasonal residents and renters as well as to year-round residents.

Almost half (97) of the randomly selected homes were seasonal and therefore unoccupied in January. These households could not receive the survey unless it was mailed to their winter residence. With special permission from the Province, the required names and permanent mailing addresses of the seasonal residents were obtained from a tax database. We noted that, out of the 97 seasonal households, 49 (51%) had permanent addresses outside of PEI, 8 of these were located outside of Canada (all were in the United States). The remaining seasonal residents had mailing addresses on Prince Edward Island, mostly in Charlottetown.

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[2] The data layer for Prince Edward Island civic addresses is described at the link below:
http://www.gov.pe.ca/gis/index.php3?number=77553&lang=E

[3] Open source programs such as Quantum GIS (QGIS) (www.qgis.org) are also capable of doing this.

Survey participants were directed to read all the instructions, familiarize themselves with the various instruments, and read about the values to be mapped before beginning the mapping exercise. Their first mapping task was to place a coded dot on the site of their own home. After this orienting step they were asked to proceed with placing other coded dots on the map to indicate places associated with the different values. The final steps involved filling in the questionnaire and returning the completed package in the envelope provided.

We worked with staff at the Provincial Department of Environment, Energy, and Forestry using GIS to create the map for the survey packages. The required data layers were freely downloaded from the PEI Government website. We used colour to differentiate land from sea and rivers, and to designate woodlots, agricultural land, municipally-zoned residential areas, and the National Park—features that we felt would be used by participants to orient themselves while mapping their values. The design and presentation of survey maps may be factors that influence the results of respondents, and it is important to clearly and consistently identify significant topographical features. This is especially important when performing comparative research in several sites.

We used a map scale of 1:30,000 printed on a paper size of 12 x 18 inches (30.5 x 45.7 cm). The map covered a geographic area of 100 km^2. A 6 mm dot placed on this map covered a circle of ground 180 m in diameter. We experimented with various ways of orienting the boundaries of the map area, and ultimately positioned the map parallel to the main roads (Figs.1,2).

Participants had the choice of using the sticky dots provided to identify places on the map or, if that proved difficult, to hand-draw codes on their selected places and circle them using a pen or pencil. Each participant was asked to map up to five locations for each of 12 values.

We employed a typology of 12 values plus the option of mapping other "Special Places" of personal significance (Table 1). This typology has been used previously (Brown, 2005; Brown & Raymond, 2007; Aleesa, Kliskey & Brown, 2008; Raymond & Brown, 2010). It is based on earlier work by Rolston & Coufal (1991). In previous research projects citizens were able to differentiate each of the values, which are: Aesthetic, Economic, Recreational, Life-sustaining/Biological Diversity, Historic, Cultural, Spiritual, Future, Therapeutic, Learning/Creative Expression, Existence/Intrinsic, and Wilderness. We adjusted the existing explanations of the values to provide examples typical of Atlantic coastal environments and activities. The purpose of this was to clarify the meaning of the various values and make them locally relevant.

Survey participants were free to place more than one value on any particular location. They could use any number of the dots provided. If they valued any place for a reason other than those on the list of 12 values, participants could indicate this on the map using a "Special Place" dot, and explain its meaning in a space provided on the questionnaire.

The questionnaire included with the map requested basic demographic information. This allowed us to check whether the sample was reasonably representative of the local population. These data were also used to probe the influence of various demographic factors (gender, residency status) on the quality, quantity and geographic distribution of points mapped. In future we will compare mail-out survey data with that which is collected using digital or face-to-face approaches. We want to determine whether particular demographic groups respond differently to the different mapping approaches.

Table 1: List of values showing related dot symbols

Landscape Values and Value-Dots

(M) Please place one "M" dot where you live.

(A) Aesthetic Value: I value these areas for their attractive scenery, architecture, sights, smells, sounds and silence.

(E) Economic Value: I value these areas for their economic activities, such as tourism, agriculture, or other commercial benefits.

(R) Recreation Value: I value these areas because they provide opportunities for outdoor recreation.

(LB) Life Sustaining/Biological Diversity Value: I value these areas because they help produce, preserve, and renew air, soil, and water, maintain ecological balance and provide a variety of living things.

(LC) Learning Value/Creative Expression: I value these areas because they provide opportunities for me to learn about the world, others and myself through working, playing, imagining, creating, and being.

(S) Spiritual value: I value these areas because they are sacred, or places of religion, a belief system, or spiritually special places to me.

(EX) Existence/ Intrinsic value: These areas are valuable for their own sake, even if others or I don't use them or benefit from them. They are valuable just because they exist. They have their own purpose.

(H) Historic value: I value these areas because they recall personal memories, or past events in human activity or in nature.

(F) Future Value: I value these areas because they will provide benefits (e.g. financial, educational, spiritual) for future generations or myself.

(T) Therapeutic Value: I value these areas because they make me or others feel better physically, mentally, or emotionally.

(C) Cultural Value: I value these areas because they have physical or symbolic features that help people to pass down wisdom, ideas, the arts, or ways of life.

(W) Wilderness Value: I value these areas of land or sea because they are relatively wild, uninhabited, or unspoiled by human activity.

(SP) Special Places: I value these places because they are special to me. Please dot up to 5 of your own special places, and tell us, if you choose, why these are your special places. Please write on the back of your Questionnaire.

Data Processing

Fifty-seven of the 200 surveys sent out were completed and returned. In response to the question "How difficult did you find the survey?" many participants (35%) noted that the mapping process had been easy and enjoyable. While 46% found the survey fairly easy, 14% found it difficult, and 6% found it very difficult. Those who found the survey difficult or very difficult commented that this was mainly about manipulating the sticky vinyl dots.

Completed maps were scanned and the resulting images were geo-referenced using a freely downloadable software called Quantum GIS (www.qgis.org). Geo-referencing is the process of establishing the location of a geospatial document, such as a map, using real geographic co-ordinates. For each map digitized and geo-referenced we created a shapefile (a popular ArcGIS spatial file format) and assigned points for each of the values recorded by respondents. To each mapped point we assigned the appropriate value code and the unique identification number of the map on which it appeared. This ensured that each point could be connected to the original map, to the residential address of the participant, and to that person's demographic data. Questionnaire data were entered into a specially designed, secure online database in the UPEI Virtual Research Environment. This data was analyzed using qualitative and statistical methods.

After checking for errors, we generated a map showing all the locations that residents, as a group, deemed important (Fig.3). Using GIS it is also possible to display each value separately (Figs.6-18), or to display dots according to the demographic category of participants. For example we can view only the dots placed by men (Fig.22a), or only those placed by women (Fig.22b), or separate the values mapped by seasonal residents (Fig.23a) in comparison with permanent residents (Fig. 23b), and so on. In this pilot study, we did not break the categories down any further—for example, to map values of young women versus older women—because the database was too limited for the exercise to be meaningful.

Results and Discussion

Response to the Survey Method

Residents in the study site demonstrated a strong interest in mapping their social and cultural values. This was evident from the high rate of response to the survey (28.5%), the large number of values mapped by participants (average 28), and the extensive written comments made on the questionnaires.

The instructions in one part of the questionnaire were to "Please use the space below to describe why your Special Places are important to you." People responded by recording their personal stories in this space. The extensive and revealing written comments illustrate the value of the mail-out survey method for gathering not only quantitative but also qualitative information. From this we have learned the value of allowing and inviting people to write about the feelings elicited by the mapping experience and the interaction with their familiar landscapes. In the future we will include more space for comments on our questionnaire.

Some respondents listed and described their special places exactly as they had indicated them on the map. Others spent more time describing the area in which they lived, and their values. These accounts detailed people's' favourite recreational activities, the trails they used for

walking and skiing, scenic locations, and therapeutic retreats. For instance, one person described her special places in terms of activities, writing "Observing birds, especially eagles feeding on gaspereaux, herons, etc. Quiet times to walk, de-stress. Winter cross country skiing from North Shore Community Centre following snowmobile trails to Friston Rd and around to Covehead Rd. Walking, berry picking, same area. Sunsets and moon rises on Tracadie beach or Stanhope beach."[4]

Some respondents stressed the importance of attaching personal background and a timeline to their landscape values. Others recorded their stories in less historical fashion, but still emphasized their place in a changing environment. Some were general observations such as those of one retired woman whose summer home was filled "with so many happy family memories," but who was "sad to see all the new development (light pollution, etc.)." Her special places were where she enjoyed recreational activities and where "sunsets are virtually spiritual experiences."[5]

Many written comments demonstrated how participants' relationships with the landscape changed over time. One senior male wrote more than 750 words describing the changes in natural and built environments since the 1930s. He then surmised that his own "historical ramblings are likely not pertinent to the survey objectives; however, I have enjoyed writing them as a bit of a background."[6] Another male participant indicated: "Some of these places I have frequented for about 75 years. Some are special to me to this day and some very special to my late wife and me from 1955 to 2008."[7] This suggests that people may attribute different values to places at different points in time, depending on their social circumstances. The special places of one elderly participant were five sites clustered within walking distance of his residence.

Another participant stated that "special places for me are the estuaries, swamps, creeks, bays and ocean," including environments under stress such as "the dunes which are disappearing at an alarming rate generally."[8] A common theme was environmental degradation that influenced special places. "The forested areas are very special and very important to me and to everyone. Unfortunately there is a lot of clear cutting which has already damaged our 7 acres of woods, with a lot of erosion running off from an adjacent clear cut area into our woods when there is heavy rain."[9]

Distribution of Values

When the places mapped by participants are collated and displayed together (Fig. 3) an intense clustering of valued places is evident along the shore. In particular there were intense clusters in and around the National Park, relative to inland areas, especially over the fishing wharf in Covehead Bay and at Stanhope Beach Resort (Fig. 4). There also appear to be more values mapped within relatively large blocks of forested land, as compared to more fragmented woodlots.

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[4] SCVMP survey number 844, received 1 February, 2010.
[5] SCVMP survey number 512, received 4 February, 2010.
[6] SCVMP survey number 12, received 4 February, 2010. See also SCVMP survey number 99, for personal histories and association with historic sites.
[7] SCVMP survey number 397, received 29 January, 2010.
[8] SCVMP survey number 686, received 4 February, 2010.
[9] SCVMP survey number 953, received 29 January, 2010.

As expected (judging from previous research), people made use of all the value categories but the most frequently mapped values were recreational (13 percent) and aesthetic (12 percent); life-sustaining and economic values were a close third and fourth place, making up 11 and 10 percent of the mapped values respectively (Fig. 5).
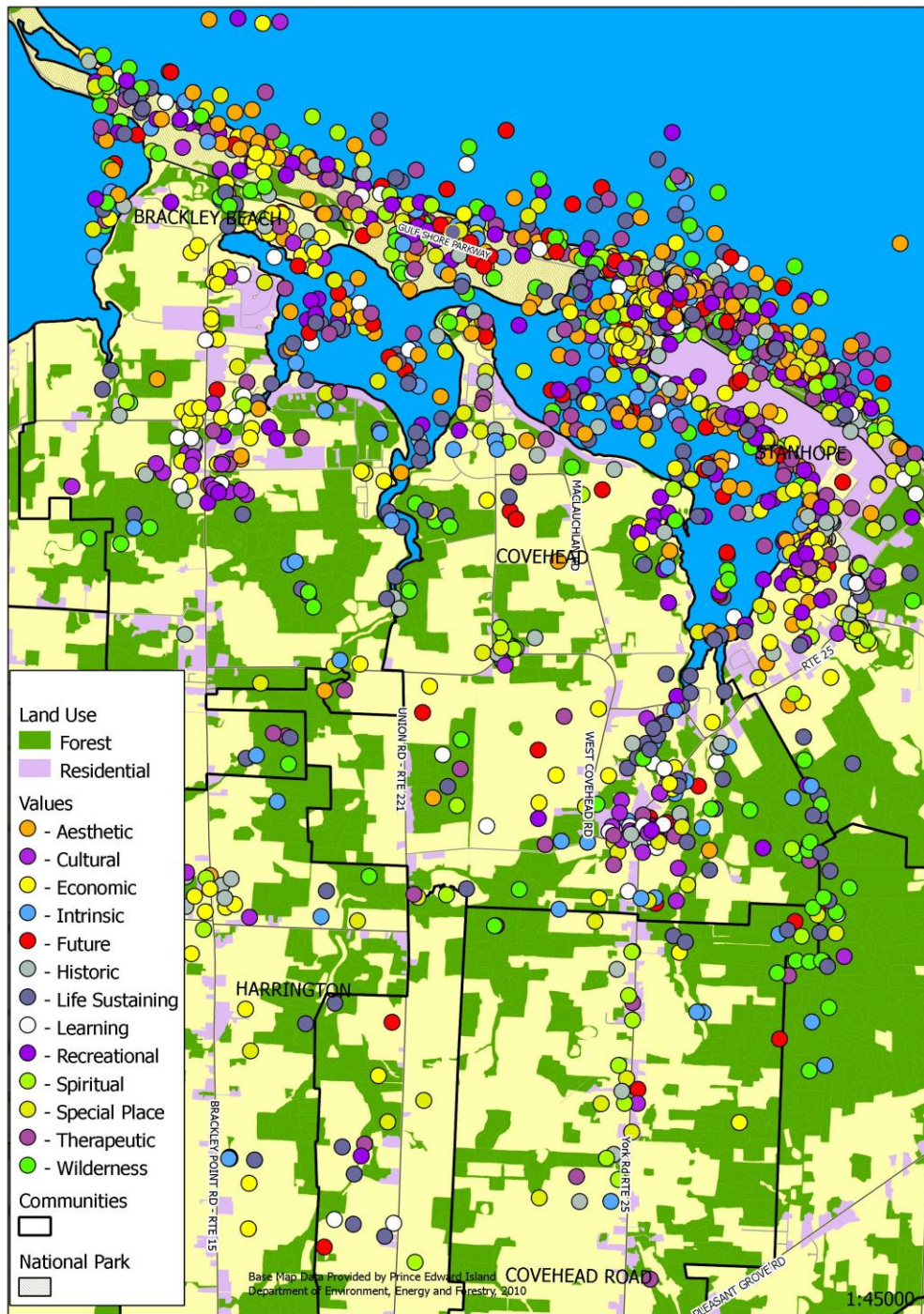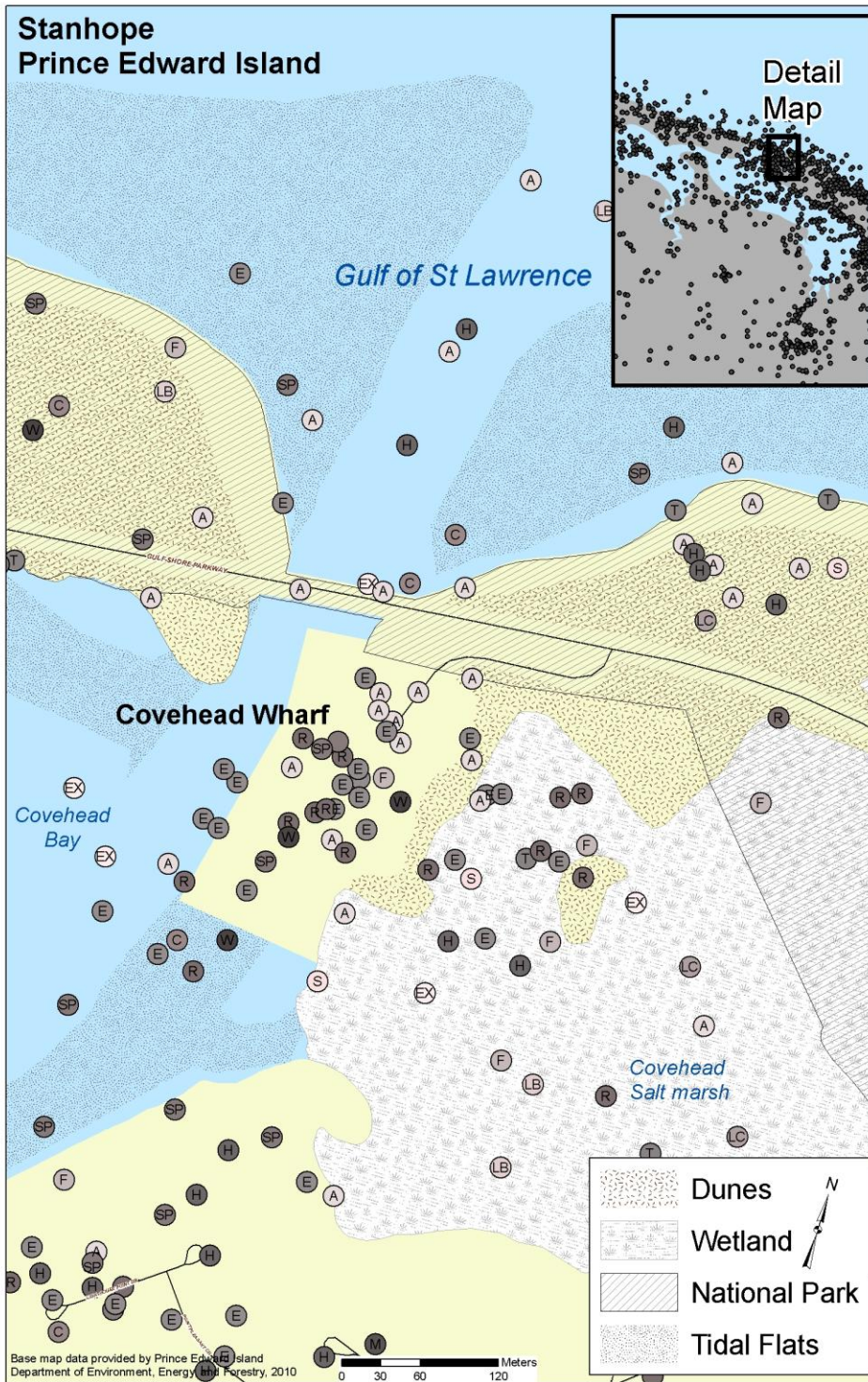

Figure 3: Collective values mapped by survey respondents

Figure 4: Close-up of values mapped along the coast, showing intense clustering in the vicinity of Covehead fishing wharf and Stanhope Beach Resort.

Distribution of Social and Cultural Values

Covehead, Prince Edward Island, January 2010

Learning - Creative
66 / 4%

Cultural
67 / 4%

Spiritual
83 / 5%

Intrinsic
85 / 5%

Future
87 / 6%

History
112 / 7%

Wilderness
113 / 7%

Special Places
134 / 8%

Therapeutic
134 / 8%

Recreational
205 / 13%

N = 1618

Aesthetic
196 / 12%

Life-sustaining /
Biological
Diversity
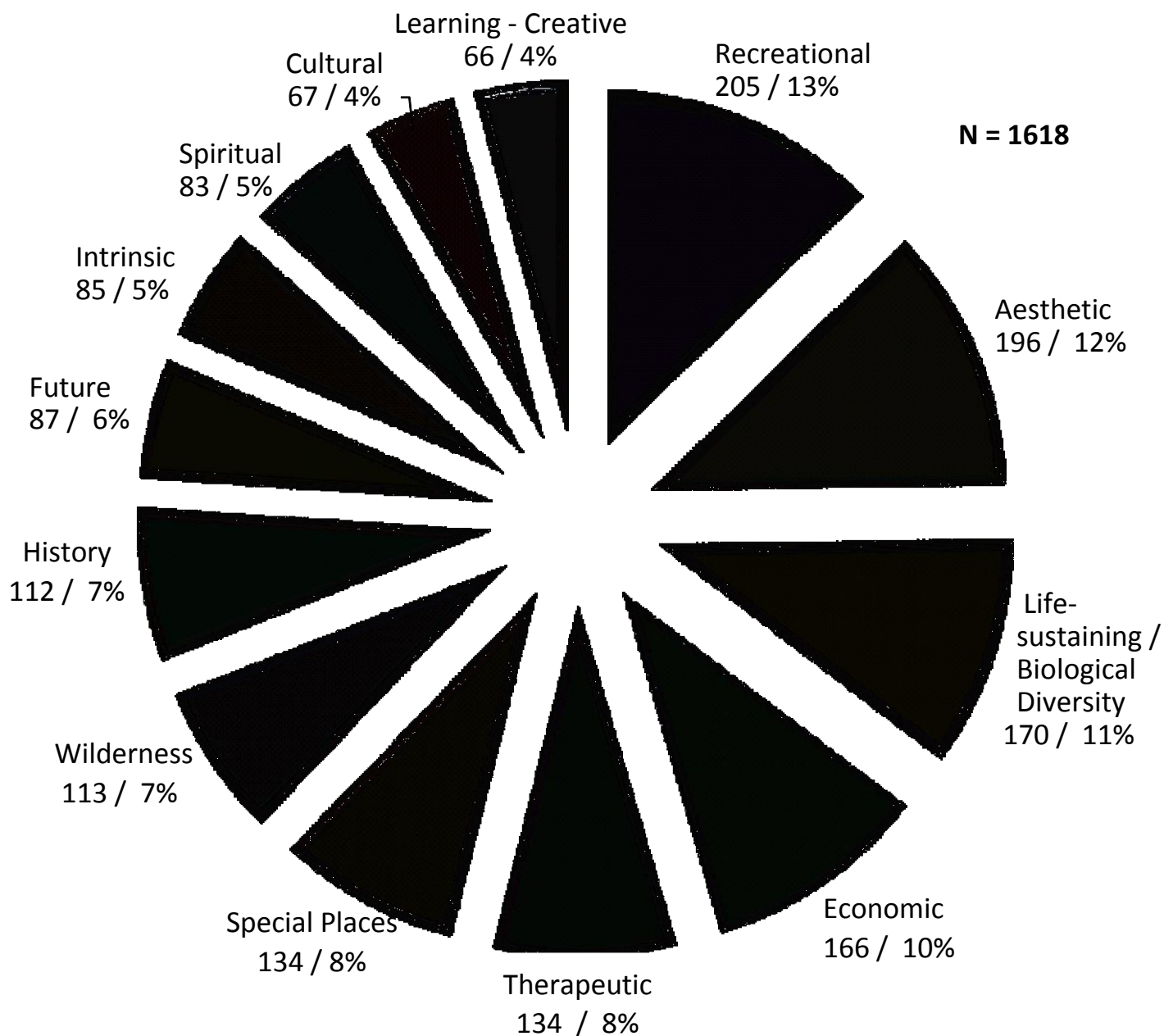170 / 11%

Economic
166 / 10%

Figure 5: Number and Percentage of mapped points corresponding to each value.
Total number of points mapped = 1618.

Existence and Intrinsic

Water received much of the attention of respondents when mapping existence and intrinsic values. Nine points or 11% were on rivers/creeks, 23 points or 27% on open bodies of water, and 11 points or 13% on shorelines. Forest also played a modest role with 15 points or 18% of values mapped. Compared to the other values mapped, Existence and Intrinsic showed less value around populated areas such as that directly south of the National Park in Stanhope. All points were mapped some distance away from the respondents' homes.

Aesthetic

Aesthetic values were similar to those values mapped for recreational in that the vast majority of points were seen along the shore (54 points or 28%), National Park (70 points or 36%) and in the water (71 points or 36%). Strong value could also be seen on the Stanhope Beach Resort and Covehead Wharf. Some value was placed on the Stanhope Bay Golf and Country Club. The few points that were valued inland were on agricultural land or forests.
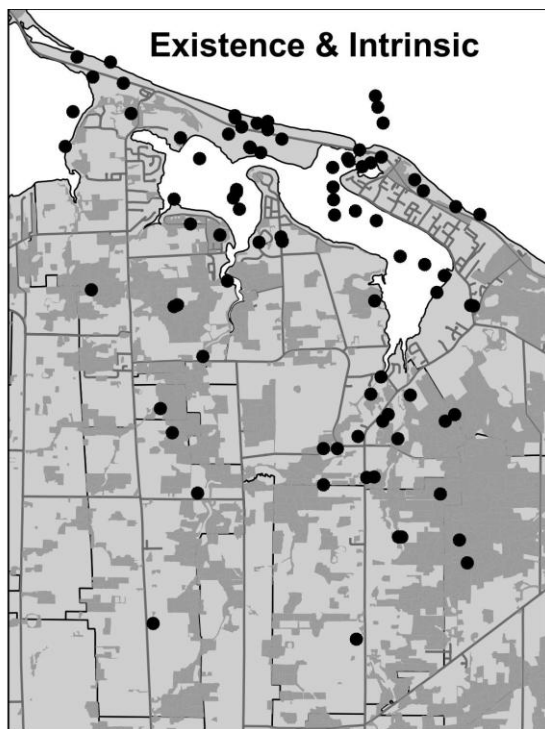

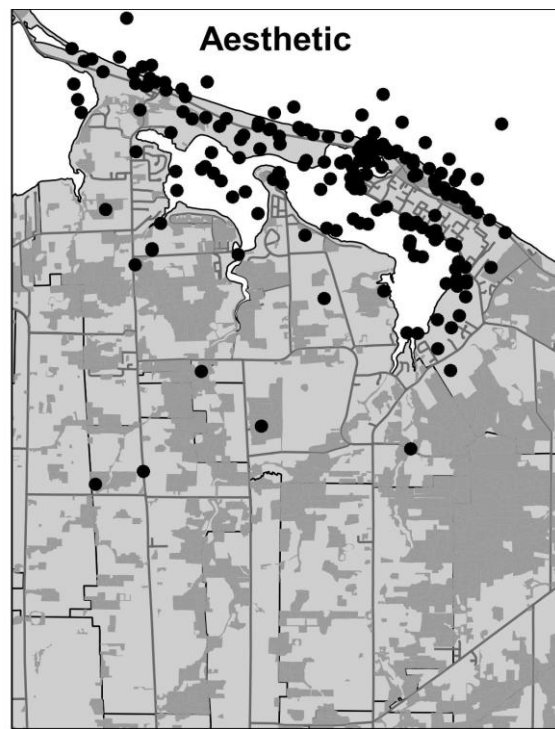**Figure 6: Existence and intrinsic values mapped by respondents**

Figure 7: Aesthetic values mapped by respondents

Cultural
Cultural values (like learning and creative expression) saw a strong connection with community. Clustering could be seen on the North Shore Community Centre, Stanhope Place, and the Brackley Beach Community Centre. The Covehead Wharf, Stanhope Beach Resort, Shaw's Hotel, Shaw Cemetery, Millstream Trail Rides along with the Millstream Barn and Howes Hall Art Gallery all received value as well.

Economic
Economic values were heavily placed on the Stanhope Golf and Country Club, Stanhope Beach Resort, Shaw's Hotel, Brackley Beach, Brackley Beach Real Estate Development, as well as Portage Rd. which is home to Baywatch Accommodations, North Winds Inn and Suites, and the Lobster Claw restaurant. The Covehead Wharf and various farms throughout the mapping region also garnered attention. The area surrounding Faye's Family Trailer Rentals, Harrington Paint Works, Pine Hill RV Park and Mackenzie Grocery, also received attention from respondents. The Millstream Restaurant and Vacationland were also mapped by respondents. Only one year-round resident mapped their own home as an economic resource.

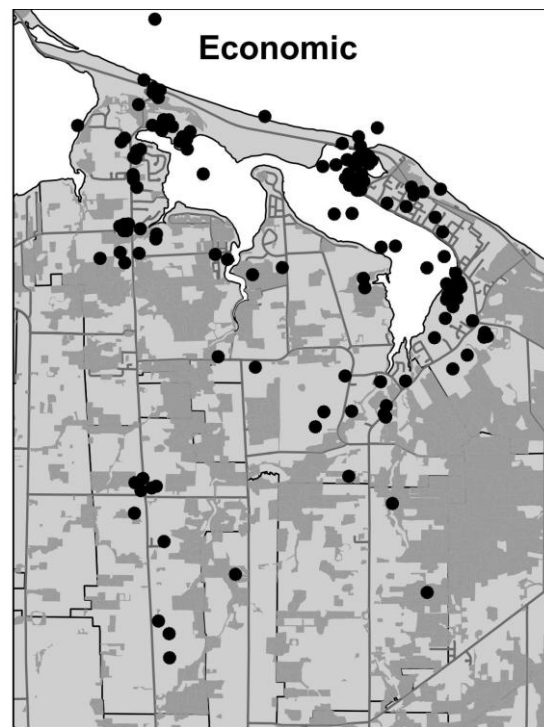Figure 8: Cultural values mapped by respondents

Figure 9: Economic values mapped by respondents

Learning and Creative Expression

For the value of learning and creative expression, obvious emphasis was placed on community resources. Heavy clustering was seen in the area of the Stanhope Community Centre (8 points). Smaller areas of clusters (3 or 4 points) could be seen on Stanhope Place and Brackley Beach Community Centre. Other areas that gained attention were the Brackley and Covehead Bays as well as all along the National Park.

Life-sustaining and Biological Diversity

Life-sustaining and biological diversity values mapped showed a strong connection with both open bodies of water and smaller rivers and creeks. Forests garnered some more attention in this value than other values. There were 38 points (22%) placed on forests, 29 points (17%) on rivers and creeks, 56 points (33%) on water and 10 points (6%) on shore lines. The National Park also received value.
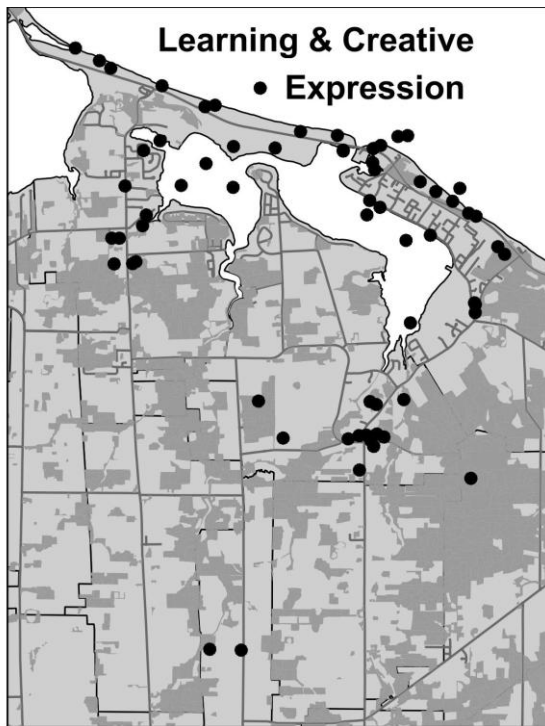
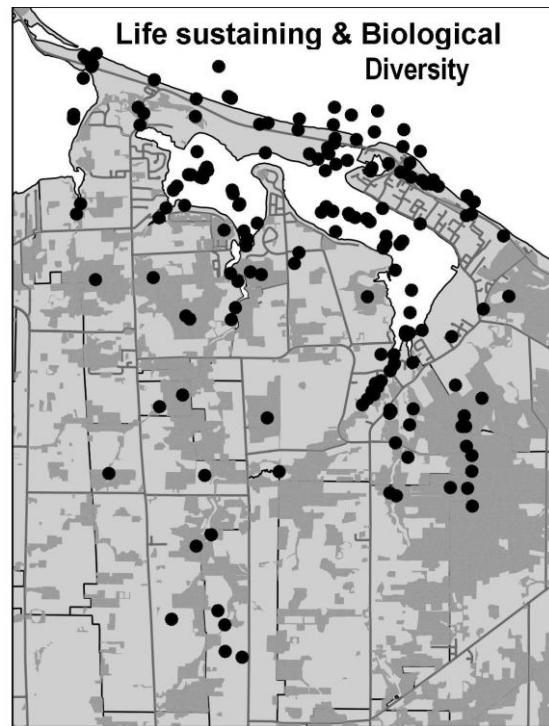**Figure 10: Learning and creative expression values mapped by respondents**

Figure 11: Life-sustaining and biological diversity values mapped by respondents

Historic

For the historic value strong emphasis was placed on Shaw Cemetery, Stanhope Beach Resort, the Covehead Wharf, the church at the intersection of Eastern and Bayshore roads, and MacKenzie Grocery. Other areas that respondents felt had historic value were Harrington Pioneer Cemetery, Shaw's Hotel, St. Eugene's Church/Cemetery, the West Covehead United Church, the North Shore Community Centre, as well as the National Park. Other points appeared to be scattered over farm land, along shore lines and on the water.

Future

Again, respondents showed a strong connection with the shore when mapping future values. Many of the points appeared on open water (35 points or 40%). The National Park proved to be strongly valued for the future value as well. Other areas that were valued for their future prospects were the Stanhope Golf and Country Club and the North Shore Community Centre. Only one respondent placed future value on their home; this was a seasonal resident. Five people placed future value on an area around their homes. Of these, 3 were seasonal and 2 were year-round.
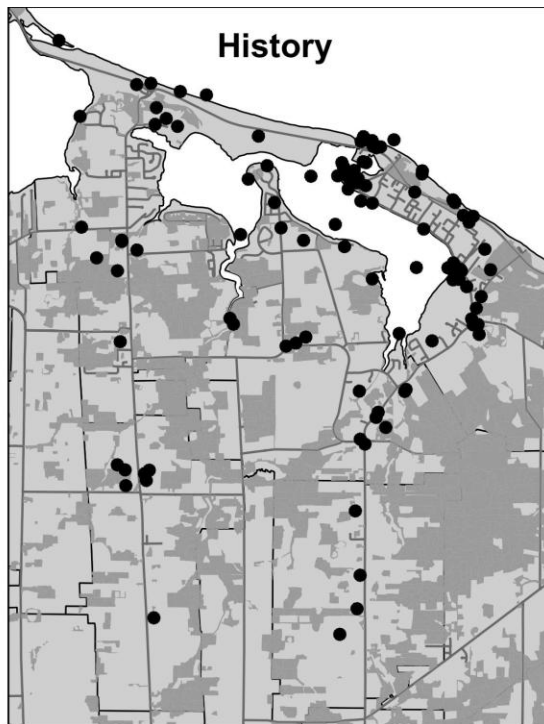

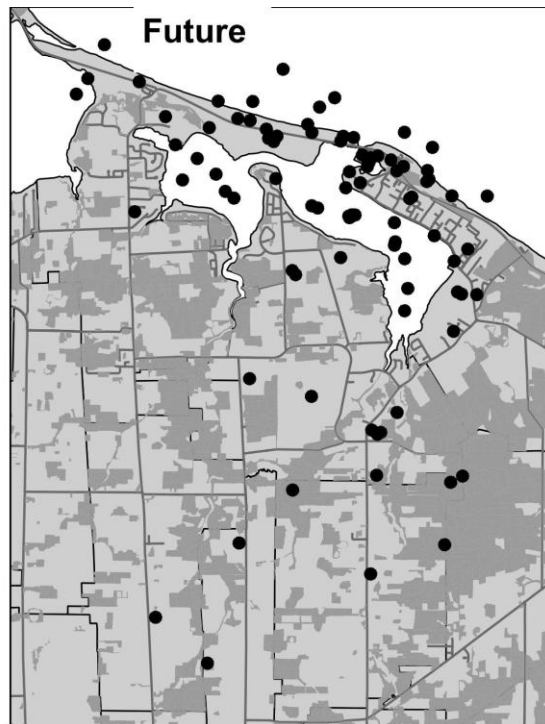**Figure 12: Historic values mapped by respondents**

Figure 13: Future values mapped by respondents

Wilderness

Wilderness values mapped by respondents were more widespread than other values. Unlike other values, a large proportion of markers were placed on forests (46 points or 41%) followed by water (26 points or 23%), shoreline (14 points or 12%) and rivers/creeks with 6 points or 5%.

Recreational

Recreational values were heavily mapped along the shoreline with 24% of the values mapped (50 points) in the National Park and in the water. Clustering could be seen around the Stanhope Golf and Country Club, the North Shore Community Centre, on the Covehead Wharf and spreading along the National Park (58 points or 28%). Other areas of value were the local fishing spots in Covehead and Brackley Bays and in the water itself (51 points or 25%). Surprisingly very little value was placed on forested areas or other areas further inland.
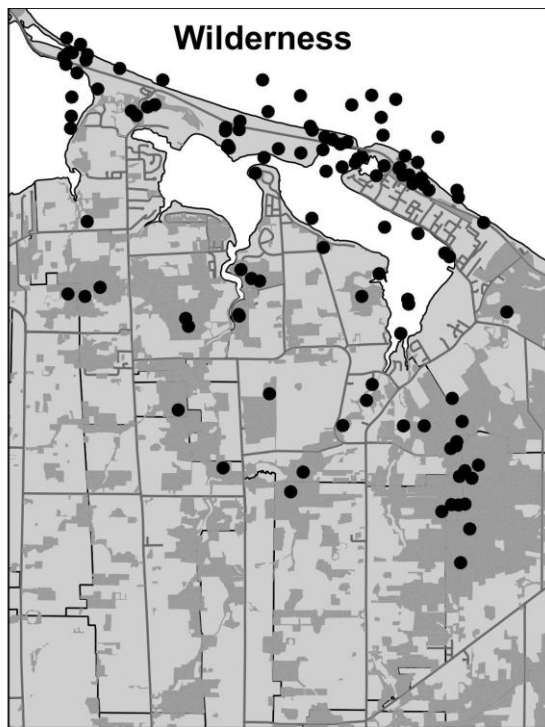

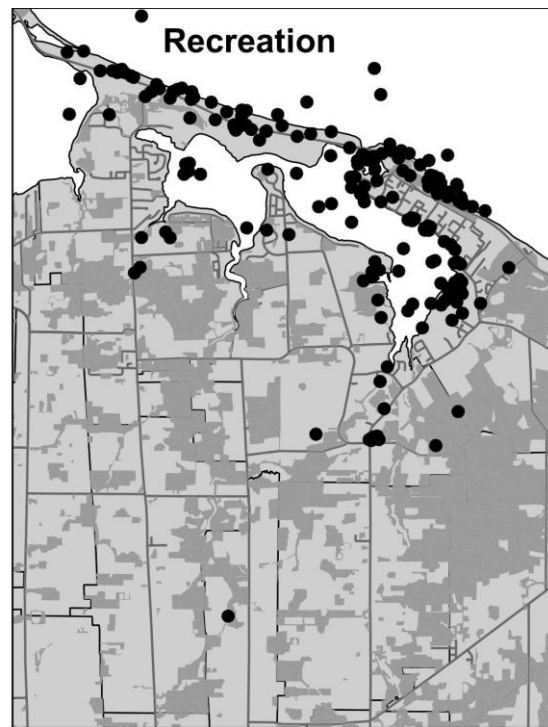**Figure 14: Wilderness values mapped by survey respondents**

Figure 15: Recreation values mapped by survey respondents

Spiritual
Churches and cemeteries as well as the National Park and the ocean were the focus of spiritual values. Clustering could be seen on the church at the Eastern Rd, Bayshore Rd intersection, the West Covehead United Church, and St. Eugene's Church/Cemetery. The National Park was also seen as a spiritual place (17 points or 20%). Shorelines received a great deal of attention as a spiritual place with 25 points or 30%. Water was also valued (17 points or 20%). York Bay Place (cottages), the North Shore Community Centre, the Stanhope Golf and Country Club, creeks, and farm land also received value as spiritual places.

Therapeutic
Sites having therapeutic value can be seen spreading all along the shore line of the National Park and Covehead and Brackley Bays as well as in the water. Many people also found therapeutic value in the Stanhope Golf and Country Club as well as the North Shore Community Centre. Of the total number of places identified as therapeutic, 34% (46 of the 134 points) were placed on shorelines, 25% (33 points) were within the National park, 41% (55) were on open bodies of water, and 9% (12) were on rivers or creeks, and 11 % (15) were on forests. Sixteen people felt an area in close proximity to their home was therapeutic, 10 of these were seasonal, and 6 were year-round.
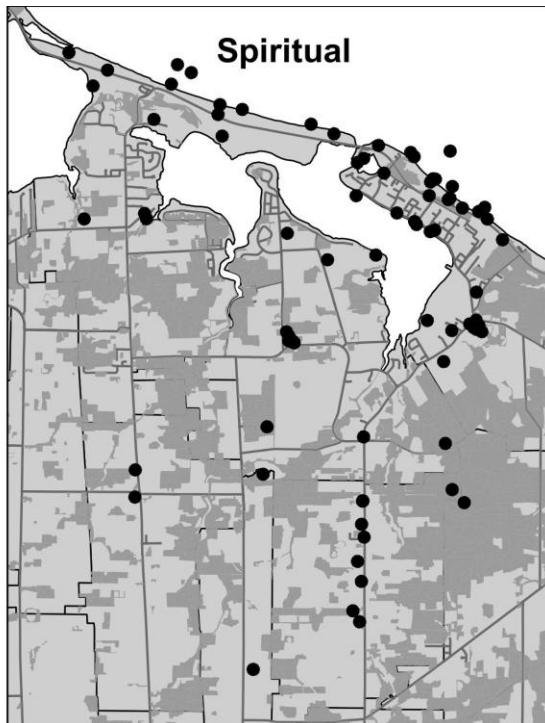
Figure 16: Spiritual values mapped by respondents
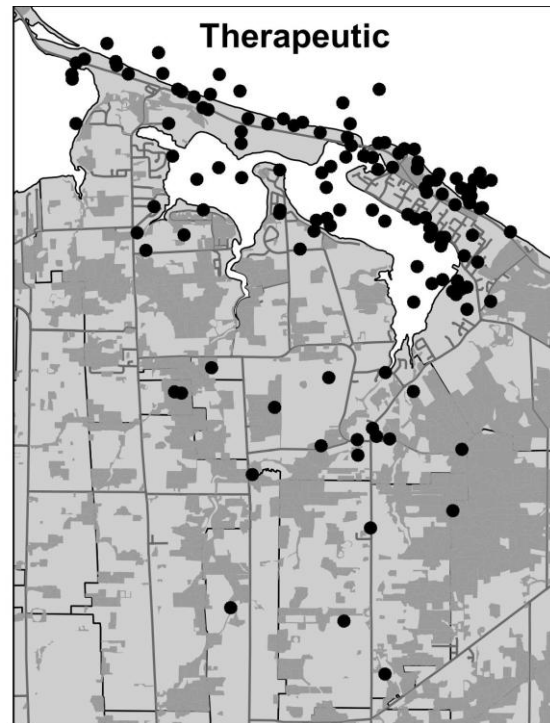
Figure 17: Therapeutic values mapped by respondents
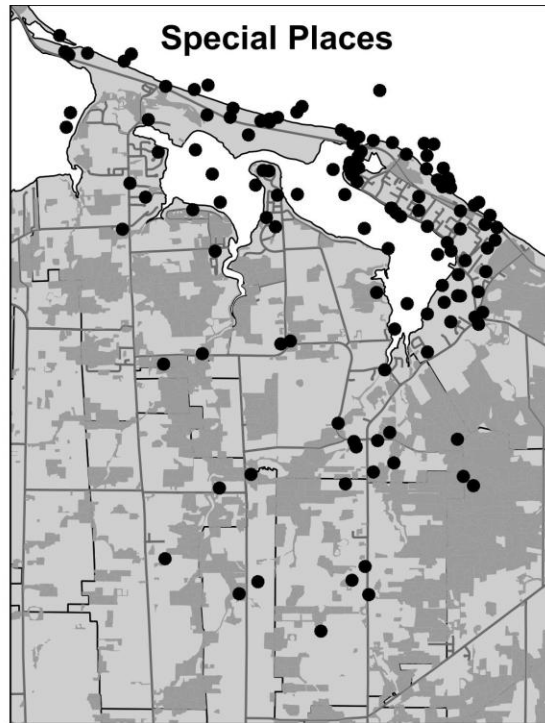
Figure 18: Special places mapped by respondents

Special Places

Special Places proved to be widely distributed on the map, but still with a focus on shore and water. Of the values mapped, 8 respondents selected an area in close proximity to their home as a special place. Of these 5 were seasonal and 3 were year-round. As with other values, the Stanhope Golf and Country Club, Stanhope Beach Resort, Covehead Wharf, the North Shore Community Centre, and the National Park all received notice. The water was also considered a special place with 42 points (31%) being mapped. The shoreline attracted 39 points (29%).

Demographics of the sample in comparison with census data and provincial data

Approximately half of the homes in the study area were seasonal (summer) dwellings. Surveys came in from both full-time and seasonal residents, but seasonal residents made up more than half of the sample (65%) and were therefore over-represented in the final database. As already noted, half of these seasonal residents had their permanent homes on Prince Edward Island. Surveys were completed and returned by both coastal and inland residents. However, more than half of all participants had their residence or summer home within 500 meters of the coast.

In terms of age distribution, our sample was significantly skewed towards older age groups. Women were also over-represented as compared to Statistics Canada data for Census area Lot 34 —the closest fit for our study area.

In Lot 34, half of the permanent residents who are over the age of 15, are under 45 years of age. In our sample only 6% of respondents were in this age bracket (15-44 years). The mail-out survey was filled out by the heads of households, and not by young people in the 15-20 years age range. The near absence of 20-45-year-olds in the sample reveals that younger workers in their childbearing years rarely responded to the request to fill in a mail survey. Therefore, to capture input from these younger demographic sectors, a different sampling approach will be required.

In Lot 34, the largest adult age groups are those who are 35–45 years of age (20%) and 45-55 years of age (19%). Another 30% of permanent residents in Lot 34 are over age 55. Among our survey participants, 75% were in the over-55 years category. This makes sense because Statistics Canada data includes only permanent residents whereas more than half (65%) of our sample was made up of seasonal residents. Seasonal residents—that is, people who own summer homes— are usually older people and often are retired.

Our sample contained a high proportion of persons having higher education; 88% had a certificate, diploma or degree. This is consistent with the general demography of Lot 34, where 83% of permanent residents have at least completed high school and 58% (63% of females and 52% of males) also hold some sort of trade certificate, diploma or degree (http://communityaccounts.ca/pei).

It is clear that being out of the labour force and having time to spare is a significant factor influencing whether or not a person responds to the invitation to fill out a mail survey. The permanent residents who filled out our survey were more likely to be out of the labour force, compared to the general population. In Lot 34, 70% of permanent residents are employed, 8% unemployed and 21% are retired. In contrast, among the permanent residents who filled in our survey only 45% were employed, while 15% were unemployed and 40% were retired.

In terms of gender, the population of Lot 34 is made up of 52% women and 48% men. Among permanent residents of Lot 34 the difference between numbers of males and females in any age category is less that 3%. However, in our sample all respondents under age 45 were female. Women also made up more than 75% of the respondents who were age 45-55, while men made up more than half of the older age groups. Overall, participants were 55% female and 45% male.

In our sample there were twice as many women than men who were unemployed. These unemployed women may have participated because they had more time available. The fact that a greater proportion of women than men are educated beyond the high school level in this area of PEI may also have contributed to their greater response to the survey.

In Lot 34, according to 2006 census data, the key employment sectors are business and management (29% of workers); and professional work including health, education, government and legal (24%); followed by sales and service (18%); trades and manufacturing (14%); and primary industries (11%). In our sample of 57 households, every category of employment listed by Statistics Canada was represented. The business and professional classes were predominant (77% of the total respondents); primary industries were represented well (9%) and other sectors were under-represented (sales and service 6%, trades and manufacturing 6%).

Overall, we can conclude that although it is directed to a random sample of the population, a survey sent by mail is not always better than handpicked focus groups in terms of representing the local demographics. As noted above, the large proportion of older people in our sample was not only due to the high numbers of older and retired seasonal residents in the study area. It was also due to the tendency of young people and working families to ignore the invitation to participate in the survey. Therefore, a mail survey alone cannot gather truly representative data.

Stratified random sampling using various research instruments would be needed to obtain a truly representative sample. But how important is it to include representative proportions of the different sectors of society in a research sample? Do people's values actually change with age, gender, income, education, ethnic origin or profession? Are the differences large enough to justify a more elaborate and costly sampling program? Our database is not large enough to answer all these questions, but we can provide some initial observations.

Trends among subsets

When we reviewed all points mapped by our respondents we noted that women tended to put markers on more places than men did (Fig. 22 a, b), and as a group, seasonal residents mapped almost twice as many points as permanent residents (Fig. 23 a, b). The places mapped by seasonal residents were most often places along the shore, close to their summer homes – presumably because these features attracted them to build their cottages in this area. Even for permanent residents, however, most values lay close to the shore and fewer were located in the interior of the island.

There were some minor but consistent trends related to people's ages. As respondents increased in age they mapped a greater proportion of "special places", reflecting their longer experience with the landscape. The oldest respondents (over 65) also tended to map fewer places having future or educational value.

No matter whether they were male or female, permanent or seasonal, people were consistent in terms of what values were most frequently mapped (Fig.5). These were recreational, aesthetic, and life-sustaining. The next most frequent were economic, special places, and therapeutic. Together these 6 values made up 1,005 points, or 62% of all the points mapped. Each of the other values accounted for a further 4-7% of points mapped.

One of the strengths of using GIS in this research is the ability to understand the locations of people's values in relation to the natural environment and the history of human land use in these areas. For instance, we were able to use the Prince Edward Island Corporate Land Use Inventory to query how often each value appeared on certain land use zones (PEI, 2003). There is ample evidence in everything from art and poetry to real estate values, that humans are attracted to the interface of land and water, whether that be a riverbank, lake or ocean shore. Half of all points mapped by our participants were over water, and a high proportion of values places on land were

adjacent to water (Fig. 19). The values associated with water were different from those associated with land. On land, the places people mapped most often had economic, recreational, historical, life-sustaining and "special place" value (Fig. 20). On water, the dominant values were aesthetic, recreational, life-sustaining, therapeutic and "special places" (Fig. 21).
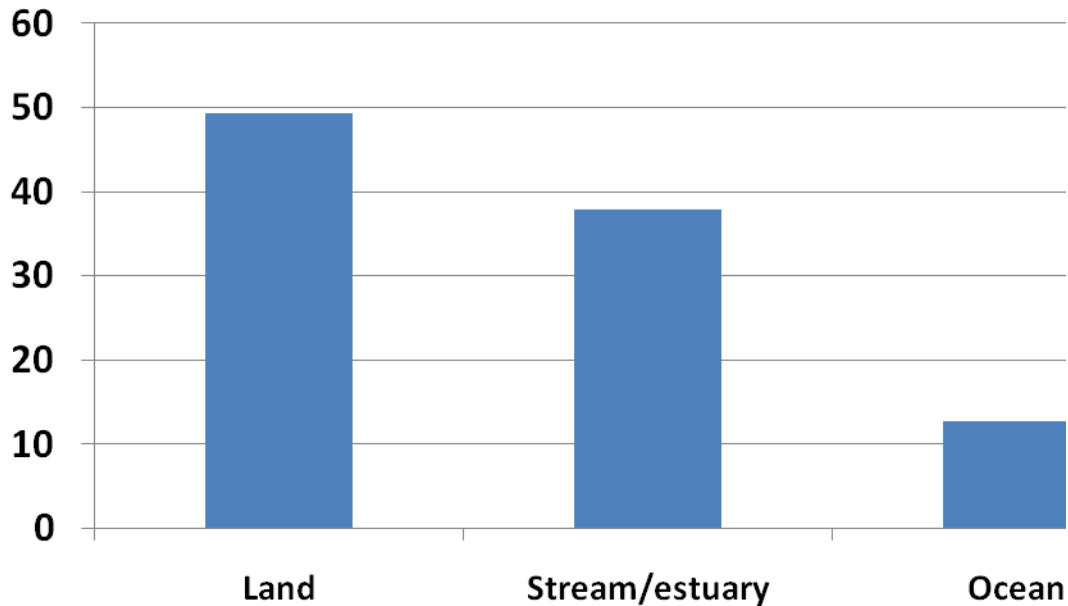
Figure 19: Percentage of total points mapped by respondents over water and on land

Figure 20: Values respondents mapped most often on land as percentage of total points
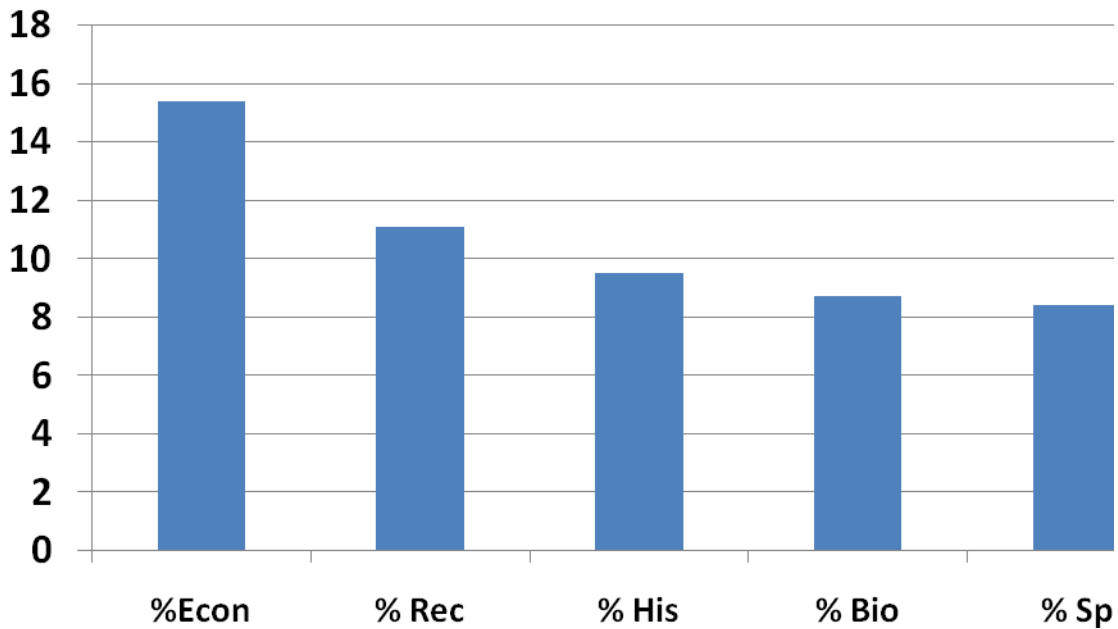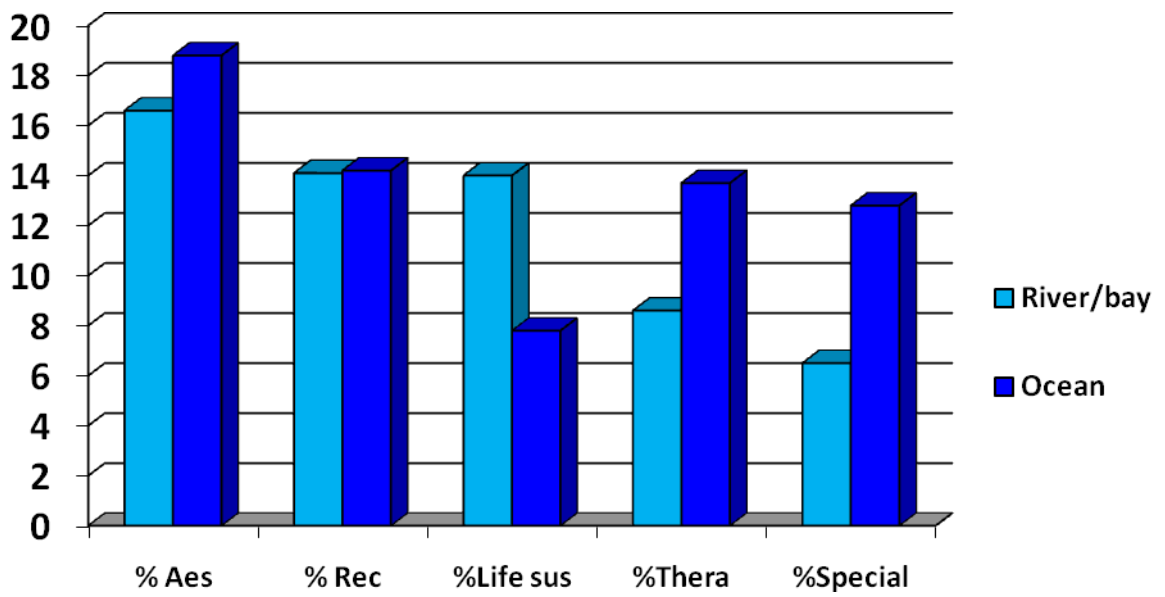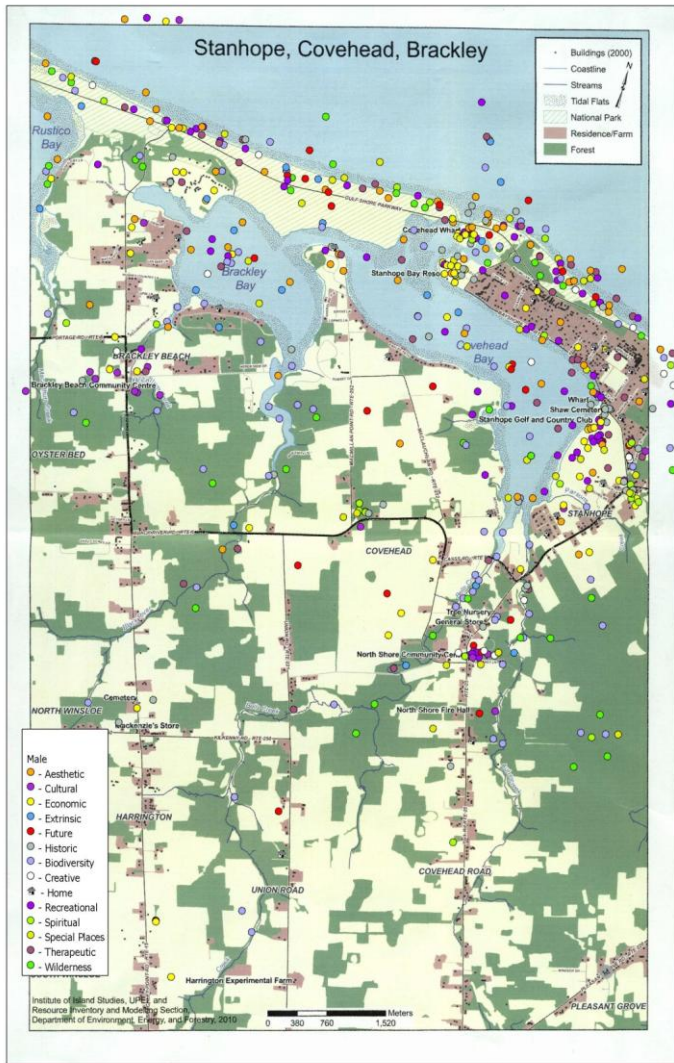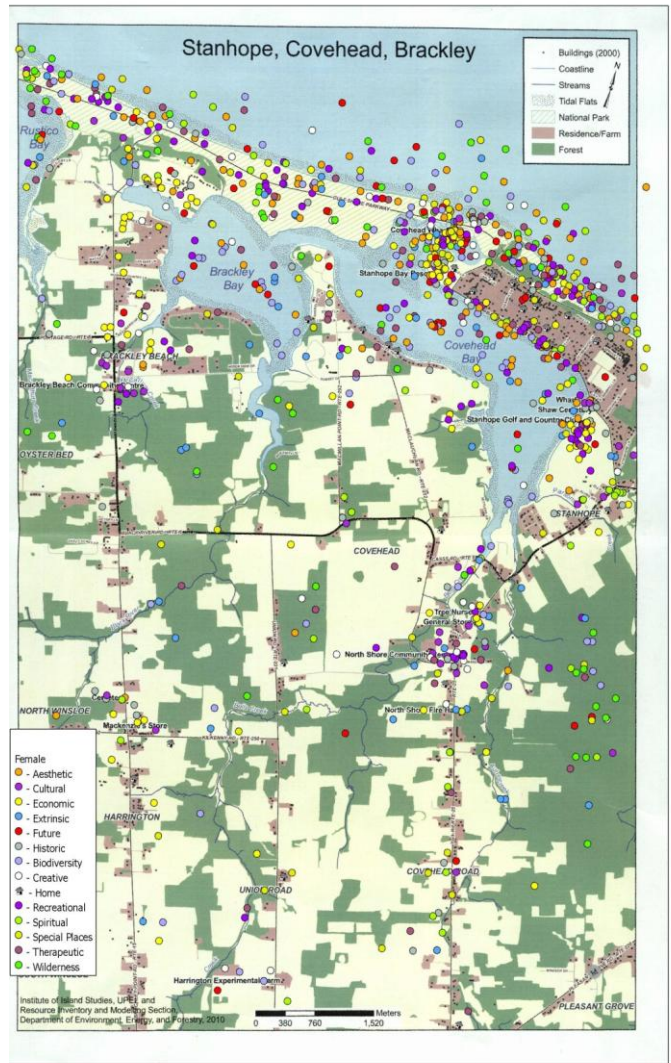
Figure 21: Values respondents mapped most often on water as a percentage of total points
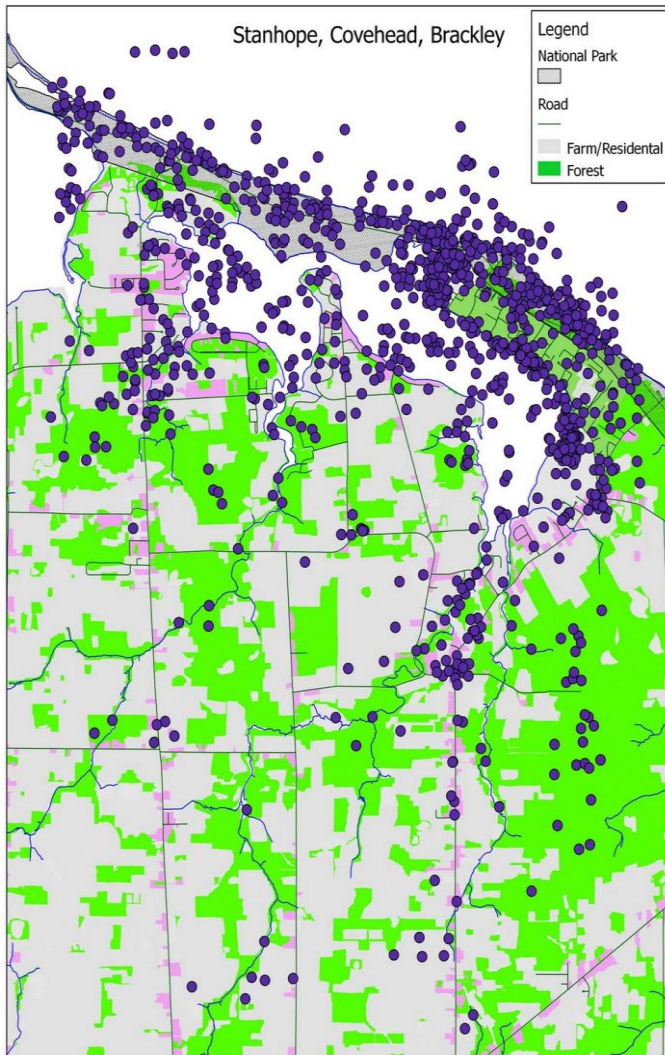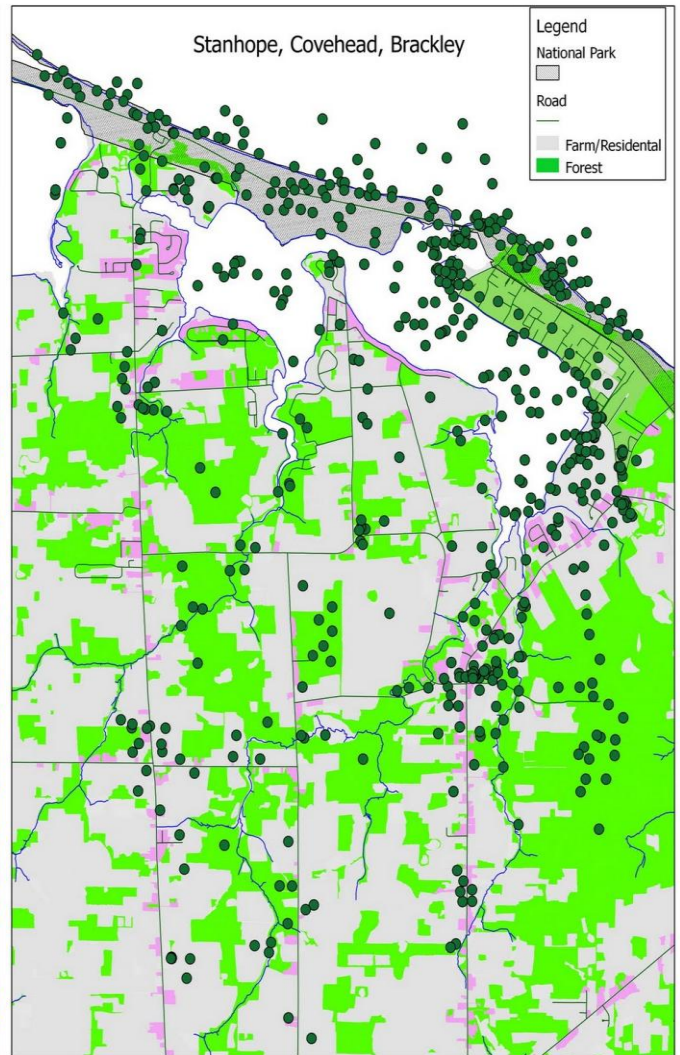
Figure 22a: Values mapped by male survey respondents

Figure 22b: Values mapped by female survey respondents

Figure 23a: Values mapped by seasonal residents

Figure 23b: Values mapped by permanent (non-seasonal) residents

Discussion and Conclusions

Island Values

It is clear that the riverbanks, beaches, and coastal properties of Prince Edward Island– which are the features most vulnerable to the effects of climate change – are highly valued by local people for diverse social and cultural reasons. Figure 4 is a dramatic demonstration that the north shore of PEI is not simply a landscape of biological habitats and economic resources. Indeed, it is a vibrant socio-ecological system where values of land and sea are deeply inscribed on the human psyche.

Our survey results suggest that many residents of the north shore of PEI are engaged citizens, with an acute sense of place. This strong sense of place engages the emotions and helps people understand their relationship with the land, turning "space" into a place with meaning and value (Eisenhauer et al., 2000; Brown & Raymond, 2007). Further, the evidence suggests that many north shore residents care passionately about the social, cultural, economic and environmental well-being of the Island. This ethic of stewardship is an important human resource for local governance.

PEI rural communities tend to be closeknit. People know and often support one another, and they pull together during hard times (Quality of Island Life Co-op, 2009). This strength of social capital leads to the expectation that Island communities have the inherent ability to cope with – or adapt to – climate change (ABS Ventures, 2003). Yet, thus far, this social capacity has not been systematically mobilized to support government decision-making (Novaczek & Shott, 2009). An important first step in developing a collective vision to support climate change adaptation is public education so that residents better understand the local implications of climate change. However, an educated public is not sufficient because there is still no framework or process for engaging citizens in land use planning, nor are there any coastal protection policies to implement (Vasseur & Catto, 2008) or tools in place to support adaptation efforts (Council of the Federation, 2007).

In this context, how can the process and products of values mapping help to build community capacity to adapt to climate change?

Values mapping as a decision-support tool for climate change adaptation

Municipal governments are at the forefront of climate change adaptation (Walsh, 2009). As climate change gains momentum, critical and difficult decisions will have to be made. The approach most likely to succeed is one that is inclusive and collaborative, that informs and engages the public, and that takes value from local knowledge (ibid.). Our results show that the mapping of social and cultural values is a process that stimulates participants to reflect upon and document their values and their attachments to specific places. Therefore, it is a powerful tool for self-education and raising awareness, while also collecting quantitative and qualitative information on the social and cultural values of communities of people. The resulting data can be used to guide development of timely responses to climate change that take into consideration people's values and their priorities. Some sections of coast will have to be abandoned to the encroaching sea. Some highly valued infrastructure may be removed from harm's way. Some alternative sites that can provide valued social and cultural services may be identified and

protected; and landowners or municipal governments may attempt to protect other key elements of infrastructure, heritage or habitats in situ.

Good governance at the local level will be essential to cope with impacts of climate change. As Walsh (2009) has pointed out, "Local government is on the front line of the climate crisis." We need to think about how climate changes can affect a dynamic socio-ecological system. This will encourage community adaptation that is more holistic, practical and effective (Walker et al., 2002).

Values mapping is a process through which people explore and recognize their own values, and the importance of coastal landscapes, habitats, activities and built infrastructure. Mapping raises awareness of how climate change will have impacts that go beyond financial losses for individuals or corporations.

Values mapping projects mediated by university researchers provide a non-partisan process through which people can have their opinions systematically recorded and visually displayed. People feel empowered when community leaders show interest in their concerns and priorities. Engagement of people in respectful government processes builds trust, which is essential to successful, collaborative governance. Empowered and informed citizens are more likely to be motivated to become part of the solution to the challenge of climate change.

In practical terms, values mapping generates information about community values and priorities that can be visualized in the form of map layers. These map layers can be integrated with other sources of information and used to support decision-making. For example, "hot spots" on a values map can focus attention on specific sites that can then be prioritized for protection, replacement or adaptive management.

We conclude that values mapping is a tool that could enable coastal communities to tap into their local knowledge and values and build upon their social capital (Novaczek et al., 2010). It is also an affordable methodology, because the GIS software that is needed for data management and analysis can be downloaded freely from online sources.

Lessons learned about the methodology

Experience in this project confirmed that having a community partner which provides local knowledge is important in the creation of the survey instruments and sampling strategy. Collaboration with Provincial government employees was also essential, because they held the map layers, knew the data, and controlled access to residents' addresses. We look forward in future to engaging provincial and community partners in the process of data interpretation. Further work with community leaders will also reveal how the data can be used to aid decision-making for climate change adaptation.

Our mail survey included a larger number of participants than the workshops performed in 2009. The households that participated were randomly selected, and as a result the participants were more representative of the local demographics. However, because surveys were generally filled out by heads of households, we collected no data from any person under 45 years of age. In future we will develop an online survey that will be more appealing and accessible to younger people and working parents who have limited time to participate in surveys.

The advantage of mapping values in a workshop setting is that the researcher can target specific demographic groups, such as school children or the elderly, who may be missed in other types of

surveys. We therefore recommend that in future, researchers consider employing a mix of face-to-face, digital and mail surveys. Digital mapping is a possibility for sampling much larger geographic areas at less cost than a mail survey. Each of these three approaches has its advantages and drawbacks, and each may appeal to people of different ages, genders or employment status. To fully explore this issue will require further methodological testing.

The future of Social and Cultural Values Mapping on Prince Edward Island

At the University of Prince Edward Island we will continue to develop and test values mapping. The infrastructure and tools we develop will allow a variety of stakeholders to participate, and freely downloadable GIS software will be used so that any local government or community organization can use the data to develop maps which are visually appealing and easy to use.

Rapidly changing mobile and internet technologies will soon allow people to contribute to maps in many new ways. The challenge for university researchers is to harness GIS technology to create flexible and integrated systems. Such systems will allow community groups to participate in meaningful and scholarly research that helps to build community capacity and resilience in this time of climate change.

We anticipate that community leaders on PEI could use the values mapping process and resulting maps to mobilize public support for collective action to adapt to predicted climate changes. We hope they will discover the information and ideas held by local residents, and then develop strategies that prioritize the protection, removal or replacement of features that are most widely and strongly valued by those residents. For example, in the case of future flooding or erosion, it is unlikely that funds will be available to remove or protect all of the valued features along an entire coast. Using maps that show which of the sites on the area are most valued, local governments will be able to focus their efforts on these places. The infrastructure that is most highly valued may be removed to higher ground or protected in situ using erosion control structures. Where valued natural habitats are at risk of flooding or erosion, plans could be made to protect similar areas that are less at risk. These areas could then be protected from forms of development that would erode their social and cultural value for future generations.

In other cases, governments will have to consider whether to allow certain developments to proceed in the coastal zone. It will be useful to know in advance whether an area that might be developed is valued for other purposes. This could lead to a decision to look for some alternative site where development is more likely to be supported by the public. By taking into consideration the cultural and social values that are attached to geographic sites, local governments will be helping to avoid or alleviate the stress associated with losses of coastal habitats and infrastructure. In other words, they will be making a contribution to the resilience and long-term social well-being of their communities.

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