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INDIGENOUS CLIMATE CHANGE ADAPTATION PLANNING USING A VALUES-FOCUSED APPROACH: A CASE STUDY WITH THE GITGA'AT NATION

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Local values and knowledge can be important components in creating robust climate change adaptation strategies for marginalized communities. Incorporating local values into the climate change planning process in a structured way and effectively using local knowledge not only improves the identification of priority actions for climate change adaptation, but also supports successful implementation. Much of climate change adaptation planning in recent years identifies actions derived from expert-driven vulnerability assessments and adaptation actions. Yet the values of each community influence how climate change impacts are perceived, and what adaptation actions are locally acceptable and will have local buy-in for implementation. Thus, it is important that planning incorporates local values if the goal is successful adaptation to climate change. This paper provides one approach for addressing this through a participatory, values-based process for climate change adaptation planning. The approach is contextualized through a case study of the Gitga'at Nation, located in northern coastal British Columbia, Canada, where key values were found to be culturally important food sources, culture, environmental resources, self-sufficiency, health, infrastructure to enable us to live well, and Gitga'at pride and cooperation. These values were used throughout the planning process to contextualize climate change impacts on Gitga'at members' way of life and to develop and evaluate adaptation actions. It is hoped that this case study provides further proof of the utility of values-based planning in the context of adaptation planning for marginalized communities.

Keywords: coastal adaptation, adaptation planning, resource dependent communities, values-based planning, First Nations, Indigenous peoples, Aboriginal peoples.

Introduction

Anthropogenic climate change is, undoubtedly, a serious threat to social, ecological, and economic systems around the world (Adger 2003; IPCC 2007;

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Parmesan and Yohe 2003; Root et al. 2003). Despite the ubiquity of information on global and regional climate change, there are various uncertainties related to, among other things, how impacts will play out at a local level—pace, scale, and magnitude (Mitchell and Hulme 1999). As a result, in many parts of the world, these impacts remain unpredictable and poorly understood, as are the myriad of secondary and tertiary effects that will cascade through the natural and human world (Adger et al. 2012; IPCC 2007; Knutti and Sedláček 2013; Mitchell and Hulme 1999; Turner and Clifton 2009). In response, many communities are turning to adaptation planning as a process to develop programming and prepare mechanisms to ultimately enhance their adaptive capacity and resilience in the face of risks, hazards, change, and disaster (Ogden and Innes 2009; Vogel et al. 2007). In the context of climate change, adaptation planning includes minimizing the risks associated with both predicted and unknown climate change impacts, and maximizing any opportunities that emerge within a changing climate (IPCC 2007). Within Canada, where this paper's illustrative case study is based, there is an emphasis on climate change planning for remote communities, both Indigenous and non-Indigenous (e.g., Andrachuk and Pearce 2011; Pearce et al. 2011), although many cities and municipalities have also undertaken adaptation planning (e.g., Bowron and Davidson 2012; Richardson 2010; Saanich Municipality 2012; Surrey [City of] 2013).

Climate adaptation planning processes are often technical in nature and are structured around the analysis of exposure or exposure-sensitivity to specific climate change risks that are known to the researcher (Wolf et al. 2012). Adaptation actions are often developed by subject matter experts as part of this process (e.g., engineering solutions to coastal sea rise). When applied to climate change adaptation planning, processes based on this status quo may not adequately contextualize climate change impacts and responses at the local level, and thus may fail to emerge with solutions or strategies that are broadly accepted or appropriately prioritized within the affected community (Cross et al. 2012).

While expert input is an important component of climate change adaptation planning, we argue in this paper that adaptation planning must have an enhanced level of local citizen involvement in the process if solutions are to have high community buy-in, fit the local context, and be implemented subsequent to the planning process. Local input is particularly important in marginalized communities, which may have limited resources for procuring expert input, limited capacity for implementation (in which case community buy-in for implementation is even more important), and a breadth and depth of local or traditional ecological knowledge. Further, there is a recognized need for a more "contextually based understanding" (Peterson 2010) and a process that is conscious of the interaction between decisions and the surrounding sociocultural context. As discussed in Wolf et al. (2012:2):

What is considered harm or an impact that would be worthy of a response ... depends on the perspective with which the impact is viewed and how it is understood, as well as the broader context within which the impact takes place. What is considered successful and legitimate adaptation therefore is determined in part by what people perceive to

be worth preserving and achieving, and these in turn hinge on their underlying values and objectives.

One way to address these issues is through the use of a values-focused approach as put forward by Keeney (1996a, 1996b). Values-focused thinking is a structured decision-making process that requires decision makers to understand the community's values (i.e., what matters) as a method for developing and evaluating alternatives. This runs counter to more conventional approaches to decision-making, which often begin with identifying readily apparent alternatives rather than articulating values first and then identifying alternatives that support them (Keeney 1996b). Values-focused thinking was originally developed within the decision sciences, but has been applied to various planning processes (McDaniels and Trousdale 1999; Morais et. al. 2012).

While there are many definitions of values across the social sciences (a good overview is provided in Wolf et al. [2012]), at their core, values can be understood as "what matters most" to a group, and could include concepts such as, freedom, collectiveness, practicing traditional cultural activities, or independence. Values are separate and distinct from facts: community members are experts in their values, but may require technical assistance in developing the facts (i.e., accurate and relevant information). Values can change how a person interprets or prioritizes facts. Facts and values are often conflated in planning processes (or values are left out altogether [Wolf et al. 2012]), so the values-focused approach separates facts from values. The values that result from the process will not only help to create, evaluate, and prioritize adaptation actions that meet local needs, but also provide a framework for long-term monitoring and evaluation (i.e., "is this action having the desired impact on our local values").

While some researchers have started using values in climate change planning (Wolf et al. 2012), there is still a dearth of case studies and research on the use of values-focused thinking as part of the climate change planning process. One way to understand how values-focused decision-making could be used in climate change planning is to view adaptation planning as a series of decisions. In the case of climate change planning, some of the decisions being made include, (1) what climate change impacts are seen as most impactful to the community, (2) which adaptation actions best meet the needs of the community, (3) which actions have the highest community buy-in, and (4) which actions are realistic given the community's constraints.

Here we provide a case study based on the authors' experiences in climate change adaptation planning with the Gitga'at First Nation (i.e., Indigenous), a remote community on the north coast of British Columbia (BC), Canada.

Case Study of the Gitga'at Nation

Background

The Gitga'at Nation is one of 14 subgroups that make up the Tsimshian (Ts'msyen) language and cultural group occupying a large area of northwestern

BC and extending into the southeastern portion of the State of Alaska. Gitga'at people trace their ancestry to early Indigenous groups that migrated down from the Skeena River Valley and populated an expansive region, including what is now referred to as Gitga'at territory (Figure 1). Gitga'at means "people of the cane" in *Sm'algyax*, the language of the Tsimshian people, and refers to a pole that was used to move canoes along rivers in earlier times.

Today there are approximately 700 members of the Gitga'at Nation. The village of Hartley Bay is the main Gitga'at village and is home to approximately 170 Gitga'at people. The majority of the remaining members reside in Prince Rupert, a port town located 128.75 km to the northwest. Despite there being only 170 members of the Nation living in Hartley Bay, it remains the social, cultural, and political hub for the entire Gitga'at Nation. Many people return there seasonally to participate in important harvesting activities and other cultural practices.

Cultural practices revolve around seasonal harvesting activities, which nourish the Gitga'at people physically and spiritually while connecting them to one another and their environment. These connections are "reinforced daily through taboos and and/or spiritual protocols which surround fishing, the treatment of animals and environments, and the disposal of animal and fish remains" (Satterfield et al. 2011:23).

Despite the colonizing efforts of the state and church that persisted throughout much of the nineteenth and twentieth centuries, Gitga'at culture and society remains uniquely intact. In part, this integrity can be attributed to the remote location of Hartley Bay and the geography of the region. Accessible only by boat or plane, Hartley Bay exists in the heart of what is contemporarily known as the Great Bear Rainforest, a rare tract of intact coastal temperate rainforest that makes up the central and north coast of British Columbia (Price et al. 2008).

Although Hartley Bay is remotely located, the Gitga'at Nation has not been, and is not, immune to socioeconomic restructuring and ecological stressors (Ommer et al. 2007). Due to increased pressure on natural resources (e.g., fisheries) the Gitga'at have been forced to cope with declining and shifting economies, which has precipitated a complex array of social, economic, cultural, and health-related challenges.

Rationale for Climate Change Adaptation in the Gitga'at Nation

Members of the Gitga'at Nation are already realizing the impacts of climate change on their traditional territory, resources, and way of life. Community observations—both contemporary and those passed down through generations—provide valuable insight into changing weather patterns and the effects of these changes on species and ecosystems (Turner and Clifton 2009). Despite the Gitga'at's proven ability to adapt to previous environmental changes and stressors, recent more-ubiquitous changes have proven harder to predict and plan for. The scale and pace of climate change impacts on the Gitga'at way of life and values has made the task of adapting to localized impacts both critical and challenging. This issue is not unique to the Gitga'at, and other indigenous groups worldwide are being forced to reconcile their way of life with the often uncertain impacts associated with climate change (Nakashima et al. 2012).

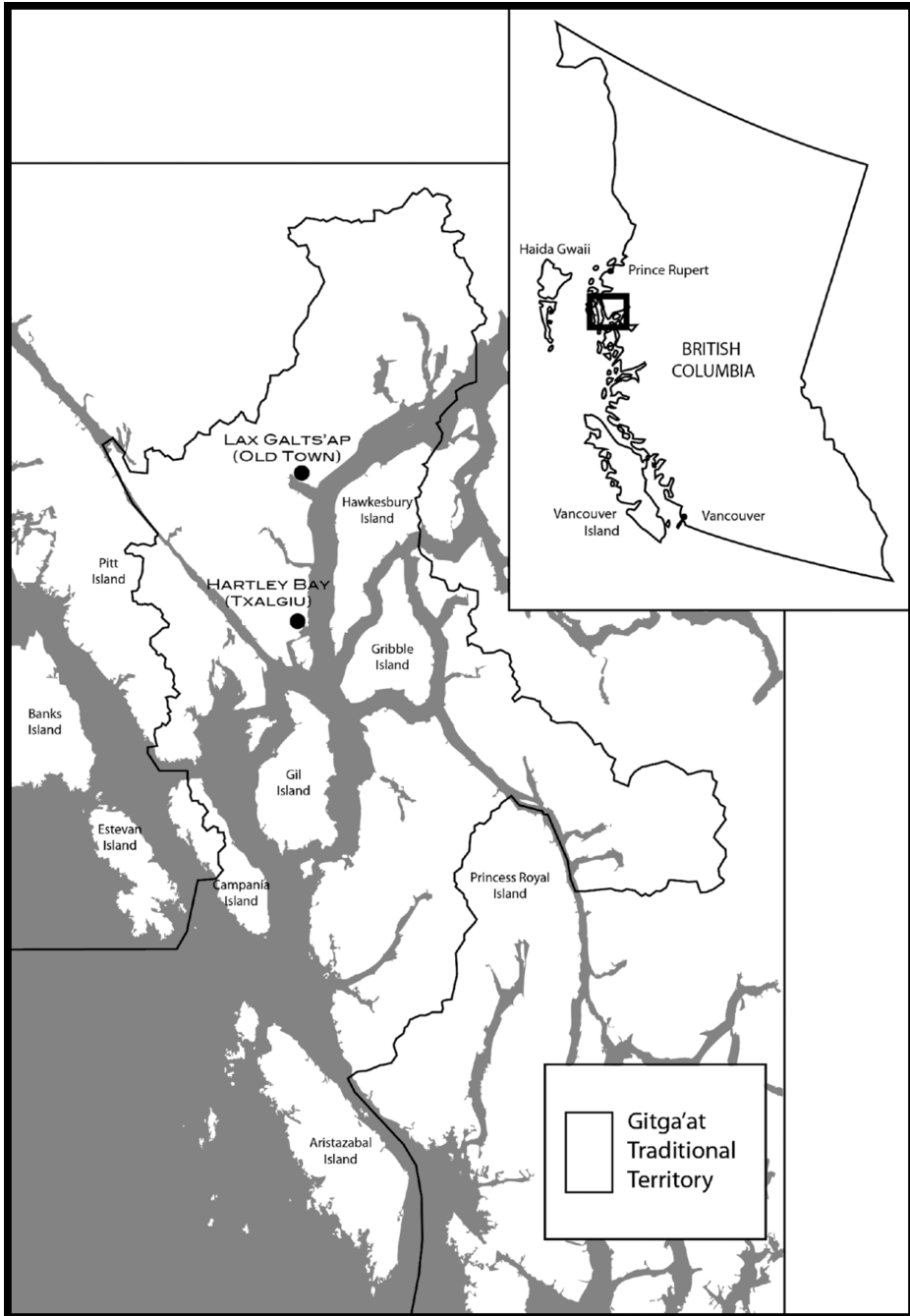


Figure 1. Gitga'at traditional territory.

Methods

In late 2012, the Gitga'at Nation initiated a climate change adaptation planning process in order to increase their understanding of localized climate change impacts and develop a plan for how they could adapt. They convened a project team consisting of external researchers, planning consultants, and Gitga'at staff who worked to develop, guide, and facilitate the process.

The project team developed a methodology for the project that incorporated elements from existing climate change adaptation planning methods (CIER 2008; ICLEI Canada 2013; Ingram and Hamilton 2014), modified to fit the unique conditions of the Gitga'at community: limited resources (time, money, staff capacity); a population with a depth of local knowledge and a low degree of in- and out-migration (FERENCE Weiker and Company 2009); and a high incidence of "planning burnout," due to a long history of community meetings and engagement activities related to planning processes, research projects, and interest from natural resource companies (many of which have produced little tangible evidence of change).

To address these factors, the chosen methodology is a four-phase strategic planning process that relies heavily on local input and knowledge and is highly focused on communicating and discussing how climate change will impact people's day-to-day lives. The methodology uses a values-focused decision-making process that (1) identifies community values, (2) uses these values as a lens to understand the potential impacts from climate change, and (3) uses the values to develop and evaluate adaptation options.

Engagement activities for the project were structured to reach a broad spectrum of members, including youth, elders, leadership, staff, and those living off-reserve. Engagement included non-standard outreach activities such as tea with elders, movie nights, and activities at the local school, in addition to more standard community workshops. The format of each workshop varied depending on the phase of the project as described in Table 1. Meeting attendance ranged from ten participants at elders meetings, to 25 participants in meetings for the whole community.

The project team developed a variety of written materials that were disseminated to member mailing lists and distributed via community hubs such as the Band office, school, and health clinic. These products included a booklet of climate change impacts, postcards advertising the projects and upcoming events, and five project newsletters. These newsletters provided updates on the project, invitations to future events, and findings from the research that would be interesting or relevant to people's lives. For example, one newsletter focused on salmonberries (*Rubus spectabilis* Pursh), an important local food source, and one for which members had reported large variations in quality and quantity in the previous few years.

The four-phased methodology is described below and is summarized in Table 2. The project phases were framed to participants as questions in order to encourage thought and invite participation (e.g., "Where are we now?").

1. Values Assessment ("What Matters Most?")

In this first project phase, Gitga'at values were identified so they could be used in subsequent planning steps. Local values had already been documented

Table 1. Workshop summary.

Dates	Workshop location	Workshop description
November 2012 community workshops	Hartley Bay (everyone welcome) Hartley Bay (elders and elected and hereditary leadership) Prince Rupert (everyone welcome) Hartley Bay School (ages 7–16)	Introduction to the project and high-level climate change impacts, discussion about climate change observations, discussion about community values, discussion about the intersection points between values and climate change. After a general discussion about climate change and potential impacts in the area, youth were asked to pick a local impact of climate change—increased rain, rising sea levels, increased temperature—and draw an “influence diagram” showing how this could be linked to the plants, animals, and activities in their lives. Project researchers provided updates to the community, and discussed observed changes in the area.
November 2012 school workshop	Hartley Bay (everyone welcome)	Project researchers provided updates to the community, and discussed observed changes in the area.
January 2012 community workshops	Hartley Bay (everyone welcome)	Project researchers provided updates to the community, and discussed observed changes in the area.
May 2012 community workshops	Hartley Bay (elders and elected and hereditary leadership)	Project researchers provided updates to the community, and discussed observed changes in the area.
August 2013 community workshops	Hartley Bay (everyone welcome) Hartley Bay (elders and elected and hereditary leadership) Prince Rupert (everyone welcome)	These meetings focused on developing and evaluating climate change adaptation options. Each meeting began with a discussion of participants’ climate change observations since the last set of community meetings. Following this, participants were asked to think about ways that they have already adapted to climate and other changes in the past. They were then asked to develop potential climate change adaptation actions to address the impacts on their key values (developed in previous workshops and presented in this workshop through a series of wall posters and presentations). Through group and individual discussions, participants came up with ideas and were asked to write them on sticky notes and place them on posters for each value. Participants were then given five green sticky dots per poster and asked to “vote” on the actions that they thought would be most appropriate and have the biggest positive impact. These meetings focused on evaluating action ideas and moving them forward.
February 2014 community workshops and movie night	Hartley Bay (everyone welcome) Prince Rupert (everyone welcome)	Each meeting began with a discussion of climate change observations since the last set of community meetings. Following this, participants were shown the short list of action ideas and discussed to what degree each action was already happening, and how this could be built on. In addition to whole-group discussions, worksheets were provided where participants could record their thoughts and provide them to the researchers in an anonymous way. Participants were asked to think about how they could contribute to climate change adaptation (at the personal, family, or community level). Following a group discussion, participants wrote their ideas on a postcard, which will be mailed back to them in six months as a reminder of their commitment. A movie about climate change— <i>Chasing Ice</i> —was shown at the end of this workshop.

Table 2. Project methodology outline.

Project phase	Description
1) Values assessment (“what matters most?”)	Identification of key community values and objectives with regards to climate change
2) Vulnerability assessment (“where are we now?”)	Identification of current and predicted climate change impacts, and their potential effects on Gitga’at values
3) Developing the adaptation plan (“what can we do about it?”)	Development and refinement of adaptation actions (using values and other evaluation methods)
4) Implementation (“are we there yet?”)	Implementation plans, mainstreaming, and monitoring and evaluation

as part of previous planning projects that focused on the Gitga’at economy (Gitga’at First Nation 2011a) and Gitga’at marine use (Gitga’at First Nation 2011b), and the project team used this existing information to compile an initial list of values.

The draft list of values was presented to the community at the first set of community meetings for validation, discussion, and, if necessary, revision or omission. In order to make the concept tangible to community members, “values” were framed as “what matters to us” or “our way of life.” A graphic (Figure 2) was used to convey the importance of climate change planning to Gitga’at members’ lives.

2. Vulnerability Assessment (“Where Are We Now?”)

Phase two consisted of a vulnerability assessment. The Gitga’at Vulnerability Assessment followed a relatively standard outline that evaluates vulnerability as a function of exposure, sensitivity, and adaptive capacity (CIER 2008; ICLEI Canada 2013; Ingram and Hamilton 2014; IPCC 2007). Exposure refers to those climate changes that are already being felt, and those systems that are exposed to future climate variations (Fussel and Klein 2006). Sensitivity, in the climate change context, refers to the degree to which a community is affected by the climatic change that they are exposed to. Adaptive capacity refers to the community’s ability to adapt to changes, and is typically a function of things such as income, education level, and social structures (Ingram and Hamilton 2014).

Exposure

Community observations of change were collected at the first set of project meetings (see Table 1). Each community meeting began by asking people to think about the changes that they had seen in the natural world in their lifetimes (or longer term if information had been passed from generation to generation). Participants were asked to think about observations within several dimensions: climate; weather; plants and animals; river flows; food sources; health; transportation; and other.

The project team facilitated a plenary discussion, which was followed by small group discussions (four to six people) where participants were encouraged to discuss changes and write down their thoughts. Written answers were collected and displayed on posters for all to see and discuss. This method ensured that there were both group and individual opportunities to interact, an important feature for any group activity, but especially so in the Gitga’at community where some participants are comfortable in speaking at a meeting and others prefer not to express their opinions in a group.



Figure 2. Communications graphic used to convey the intersection of values and climate change impacts.

Local observations were complemented by the project team's research into climate and ecosystem impacts for the region (past and projected). This work was summarized in the Gitga'at Biophysical Vulnerability Assessment (Lamontagne and Matthews 2013) and packaged into a short, summary leaflet that was distributed to the community.

Sensitivity

Sensitivity was evaluated through the lens of community values. In a series of community workshops, the results from the "exposure" analysis and the values research were used to look at the intersection between climate impacts and local values (as illustrated in Figure 2).

The project team presented the potential climate changes to the community, and community members discussed how each core community value could be impacted by this change. Discussions were documented through the development of influence diagrams, which look at the backward and forward linkages between events to show how climate changes could cascade through the natural world and impact Gitga'at core values (i.e., way of life; Figure 3).

Following this activity, participants were asked to evaluate how each of the values, identified earlier in the project, could potentially be impacted by climate changes. This was done through group discussions followed by the use of interactive posters on which participants could post their answers using sticky notes and read and review other responses.

Community input was augmented by a review of available literature of baseline sociocultural indicators (e.g., health, income, and education levels) in

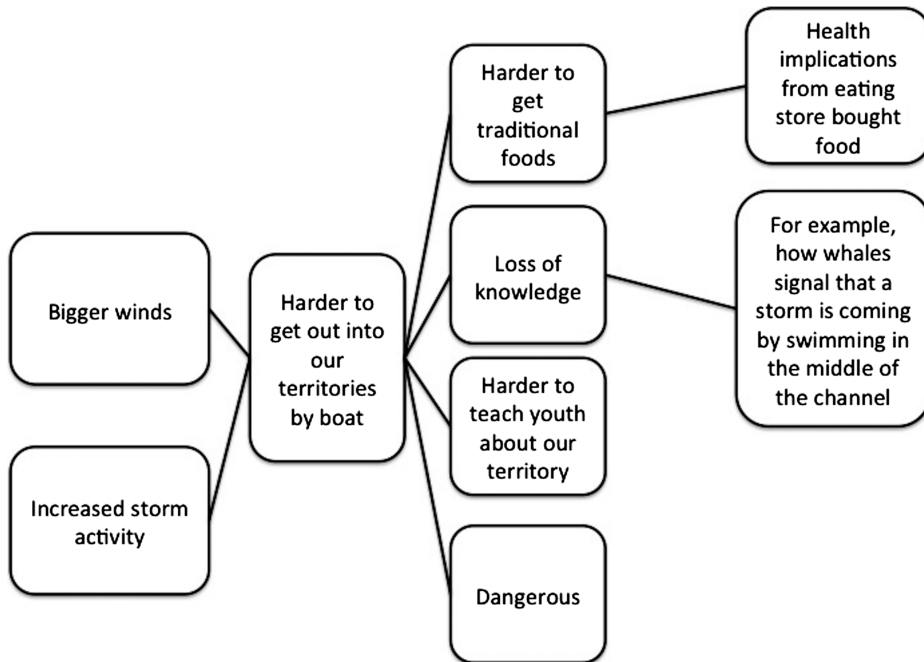


Figure 3. Influence diagram showing a workshop participants' assessment of how stronger winds would impact the biophysical world and their day-to-day life.

order to gain a greater understanding of the potential impacts from climate change on the Gitga'at population. The results from the community discussion and literature review were compiled and examined in the context of five key areas: 1) cultural; 2) social; 3) economic; 4) health; and 5) infrastructure sensitivity.

Adaptive Capacity

Adaptive capacity was assessed through group discussions about the ways in which the Gitga'at have adapted to changes (cultural, social, economic, etc.) in the past, and how well they could cope with changes today. Community meetings and one-on-one interviews informed this portion of the project. Quotes and stories drawn from these discussions were disseminated in newsletters and posters throughout the project to provide examples of adaptation measures, and also to raise community confidence in their ability to adapt to future changes. For example, a participant in a climate change workshop stated: "We've always been here, we've always adapted. Our forefathers have always done what they've needed to do to stay in the area" (workshop participant 2012). This statement is a potent example of Gitga'at's proven ability to adapt.

3. Developing the Adaptation Plan ("What Can We Do About It?")

Understanding how climate change is and will continue to impact Gitga'at values led to the development of numerous adaptation options. In a series of community workshops and one-on-one meetings, project team staff worked with

community members to develop actions to address the points at which climate changes would negatively impact community values. These ideas formed an initial “long list” of actions that would be moved forward for review and evaluation.

The project team also conducted a literature review of climate change adaptation plans from communities dealing with similar issues, mining them for potential action ideas. Appropriate actions were added to the “long list.” Further, there was a recognized role for external input, particularly around technical factors such as infrastructure readiness for climate change impacts (sewage, transportation systems, etc.). The project team took the initial list of actions and worked with subject area experts to refine existing ideas and elicit additional ones.

The Gitga’at could not feasibly do all of the actions on the “long-list.” As such, actions were evaluated by community members, Band staff, external experts, and the project team to better understand several key elements. Actions were evaluated in two ways: first, how well the action would alleviate climate impacts on key Gitga’at values (actions that would have positive impacts on multiple values were prioritized); and second, how well each action would address Gitga’at’s climate hazards. By structuring the analysis in this way, gaps were identified (i.e., areas where no actions would address climate impacts on key values) and additional actions could be developed.

Actions that made it through the above analysis were subjected to three more evaluation criteria: first, the urgency for proposed actions; second, how realistically this action could be undertaken, given current constraints such as time, money and capacity; and third, if this action is already being done, how it could be built on.

From this analysis, actions were either included in or excluded from the plan, and the remaining actions were sequenced into “quickstart” (actions that can be done quickly and easily to build momentum), short-, medium-, and long-term actions.

4. Implementation (“Are We There Yet?”)

As part of the fourth and final phase of the process, the project team held meetings with local staff to understand what elements were required in order to ensure that a plan was successfully implemented and did not end up “sitting on a shelf.” In these meetings, project team members presented the adaptation actions to department heads and community leadership (most of whom were involved in the process of developing the actions) and sought to understand what the barriers to implementation would be, and how these barriers could be overcome.

Results

1. Values Assessment (“What Matters Most?”)

The key Gitga’at values that were determined from this phase of work are (in rough order of importance, though it was noted by many that they cannot be prioritized): culturally important food sources; culture; environmental resources; self-sufficiency; health; infrastructure to enable us to live well; and Gitga’at pride and cooperation. Each value had several “sub-values” that provided additional detail. See Table 3 for the list of values and sub-values.

Table 3. Core Gitga'at values.

Value	Sub-values
Culturally important food sources	Availability of food source Ability to harvest and process them Ability to pass on traditional knowledge and methods
Culture	Songs, foods, dances, stories, spirituality, clan system, language, names, rites of passage, etc. Culturally important places and their names Non-food traditional species Honoring plants and animals Ability to pass on this knowledge
Preserving and restoring environmental resources	Forests, aquaculture, etc. Ability to use them for our own use, AND for economic purposes Gitga'at access, enjoy, use resources in ways that sustain and enhance culture, society, and economy
Self-sufficiency	Management practices that leave resources intact for future generations Taking care of each other in times of crisis or emergency—survivability Skilled population that can work Availability of good jobs locally Adaptability/survivability
Health	Healthy food Healthy minds Healthy bodies
Infrastructure that enables us to live well	Homes (healthy building materials, locally specific building methods and materials) Other buildings (schools, clinic, etc.) Energy production, water treatment, other "backend" functions Boardwalks, roads, trails, etc., in Hartley Bay
Gitga'at pride and cooperation	Pride in our culture Cooperation and communication between Gitga'at groups (elders and youth, Prince Rupert and Hartley Bay, etc.) Cooperation and communication with other groups (businesses, governments, etc.)

The primary finding from the values research was that the Gitga'at way of life is highly reliant on the natural world, particularly on traditional foods, and that all other values (with the exception of infrastructure) are highly integrated with traditional foods. This finding was not new or unexpected, and reflects work by others such as Fediuk et al. (2007) who found that 80% of proteins consumed in Hartley Bay come from traditional foods.

2. Vulnerability Assessment ("Where Are We Now?")

Exposure

Exposure was evaluated by reviewing literature on past and predicted climate changes, and by working with community members to understand what changes they had observed in the area during their lifetimes. All participants, particularly elders who had lived in the area many years, were quick to point out that things had been changing. Project researchers collected hundreds of community observations. After a process of grouping, removing duplicates, and condensing, the following themes emerged as paramount: sea level rise and coastal erosion in the main village of Hartley Bay and nearby seasonal harvesting camps; changes in river temperature and flow (stronger surges in winter and spring, less water and higher temperatures in summer); less predictable weather

and seasons (in particular, spring coming earlier); and increased storm frequency and intensity. All of these climate and ocean-related observations were confirmed in the review of past climate data for the region and are in line with the predicted impacts for the region.

Scientists researching climate change are predicting that temperatures will rise (e.g., Christensen et al. 2007), precipitation volumes will increase in all seasons except for summer (which is expected to get drier; Christensen et al. 2007; Rodenhuis 2009), and extreme temperature and precipitation events are likely to increase in frequency (e.g., Kharin et al. 2007). The mid-latitude westerlies are expected to shift northward and become more intense, while the mid-latitude storm track may become more intense, less frequent, and shift northward as well (Christopherson and Byrne 2009). Sea levels will continue to rise, interacting with changes in storm events to alter storm surge patterns (Thomson et al. 2008). Increasing concentrations of atmospheric carbon will also result in ocean acidification, which will impact many of the marine species that the Gitga'at rely upon for subsistence and trade (Meehl et al. 2007).

The cascading effects that these climate changes will have on plant and animal species in the region appear to be complex and poorly understood. However, most key species valued by the Gitga'at are expected to be negatively impacted in one way or another. For example, anadromous fish species like salmon are very likely to have their upstream migration, spawning, incubation, rearing, and/or ocean migrations disrupted by changes in water temperature (e.g., Beamish et al. 2009; Harley et al. 2006; Morrison et al. 2002) and river flow levels (e.g., Beamish et al. 2009). Intertidal bivalves (e.g., clams and cockles) are likely to face increased predation by the ochre sea star (*Pisaster ochraceus* Brandt) (Gooding et al. 2009), as well as have their growth and survival threatened by more acidic conditions (Meehl et al. 2007). There is very little research on the effect of climate change on the red laver seaweed (*Pyropia abbotiae* V.Krishnamurthy; formerly *Porphyra abbotiae* V.Krishnamurthy), which is an important cultural food source (Turner and Clifton 2006). However, it is possible that increased freshwater inputs in winter and spring from runoff and precipitation (Christensen et al. 2007), as well as hot and dry conditions during low-tide exposure in summer (Harley and Graham 2012; Okey et al. 2012), will degrade the quality, if not the ultimate survival, of red laver (Bocking et al. 2011). Other general trends predicted include northward migration of species and earlier budding and flowering of plants (Polgar and Primack 2011).

In the case of plant and animal changes, local observations provided the richest source of information on a hyper-local scale that was not available in the literature. Observations tended to confirm predictions, where predictions existed, and added depth of information. Observations highlighted changes in abundance of animal species including salmon (more variable) and eulachon (*Thaleichthys pacificus* Richardson) (decreased quantity), as well as changes in the abundance and quality of plant species, such as berries (more variable, waterlogged), seaweed (lower quality and quantity), and crab apple (*Malus fusca* (Raf.) C.K.Schneid) (decreased quantity). There were also a number of observations about species moving into the area that had not been there before (e.g., sea turtles [*Testudo mydas* Linnaeus]), and species arriving in the area

Table 4. Community perceptions of the impacts of climate change on the value “Traditional foods.”

Traditional foods		
Sub-value	How could climate change impact this value?	How impacted will this be by climate change?
Availability of food source	Potentially less salmon due to warmer water Water temperatures and less water in streams will affect salmon fry Potentially less seaweed due to storms, warmer water Algal blooms (like red tide) could affect local species—red tide has not impacted our shellfish in winter YET Cockles and clams washed away from erosion and sea level rise, as well as wave action from supertankers (cumulative impacts)	Extremely
Ability to harvest and process traditional foods	Storms have a huge effect on how you harvest shellfish. Need to harvest them at low tide. Storms hold the tide up, so we can't get to the shellfish. Harder to reach due to storms Harder to find a time to harvest and dry seaweed, halibut, etc. Loss of traditional knowledge if we cannot get out to harvest and pass on the knowledge	Very

earlier than they normally do in the spring (e.g., robins [*Turdus migratorius* Linnaeus]).

Sensitivity

Sensitivity was evaluated by working with community members to understand how climate change could impact each of the key Gitga'at values. A sample of the outputs from these discussions is shown in Table 4 for the value “Traditional Foods.” A number of social, cultural, economic, health, and infrastructure impacts were identified: increased difficulty in traveling; uncertainty about when and where to harvest traditional foods; a decrease in the “sharing culture” that the community used to have; and other impacts.

Cultural Sensitivity to Climate Change

The research demonstrated that the Gitga'at would be highly culturally sensitive to climate change, primarily through impacts on traditional foods, non-food traditional species, culturally significant places and their corresponding place names. Not only do Gitga'at place names tell stories about the territory and the histories that have occurred in that place (Satterfield et. al. 2001), they also reflect the geographic, geological and ecological nature of the place and the type of activities that occur there. For example: *Ksgank'o* translates to *place all around kelp*; *K'agwentks* translates to *place of Spring*; *Si'alaao* translates to *where into trout* (Marsden 2012). Changes in geology or ecology of the region, which are both real and potential risks of climate change impacts, could render these traditional place names inaccurate.

If climate change is impacting plants and animals in Gitga'at territory, Gitga'at livelihoods and traditional ways are also threatened. Several

harvesting and hunting grounds, grave sites, petroglyphs, totems, middens, and pictographs could be impacted, particularly those close to sea level. For example, low lying places, such as the treasured petroglyphs in Old Town, which are already partially covered by high tide and subjected to increased wave action associated with increased wind and storm frequency, may become submerged or eroded completely, erasing them from the Gitga'at traditional landscape and culture.

Climate change impacts threaten to further erode Gitga'at traditional knowledge by changing the conditions and context in which this knowledge is relevant and accurate—for example, knowing the tides, weather signs, animal behavior, and how to gather, preserve and prepare traditional foods (Stoner and Reid 2013). This traditional knowledge has proven resilient to environmental and cultural changes over millennia, but the speed of climate change could render some practical traditional knowledge less useful or outdated. It is also important to note that much of Gitga'at culture is learned and passed on through doing—by going out with parents and elders and learning first-hand the place names, songs, dances, and harvesting methods. If climate change makes it more difficult to get out and practice cultural activities, then knowledge transfer will not occur and the knowledge will erode.

As an example, in early 2014, Gitga'at members were not able to go out and harvest cockles as they always do in winter due to a harmful algal bloom, a phenomenon that usually happens during summer months but has been happening earlier, potentially due to warmer ocean temperatures. The loss of traditional knowledge, for example around harvesting clams, would be devastating for the Gitga'at community at an individual, family, and community level. Traditional knowledge is the basis of Gitga'at culture, and its erosion or loss would have numerous social impacts in areas such as health, economics, and social structures.

Social Sensitivity to Climate Change

Gitga'at has a relatively young population with the median age of residents in Hartley Bay being 32.8 (ten years younger than the provincial average; Statistics Canada 2011). In addition, 30% of the Gitga'at population is under the age of 15, meaning more dependents than on average for the province (Statistics Canada 2011). When dealing with climate change-related impacts such as storm events or a loss of food sources, this could make it harder for parents and caregivers to cope mentally as well as physically. Climate change could also mean additional stress on Gitga'at elders, many of whom live alone and rely on traditional foods provided by family members.

Formal education levels are relatively low in the Gitga'at community. Sixty-eight percent of the Gitga'at do not have a high school certificate, diploma, or degree whereas only 20% of BC residents are at this level of education (Ference Weiker and Company 2009). This could indicate a population potentially particularly sensitive to climate change impacts (due to a lack of understanding of the threats [Cutter et al. 2003; Ference Weiker and Company 2009; Mikkonen and Raphael 2010]). However, a high level of traditional or local knowledge and education offsets low levels of formal education. Unfortunately, as mentioned

above, this local knowledge could be eroded or become less relevant due to climate change.

Economic Sensitivity to Climate Change

Gitga'at people are economically sensitive to climate change, due to a high level of reliance on land and resources for jobs and food. Although not as common as it once was, some Gitga'at members are still involved in the commercial fishing industry, which will likely be impacted by climate change (Okey et al. 2012). Many Gitga'at members are highly reliant on subsistence fishing and gathering of a variety of species. Many of the Gitga'at's major economic development initiatives, particularly planned shellfish aquaculture and a small-scale hydroelectric project, could also be negatively impacted by a changing climate (i.e., shellfish could be impacted by ocean acidification and the renewable energy project could be impacted by changing stream flows).

Infrastructure Sensitivity to Climate Change

Climate change impacts on Gitga'at infrastructure are already being seen: precipitation changes are causing increased mold in houses; wooden boardwalks are rotting faster than before; and sea level rise is causing seasonal flooding at seaweed gathering camps. Houses and other infrastructure that are near the coast, such as the main village of Hartley Bay and the seasonal camp at Old Town, will be vulnerable to rising sea levels, erosion, and flooding. All buildings may also be more susceptible to mold due to increased precipitation.

Infrastructure also includes important services such as telecommunications, electricity, drinking water, and sewage. Because of the remote location of Gitga'at territory, and a risk of being cut off from essential services, there is heightened sensitivity to climate change in the case of extreme weather events. There is an existing breakwater that does not appear to be in distress with existing levels of sea level rise and storm surges, but could be over time.

Travel infrastructure would also be sensitive to climate change. Hiking trails to crab apple orchards and berry patches have become muddier and less safe, and this threatens people's ability to access food and exercise. Increased and less predictable storm events would make it harder and/or unsafe to travel from the main village of Hartley Bay by plane or boat. This could have serious implications for abilities to harvest traditional foods and obtain purchased supplies and foods from elsewhere. Food security quickly becomes an issue if one cannot travel to harvest or purchase food.

Health Sensitivity to Climate Change

Through various pathways, climate change could have numerous effects on Gitga'at health. Although there is the potential for direct health impacts such as sunburn and heat exhaustion, in the near term these are not considered a concern due to the relatively mild climate in the area. However, there are a number of indirect health impacts that increase Gitga'at sensitivity to climate change.

The most highly prioritized health impact is associated with a reduction in the consumption of traditional foods, and the declining relative proportion of traditional foods in people's diets. Increasing consumption of store-bought foods

is widely documented as having negative health impacts, particularly in First Nations communities, including increased instances of diabetes and obesity (Downing and Cuerrier 2011; Fediuk et al. 2007; Kuhnlein et al. 2013). In addition, not being able to engage in the act of harvesting traditional foods and associated cultural practices could lead to increased mental stress, depression, and anger (Gill and Ritchie 2011).

Adaptive Capacity

The Gitga'at have a history of adapting to many changes, including environmental changes and major cultural ones, and these stories were shared at a series of community meetings. There are many factors that contribute to Gitga'at's ability to adapt, including but not limited to strong social connections, mutual trust and support, experience with past adaptation, flexibility, strong leadership and knowledge, and ability to plan.

These discussions also revealed that many community members were already adapting to climate changes in some way. For example, a staple Gitga'at food is red laver seaweed, called *I'ask*. Gitga'at members' ability to preserve it has been compromised due to wetter weather during the traditional harvest time, which precludes the traditional practice of sun-drying the seaweed. Due to these changes, individuals and families have begun drying seaweed indoors, or freezing it wet and drying it at a later time. As another example, the local school has been videotaping elders and others engaged in traditional activities like crab harvesting and tapping trees for pitch (used in traditional medicine) in order to preserve this knowledge.

3. Developing the Adaptation Plan ("What Can We Do About It?")

The final list of actions is shown in Table 5. Since many actions addressed multiple community values, the project team grouped the actions into logical themes, rather than by value. These groupings will also facilitate implementation since themes roughly relate to departments within Gitga'at Band administration (e.g., operations and maintenance) or to groups outside of the administration (e.g., health clinic). Three key underlying messages were emphasized by participants in this phase and underpinned many of the actions: 1) building adaptive capacity; 2) preserving traditional knowledge; and 3) adaptation is everyone's responsibility.

4. Implementation ("Are We There Yet?")

The constraints of limited time and budget necessitated an increased focus on "mainstreaming" climate adaptation actions into existing processes and procedures. Additionally, staff and leadership determined that climate change planning must remain "top of mind" in their work—for example, when making decisions around economic development projects, infrastructure spending, emergency planning, and skills training (all of which will be impacted by climate change). Staff will be developing checklists for leadership to use in order to incorporate climate change information into decision-making processes. Other elements that were identified as critical for implementation included clear timelines, responsibilities, and checklists and tools for tracking implementation and results. These requirements were integrated into a

Table 5. Overview of Gitga'at adaptation actions and the values they impact.

Theme	Actions	Value impacted
Document and teach traditional knowledge (especially around food)	Cultural skills "How-To" library (i.e., documenting cultural skills)	Culturally important food sources, culture, environmental resources, self-sufficiency, and health
	Traditional skills workshops and learning events for all	Culturally important food sources, culture, environmental resources, self-sufficiency, health, and Gitga'at pride and cooperation
	Continue cultural learning in the school	Culturally important food sources, culture, environmental resources, self-sufficiency, health, and Gitga'at pride and cooperation
Increase our food self-sufficiency	Ongoing mapping and surveying of historic and new harvesting sites	Culturally important food sources, environmental resources, self-sufficiency, and health
	Organize communal harvesting, processing, and distribution	Culturally important food sources, environmental resources, self-sufficiency, health, and Gitga'at pride and cooperation
	Ongoing research into traditional and new resource management systems (clam beds, seaweed, cultivation, etc.)	Culturally important food sources, environmental resources, self-sufficiency, and health
	Continue to improve/fortify harvest camps	Culturally important food sources, environmental resources, self-sufficiency, health, infrastructure to enable us to live well, and Gitga'at pride and cooperation
	Build greenhouse(s) and host education workshops	Culturally important food sources, self-sufficiency, health, and infrastructure to enable us to live well
Ongoing climate change research and capacity building	Ongoing research and community education on the effects of climate change for our area	All
	Develop a "Knowledge Bank" to document observations	All
	Consider climate change in administration/Council decisions and planning	All
Buildings and infrastructure	Update building standards and recommended materials	Health, infrastructure to enable us to live well
	Conduct an engineering study of general infrastructure readiness to climate change	Infrastructure to enable us to live well
	Pursue energy self-sufficiency through wind, hydro, etc.	Self-sufficiency, infrastructure to enable us to live well
Strengthen community well-being	Revive system of house checks	Self-sufficiency, health, and Gitga'at pride and cooperation
	Investigate ways to improve mental health and resilience (conflict resolution, problem solving, coping skills)	Self-sufficiency, health, and Gitga'at pride and cooperation
	Investigate options for improving cohesion between on- and off-reserve members	Gitga'at pride and cooperation

Table 5. Continued.

Theme	Actions	Value impacted
Improve emergency preparedness	Create a plan to improve physical exercise and healthy diet programming	Health
	Review/revise and communicate a community-based Emergency Management Plan	Self-sufficiency and health
Greater economic self-sufficiency	Support emergency preparedness in every home	Self-sufficiency and health
	Training youth and other community members in areas/industries for the “jobs of tomorrow”	Self-sufficiency, and Gitga’at pride and cooperation
Build relationships with partners (Nations, towns, groups, etc.)	Ensure economic development plans factor in climate change	Self-sufficiency
	Build relationships with neighboring Nations and local governments	Environmental resources, self-sufficiency, and Gitga’at pride and cooperation

monitoring and evaluation strategy that will be carried out by staff members in the coming years.

Discussion

Local knowledge and engagement were recognized as important aspects of climate change planning in all guides reviewed as part of this project (CIER 2008; ICLEI Canada 2013; Ingram and Hamilton 2014). The Gitga’at project team found that one specific engagement activity—gathering community observations of changes in natural phenomena (weather, plants, animals, etc.)—proved especially poignant in this project and had a number of positive impacts on the community members, researchers, and project outcomes. Local observations provided a level of local climate change data that was often not available in regional data or projections, particularly regarding the impacts on plant and animal species. In cases where observations lined up with scientific data and projections, the validation of Gitga’at members’ observations worked to empower community members as they discovered that their experience and in-depth knowledge of the local area holds significant value in predicting and planning for future climate change impacts. Additionally, the community discussions about local observations acted as an entry point to gain community interest and buy-in for the project, and underscore the importance of this planning process to people’s day-to-day lives. Although initially intended to be discussed only at the first set of meetings, discussing climate observations was so popular and useful that each subsequent climate change planning meeting began with a discussion about recent observations, and this practice is being carried on every six months going forward. The utility of local observations was likely due to the Gitga’at’s deep knowledge of the biophysical world, and the low

emigration levels of most Gitga'at residents (many of whom have lived in Hartley Bay or surrounding areas for their entire lives).

Unlike most climate change planning processes that are location-based (e.g., a town, city, or region), the Gitga'at project, and other Indigenous planning projects, sought to assess the climate impacts and responses of a population that is physically dispersed, but linked through common culture and ancestry. Because of their dispersion, not all Gitga'at members are dealing with the same climate change impacts, nor do they have the same sensitivity, particularly around reliance on natural resources that may be impacted by climate change. It proved to be difficult to reach members who did not live in Hartley Bay, perhaps because they do not feel as connected to the Nation, or there are more competing interests and activities outside of Hartley Bay (Hartley Bay has no shops, restaurants, or other amenities). Methods for creating robust climate change strategies that meet the needs of dispersed populations should be a topic for further exploration, as should the relative effectiveness of creating plans for populations vs. locations.

Conclusion

Planning processes in general are replete with challenges associated with community support for implementation, and often neglect the unique characteristics (values) of a given community or group, which can provide complex or nuanced interpretations of the facts and potential responses. These challenges often result in important omissions that may lead to setbacks or failures to employ effective implementation. Using a participatory values-based approach, and involving those who the plan intends to serve in a participatory way throughout the process, can help to avoid common pitfalls in the planning process (Arvai et al. 2001; Keeney 1996a).

The values-based approach was appropriate for climate change planning in the Gitga'at context, and may be appropriate in other remote Indigenous communities, many of whom face systemic human and financial resource related challenges. Finding ways to generate community interest in adaptation planning involves providing equal weight to traditional or local knowledge and expert technical knowledge. In this way it becomes possible to identify and achieve implementable actions that require fewer financial resources, and that the community has a vested interest in implementing. The values-based and participatory methods used in the Gitga'at climate change adaptation planning process were effective in engaging community members, leveraging minimal resources, and potentially enhancing the adaptive capacity of the Nation.

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