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Local-scale climate change stressors and policy response: The case of Homer, Alaska

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Northern communities are experiencing greater climate variability, with extreme climate impacts occurring more frequently and with more intensity; with the need for adaptation to reduce the risk becoming more immediate. Specific stressors and decision dynamics surrounding the nature of local government policy and planning for climate adaptation are underrepresented in the scholarship. This study seeks to contribute to the literature by exploring the case of Homer, Alaska. Through narratives of key informants connected to the community's climate change agenda, this paper explores primary climate stressors and the nature of adaptation policy integration. Findings suggests that while Homer is experiencing a variety of climate change impacts, adaptation remains a low priority for city officials. This study sheds light on some of the challenges of integrating climate adaptation policy with strategic community planning, and in turn provides decision-makers with insight into considerations for mainstreaming resilience thinking at a local government scale.

Keywords: community planning; climate resilience; coastal communities; climate adaptation; decision-makers

1. Introduction

Climate change is one of the most important and complex challenges facing society today. The scientific consensus on climate change holds that the burning of fossil fuels has increased the concentration of atmospheric greenhouse gas (GHG) emissions (e.g. Hansen, Sato, and Ruedy 2012), which has resulted in an increase in global average temperatures. Policy mechanisms to entice a move towards a low-carbon economy and thus mitigate climate change have taken centre stage in international policy discussions, with governments from around the world taking action in the form of long-term mitigation strategies (e.g. Birchall 2014b, 2017). A growing body of literature exploring public and private sector organizational strategies to reduce GHG emissions (e.g. Birchall 2014a; Birchall, Murphy, and Milne 2015; Dhanda and Hartman 2011; Spash 2010) has emerged.

However, as GHG emissions continue to increase unabated, with climate models forecasting a further rise in global temperature, more extreme weather events and a rise in sea-level (IPCC, 2013), the need for adaptation to reduce the risks of dangerous climate change is becoming more immediate. Adaptation is particularly important at the local level, where cities and communities are on the front line of climate impacts (e.g. Forino et al. 2017). Yet, scholarship in this area demonstrates a bias for efforts around climate mitigation over adaptation (Measham et al. 2011;

Baynham and Stevens 2014). With urban centres projected to absorb the majority of global population growth over the next 40 years (e.g. Jones 2012; Carter et al. 2015), consideration for adaptation will become more pressing. This growth will stress ageing infrastructure and exacerbate the threat climate change poses to communities (e.g. Butler, Deyle, and Mutnansky 2016; Picketts et al. 2015).

Cities and communities are thus acutely vulnerable (particularly those on the coast) (e.g. Wallace 2017) and must incorporate climate change adaptation into planning schemes (e.g. official community plans, zoning, regulations) if they are to become resilient to extreme climate variability (e.g. Baynham and Stevens 2014; Sano et al. 2011; Stults and Woodruff 2017).

Gaining political buy-in for climate adaptation can be difficult, however. Decision-makers that maintain climate change impacts are too rare, or only relevant in the future, can hinder proactive adaptation actions (Moench 2014). Moreover, given the shifting mandates of local authorities, adaptation planning can be overshadowed by other pressing priorities (e.g. Berrang-Ford, Ford, and Paterson 2011). This is compounded further when direction from higher levels of government is unclear (e.g. Juhola, Haanpaa, and Peltonen 2012; Kettle and Dow 2014).

While climate change is featuring more prominently on local government agendas (Bulkeley and Betsill 2013), research suggests that local efforts are fragmented, with a propensity towards rhetoric, manifesting as a peripheral agenda (e.g. Carter et al. 2015; Kithiia and Dowling 2010) instead of integrated with existing strategic policy (e.g. Giordano 2012; Funfgeld and McEvoy 2012; Baker et al. 2012).

Indeed, where adaptation is evident, local initiatives are often found to be focused on the short-term (or reactionary), rather than long-term (or anticipatory) strategic planning (e.g. Pearce et al. 2011; Preston, Westaway, and Yue 2011). What's more, emphasis is typically placed on rudimentary hard structures (e.g. armour and seawalls) (e.g. Geisler and Currens 2017; Betzold and Mohamed 2017), instead of flexible policy mechanisms (e.g. Labbe et al. 2017; Manning et al. 2015; Davoudi et al. 2013; Hino, Field, and Mach 2017; Rulleau and Rey-Valette 2017).

Literature has emerged around assessing climate adaptation readiness, where tracks of inquiry explore governance systems' capacity for adaptation (e.g. Ford and King 2015; Masson et al. 2014). Resilience and debate around what makes a community resilient to climate change is becoming increasingly prevalent (e.g. Lu et al. 2017; Reed et al. 2015; Moench 2014; Davoudi, Brooks, and Mehmood 2013; Porter and Davoudi 2012). Yet while scholarship is growing, specific stressors and the decision dynamics surrounding extent of local government policy and planning for climate adaptation remain less understood (e.g. Labbe et al. 2017). This is particularly the case in the far north, where communities are experiencing the impacts of climate change faster than anywhere else on Earth (e.g. Pearce et al. 2011; Ford et al. 2010; Smit and Wandel 2006).

With Homer, Alaska as a case study, this empirical work thus aims to narrow the knowledge gap and contribute to the literature by investigating primary climate stressors and extent of adaptation policy integration in a northern coastal community. Through narratives of key informants connected to Homer's climate change agenda, this paper sheds light on the community's preparedness for increasing climate variability. Homer is not unique in its need to adapt to climate change. Findings from this study may provide other communities with a similar set of climate

related stressors, and/ or policy related challenges, with a sense of shared experience, and insight into how to initiate, or move forward on a climate change agenda.

2. The City of Homer, Alaska

The City of Homer, Alaska was selected for this case study as it offers an interesting opportunity to explore climate change risk and policy response. Research in this area typically focuses on large cities (e.g. Hamin, Gurran, and Mesquita Emlinger 2014). With a population of approximately 5000 (City of Homer 2017), Homer provides an opportunity to investigate climate adaptation planning from the perspective of a smaller community.

Homer is a coastal community located in southern Alaska, on the southern extent of the Kenai Peninsula. Because of Homer's location, the Pacific Ocean has a moderating affect on its temperature, resulting in mild winters and relatively cool summers. However, as climate continues to shift, the area has experienced a mean seasonal temperature rise of 3.9C in the winter, 2.3C in the spring, 1.9C in the summer, and 1.4C in autumn (1949-2016) (converted from Alaska Climate Research Centre 2017); and in the coming decades, temperature is forecasted to increase a further 2-4C (Mauger et al. 2016). Along with dramatic shifts in temperature, precipitation has become more variable and extreme (Natural Resources Defense Council 2011).

Homer is characterized by surrounding steep bluffs of silt and sand, and a prominent sandy spit that extends into Kachemak Bay. As a result of these physical features, Homer's most pressing climate change risk is the increase in extreme weather events. In particular, interviewees observe that a rise in intense precipitation and intense storm surges contribute to dramatic coastal and bluff erosion (Environmental Stakeholders), which ultimately threatens public and private assets.

With respect to policy, Homer is the only municipality in the State that has demonstrated interest in climate change resilience through the completion of a stand-alone climate adaptation plan (Lyles, Berke, and Heiman Overstreet 2017). Gaining Council approval in 2007, the Homer Climate Action Plan was largely influenced by the International Council for Local Environmental Initiatives' (ICLEI) Climate Resilient Communities Program, and motivated by a lack of leadership at State and Federal levels of government (City of Homer 2007a).

3. Approach

Through the case study of Homer, Alaska, this paper investigates specific stressors and the decision dynamics around local government policy and planning for climate adaptation. Case study research often draws disapproval from positivist scholars who consider the approach to lack rigour and accuracy (e.g. Liamputtong 2011). Indeed, while the use of one case study over several has the potential to elicit criticism for lack of depth, Brower, Abolafia, and Carr (2000) argue that a single case can provide contextually rich insight. Siggelkow (2007) echo this notion, and employ the example of a fictitious talking pig to suggest that even "a single case can be a very powerful" (p. 20). Ultimately, a qualitative, or inductive approach was adopted for this study as it allows for the generation of rich narratives from the everyday experience (e.g. Yin 2014; Ford et al. 2010).

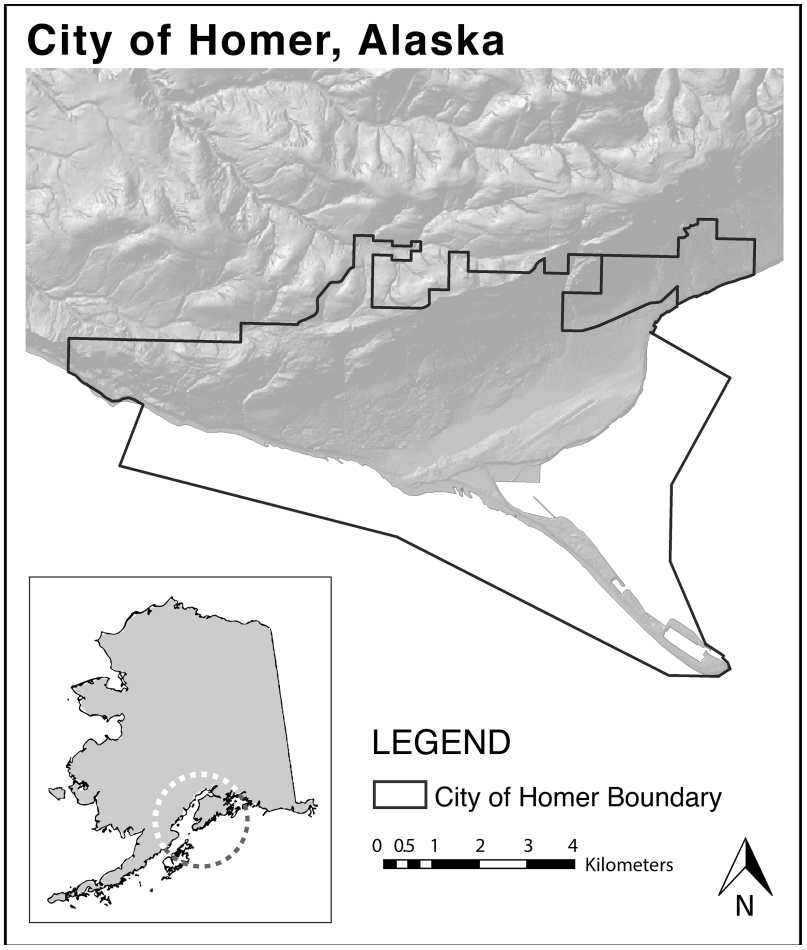

Figure 1. The City of Homer, Alaska.
Source: Coordinate System: NAD 1983 State Plane Alaska 4 FIPS 5004 Feet; Projection: Transverse Mercator; Datum: North American 1983; Data Source: Kenai Peninsula Borough Alaska; Geographic Information Systems; Date Created: May 15, 2018.

As the intent of the research was to be investigative and probing, it included semi-structured interviews with key informants connected to Homer's climate change agenda. Participants were selected purposively using criterion sampling. Because climate adaptation necessitates the incorporation of a variety of perspectives (e.g. Horney et al. 2017; Measham et al. 2011; Masson et al. 2014), and to increase the rigour of the study, a range of local decision-makers and stakeholders with relevant experience were included (n=8):

- **Senior planners (3),** from Homer and the State of Alaska's Community Resilience and Climate Adaptation Program, that could speak to governance around climate risk identification and adaptation plan conception and development; and, how implementation is incorporated into community planning;
- **Elected official (1)** (city councilor), that could address community vision and the importance of climate change thinking; and,

- **Environmental stakeholders (4)**, including environmental professionals and climate experts from the Kachemak Bay National Estuarine Research Reserve, and the University of Alaska.

Initial recruitment involved an email detailing the research objectives, the nature of the study, as well as information regarding security and confidentiality (including preservation anonymity).

Interview questions were generally designed to stimulate discussion around climate change impacts and challenges, as well as the state of the community's climate adaptation policy response. For instance:

> *In your view, how do the physical impacts of climate change influence your community?*
>
> *When it comes to climate change adaptation, what are the key drivers for action in your community?*
>
> *How would you characterize the nature and extent of your community's climate change adaptation agenda?*

Moreover, interviews were executed in a manner that facilitated fluid dialogue, and allowed interviewees' the chance to relate their story (e.g., Feldman et al. 2004).

Interviews and follow-up occurred between August and December 2016. Interviews were in-person, on site in Homer, with the exception of three which took place in Anchorage (2) and Fairbanks (1). Ranging in duration from 40 minutes to 90 minutes, interviews were digitally recorded, then professionally transcribed verbatim. To further assure accuracy of the transcripts, interviewees were provided the opportunity to review their respective transcript before data analysis occurred. Transcripts were modified to limit speech ticks (e.g. "you know," "kinda"), false starts, and punctuation.

The authors manually coded the transcripts, then compared the emerging themes. While influenced by the research objectives and the interview protocol, themes were primarily generated through a thorough examination of the transcripts, including organizing the data from across the transcripts into key topics, ideas, or quotes (e.g. physical impacts, infrastructure vulnerabilities, policy response etc.). Because analysis of qualitative data is an iterative endeavour, with "messy" interactions (Bryman and Burgess, 2002), the authors were mindful to preserve the nuanced dynamics between the discourses. Further, the theme development process was clearly documented, so as to ensure what is "claimed to be analyzed is being analyzed" (Pepper and Wildy 2009, p. 23).

Through analysis of narratives derived from key informants, a better understanding of individuals' experiences was achieved (e.g. Kleres 2011). This in turn provided insight into the community's general resolve and preparedness for climate change. In order to triangulate the findings and further improve reliability (Engward and Davis 2015), research also included the review of strategic planning documents (e.g. adaptation related strategies and hazard mitigations plan, official community plan).

4. Primary stressors

Climate change impacts are not new in Alaska, however they have begun to rise occurrence and magnitude (ADEC 2010; Melvin et al. 2016; Lader et al. 2017). According to the interviewees, Homer is experiencing a range of climate related stressors. For example, erratic precipitation overloads stormwater systems during intense rainfall events and threatens freshwater supply during periods of drought (Senior Planners); warmer ambient temperatures have allowed aphids, historically marginalized by cold winter temperatures, to devastate native spruce trees (Environmental Stakeholders), and higher temperatures for extended periods of time, along with a transition to a savannah-like landscape is increasing the threat of wild fire; and, warmer and more acidic coastal waters have a multitude of effects on the marine ecosystem (Environmental Stakeholders; National Resources Defense Council 2011). However, the two most pressing stressors, as ranked unanimously by the interviewees, relate to the Homer Spit (storm surges) and the bluffs (erosion) that surround the city. The following section highlights how climate change is influencing the Homer Spit and the community's surrounding bluffs.

4.1.Homer Spit (storm surges)

The Homer Spit is a City owned, natural unconsolidated sand spit, extending southeast from the mainland approximately 7.4 Kilometres into Kachemak Bay (City of Homer 2011). Immediately following the 1964 earthquake, which devastated much of Alaska, large portions of the Spit suffered subsidence and collapsed into the sea. According to Waller (1966), following the magnitude 9.2 event, the Spit lowered by approximately 1.3-1.8 meters, resulting in 70 percent coverage at high tide.

Today, the Spit is continually being physically morphed by deposition and erosion of sediments. Though common in a dynamic coastal system (Wicks and Atkinson 2017), increasingly powerful wind and wave action originating from the Gulf of Alaska, as observed elsewhere along Alaska's coast (e.g. Terenzi et al. 2014), further exacerbate the trend (e.g. National Resources Defense Council 2011).

The Spit's relative elevation is keeping pace with sea level rise, owing to tectonic uplift and isostatic rebound associated with glacial melt on the Kanai Peninsula (Larsen et al 2004, 2005). However, vulnerability to inundation remains, as storm surges are becoming more erratic, and increasing in both occurrence and strength (Senior Planners; Environmental Stakeholders). This challenge is apparent in other regions of the State, and is expected to increase as the climate continues to warm (Overbeck et al. 2017).

In Homer, when fall/ winter storms coincide with high tide, vulnerability can increase further (Bromirski et al. 2017). For instance, during such storms access to the Spit is often hindered as a result of waves over-topping the seawall and propelling debris (e.g. boulders and logs) onto the Sterling Highway, the only road connecting the Spit to the mainland (Senior Planners).

The Spit is occupied by a number of critical assets, including a thousand-slip harbour for deep and shallow draft vessels, ferry and cruise ship terminals, coast guard facilities, a marine industrial complex (fishing, ice and fuel storage), commercial and residential buildings, as well as campgrounds and an arena. The closing off of stretches of the Sterling Highway does indeed leave assets on the Spit disconnected from the city, however vulnerability is more directly linked to low elevation in general. Assets on the Spit sit approximately 7 meters above sea level (US Army Corps

of Engineers 2007). When large storm surges occur, flood zone elevations become high and extensive (Senior Planners).

Though flooding is a challenge, it is the destructive force of the wave action that results in the greatest damage. As an interviewee described, “there have been several storm events that scoured the outside of the Spit and undermined the foundation of older buildings” (Senior Planners); campgrounds have been “completely washed away” (Senior Planners); the boardwalk and parking lots have been undermined, leaving structures to collapse. Ultimately, infrastructure designed to last a number of years, will fail in a single season (Senior Planners; Elected Official).

Thus far Homer's adaptive approach to increasing storm surge activity is to armour vast extents of the south-west side of the Spit with heavy rock. Moving forward, one interviewee summed up the Spit’s fate as follows: “I think the writing’s on the wall, …if you want to save it you’re going to have to armour the whole thing” (Elected Official). Unfortunately, armour rock is not a local resource, making it an expensive solution in the long-run, particularly given the need for on-going maintenance.

Increasing risk further, in order to accommodate a greater number of commercial and recreational vessels, city officials plan to expand the deep water portion of the harbour on the Spit. Though the Homer Spit Comprehensive Plan generally encourages economic development on the Spit (City of Homer 2011), further densification presents clear infrastructure related challenges linked to storm surges. Moreover, expanding the harbour will also lead to additional maintenance costs for dredging, an expensive commitment given elevated sediment loading connected to increasing glacial melt (Environmental Stakeholders).

4.2.Bluffs (erosion/ instability)

The topography of Homer is characterized by prominent bluffs and shallow-rooted vegetation, with a geology of highly erodible peat soils and sandstone. The interviewees consider the bluffs to be relatively unstable, and have seen a steady progression of bluff slumping (Environmental Stakeholders; Senior Planners). Drawing on previous erosion studies (e.g. US Army Corps of Engineers 2007) and more recent observations, city officials acknowledge that bluff erosion will worsen in the near-term, irrespective of climate change (Senior Planners). This is echoed by the Natural Resources Defense Council (2011), which highlights that shoreline erosion is becoming more pronounced and increasingly extensive along Homer’s shoreline. Indeed, the interviewees understand that increased intense precipitation (rain) associated with climate change (Natural Resources Defense Council 2011; Lader et al. 2017) will result in erosion and bluff collapse occurring at a greater rate (Senior Planners).

This challenge exists in the colder months as well, as a result of a rise in rain on snow events (e.g. McAfee et al. 2014; Bieniek et al. 2018). As an interviewee explained, when intense (cold) rain falls onto impermeable frozen ground, it can create a flash flood scenario (Environmental Stakeholders). As flood waters flow over the crest of a bluff and draw towards the sea, more easily erodible soils breakdown, destabilizing the bluff and often resulting in debris and rock falls. A further threat to bluff integrity relates to wave action associated with the rise in storms originating from the sea (e.g. Terenzi et al. 2014). Increased wave action against the shoreline has the effect of undermining the bluff, weakening the base and contributing to collapse (e.g. Edil 2010; Wicks and Atkinson 2017).

While the bluffs that surround Homer are becoming an increasing risk in general, they nevertheless afford pleasant views of the Pacific Ocean and Kachemak Bay, the Kenai Mountains, and Grewingk Glacier, and thus attract development. Of particular concern for city officials is the increase in impervious surfaces (Senior Planners), which like frozen ground, leads to greater runoff when intense rainfall occurs, resulting in further destabilization of the bluffs and property loss (Elected Official). This point is further illustrated in the storm water handbook (City of Homer 2007b), where it is noted that a high water table is another contributing factor to overland flooding and erosion in Homer; shallow subsurface water flows can result in slumping/ erosion due to increased weight of soil.

Bluff erosion has also affected road integrity:

> There's not a lot of solid bedrock near the surface, so the nature is that [the ground] always slumps, and we are definitively getting more events. We had a road collapse last year that had only recently been put in (Senior Planners).

Road collapse is a chronic concern for city officials, in particular the Sterling Highway, as it is the only route connecting Homer with neighbouring communities.

With respect to adaptation, homeowners are taking the lead on rendering bluff property suitable for development. As one interviewee conceded, "home owners are spending big chunks of money to maintain their property; [the view is] beautiful, but, there's a limit to what engineering will do for you there" (Senior Planners). Similarly, homeowners have taken it upon themselves to build seawalls (some made of fibreglass, some of railway ties) to limit wave action and undermining of banks on oceanfront property (Elected Official).

5. Policy response

This section discusses Homer's policy response to climate change, and situates the discussion in the relevant literature.

5.1.Low priority

Climate change is not a new phenomena, nor is the need for local authorities to cope with climate variability. Indeed scholarship suggests that local governments are the level of government most influenced by the impacts of climate change (e.g. Forino et al. 2017). As atmospheric GHG emissions continue to rise, however, communities are experiencing greater climate variability, with extreme climate impacts occurring more frequently and with more intensity (e.g. Wallace 2017). In northern latitudes, the effects of climate change tend to be disproportionally felt, with Arctic temperatures increasing faster than the global mean (IPCC 2014), and Alaska warming 2x as fast as the rest of the country over the past 60 years (Stewart et al. 2013).

Despite observed impacts on the Spit (storm surge) and the bluffs (erosion/ instability), officials in Homer believe they are not under critical threat at this time (Senior Planners). As one interviewee noted: "in many respects climate change will be moderate here" (Environmental Stakeholder). Nevertheless, though some interviewees do indeed support this characterization, they caution that circumstances could shift rapidly. To this point, while Homer is experiencing a variety of climate change impacts, the sense of security stems from the notion that at present, the impacts are not sufficiently severe to be overwhelming.

Perhaps it is not surprising then that momentum around climate adaptation remains a low priority for officials in Homer (Senior Planners; Elected Official). According to one interviewee, at this point, "climate change is something [they] are not really paying attention to" (Senior Planners). This attitude is evident in the literature, and is often compounded when officials discount climate risks because impacts are deemed rare or uncertain (e.g. Moench 2014; Hamin et al. 2014).

Action in Homer is likely further hindered by those on council that deny the existence of climate change in general: "I can say with confidence there's people on [council] who would probably dismiss climate change as being a thing" (Elected Official). While the interviewees highlight that the City Manager and the Planning Department believe in climate change, party politics and/ or lack of leadership awareness and support can impede forward action on climate adaptation (e.g. Measham et al. 2011; Pasquini et al. 2015).

5.2.Extent of policy integration

In Homer, while discourse around climate adaptation is minimal, two key strategic documents do provide the opportunity for broad consideration: The Climate Action Plan (City of Homer 2007a) and the All-Hazard Mitigation Plan (City of Homer 2016). With respect to the former, rather than climate adaptation, the Climate Action Plan is largely focused on mitigation and energy savings, since that was held to be more palatable internally at the time of adoption (Senior Planners; Environmental Stakeholders).

A general bias for mitigation is not uncommon (e.g. Measham et al. 2011). Literature in this area does note however, that while mitigation is often the favoured initial effort, adaptation becomes preferred over time (e.g. Bosello, Carraro, and De Cian 2010). Moreover, governments are recognizing the value of adaptation and beginning to transition away from actions that are purely mitigative to ones that are more complimentary in nature (e.g. Bulkeley and Tuts 2013).

Indeed, the Climate Action Plan does include recommendations for inclusion of climate adaptation in long-range planning. However, though the need for climate resilience is apparent, actions remain elusive, lost in rhetoric: "so, we have documents that say we should plan for climate change… doing those things might not ever happen" (Senior Planners). Stults and Woodruff (2017) echo this finding, and suggest that policies that show little detail around how adaptation actions will be executed, tend to fall short of implementation. To this point, in 2009, the Climate Action Plan Implementation Project Final Report was prepared for the City (City of Homer 2009). The intent of the report was to assist with implementation of actions from the Climate Action Plan, yet adaptation is absent from the report.

The All-Hazard Mitigation Plan, though intended to identify and plan for an array of environmental risks, likewise does not integrate climate change adaptation into long-term planning. Still, while not climate change driven, the Plan does indicate the need for proactive planning around flood protection, and calls for further mapping of flood plains and drainage systems (City of Homer 2016).

Homer, like other communities around the globe, has taken on a wait and see approach to climate adaptation (e.g. Butler et al. 2016). In this sense, adaptation is primarily a peripheral agenda (e.g. Carter et al. 2015) and generally left out of the decision making processes for strategic policy and planning. Scholarship in this area cautions that failure to incorporate adaptation into long-term

strategic planning risks poor land-use decisions and costly maladaptations down the line (e.g. Baynham and Stevens 2014; Jones et al. 2016).

Notwithstanding risk associated with the Spit and the city's bluffs, Homer has not experienced a large climate change-related event. Given that such events often precipitate buy-in for action on climate adaptation (e.g. Rulleau and Ray-Valette 2017; Demski et al. 2017), it may not be unexpected that adaptation is a low priority for city officials.

Nonetheless, when climate impacts do arise, city officials take action, closing Sterling Highway on the Spit during a storm surge, for instance. Still, one of the interviewees recognizes that "there is not much planning going into [the response]" (Senior Planners). This is supported by the literature as well, where Labbe et al. (2017) identify a need for the development of concrete planned adaptations, including upgrading infrastructure, bolstering emergency preparedness and planning in general.

While climate adaptation is not currently a mainstream consideration, there is a growing sense within Homer that adaptation and resilience thinking should be incorporated into the forefront of all strategic planning (Elected Official). Though some city officials express concern surrounding the complexity of integration, research suggests that incorporation of adaptation does not require a paradigm shift in thinking (e.g. Kithiia and Dowling 2010), but instead active consideration during the policy and planning decision making processes (e.g. Funfgeld and McEvoy 2012).

Homer, like many cities, has become complacent around climate change adaptation, in many instances relying on Federal programs for financial assistance following an environmental event. City officials would like to become more proactive, and autonomous with respect to climate resilience (Senior Planners). However, as is common in other small communities, officials in Homer are ill-equipped to effectively advance a climate adaptation agenda (e.g. Nalau, Preston, and Maloney 2015).

Because of the constrained fiscal situation within the United States in general, and Alaska in particular, it remains difficult for city officials to solicit experts to train key staff (e.g. planners, policy makers, council members) on how to effectively incorporate adaptation thinking into existing frameworks (e.g. Thorne et al. 2017). This dearth in decision-maker knowledge around climate change in general, and resilience in particular, results in further marginalization of climate adaptation policy and planning in Homer. A lack of steering from higher levels of government have further exacerbated inaction (e.g. Juhola et al. 2012; Kettle and Dow 2014).

Moreover, the shunting of responsibilities from higher levels of government to lower levels of government can be a further challenge. Since local authority mandates are in a constant state of change, it may be difficult for city officials interested in adaptation planning to follow through with implementation (e.g. Berrang-Ford et al. 2011). These factors serve to reduce a community's ability to effectively prepare for climate variability (e.g. Tyler and Moench 2012).

5.3. Other considerations: Private property rights and foreshore naturalization

As city officials warm to the notion of climate resilience and the need to adopt appropriate municipal rules, citizens may be reluctant to follow suit: "people are going to have that push-pull… [individuals] like to have their freedom and will take the damage when it comes" (Senior Planners).

This resonates with Manning et al. (2015)'s findings, where the authors highlight local government limitations around private property rights.

Coastal development continues in spite of climate related risk (Gibbs 2015). Bluff and coastal areas in Homer offer dramatic views of the ocean, mountains and glaciers, and therefore attract development. Though Homer does have restrictions in place, private property owners can overcome the constraints by demonstrating sound engineering. For example, within the Homer Zoning Code, provisions exist for building in flood-prone areas, requiring a development permit that includes demonstration of anchoring, appropriate building materials and methods, and other flood-proofing information (City of Homer 2017: Chp. 21.41). Similarly, the Homer Zoning Code considers slopes a special area/ zone, requiring a minimum setback of 12 meters from slope/ bluff crest. While the intent of this requirement is to limit development in unsafe space, a development permit can override the restriction (City of Homer 2017: Chp. 21.44).

One city official admitted that regulations "aren't the tightest" in Homer, adding that "property rights are still pretty big here; we are not into regulating away people's use of the land…" (Senior Planners). Indeed, current zoning does not factor in projected increases in extreme weather such as intense precipitation and storm surges. Yet, while private property rights are entrenched, and limit local government actions, citizens expect their local authority to protect them from harm (e.g. Manning, Lawrence, King and Chapman, 2015). To this, one interviewee identified that "the best [they] can do is make people aware [of the risk]" (Senior Planners).

In an effort to work with private property owners, Homer has a foreshore naturalizing policy. When opportunities present, the city purchases waterfront/ riparian property, whereupon it institutes open space restrictions to allow only passive recreation (Elected Official; Senior Planners). Though not climate change driven, the open space policy is intended to improve stormwater management (City of Homer, 2010). Even so, as evidenced by the literature (Jones, Hole, and Zavaleta 2012), naturalizing the coast does help decrease City and private property exposure to impacts of climate change.

Nonetheless, scholarship demonstrates a preference for hard structures (e.g. Betzold and Mohamed 2017). Resisting environmental change with rock armour or seawalls, however, risks providing a false sense of security (e.g. Cooper and Pile 2014; Rulleau and Rey-Valette 2017), tends to provide only a short-term buffer (e.g. Geisler and Current 2017), and necessitate costly on-going maintenance (e.g. Butler et al. 2016). Indeed, officials in Homer identified that infrastructure on the coast routinely fail to reach design lifespans (Environmental Stakeholders; Senior Planners). Naturalization, on the other hand, effectively dissipates storm surge energy and reduces erosion, facilitate ecosystem health, and promotes public access to the shore (e.g. Sano et al. 2011).

6. Conclusions

As atmospheric GHG emissions continue to rise, climate variability is quickly becoming a reality for local governments around the world. Communities in the north are particularly vulnerable, and are experiencing impacts faster than anywhere else on Earth. The case of Homer, Alaska, provides the opportunity to explore climate stressors and adaptation policy response from the perspective of a smaller community, a scale underrepresented in the literature. While Homer is experiencing a variety of climate change impacts, the most immediate challenges relate to storm surges and bluff erosion/ instability. Yet, because impacts are not sufficiently severe to be overwhelming, climate adaptation remains a low priority for city officials.

Through the case study of Homer, Alaska, this paper sheds light on some of the difficulties of integrating climate adaptation policy with long-term strategic community planning, and in turn provides decision-makers with insight into considerations for mainstreaming resilience thinking at a local government scale. For instance, in the absence of a precipitating event, it may be difficult to gain political buy-in or leadership for anticipatory action. Education and awareness around climate risks is therefore critical in order to build a mandate for embedding adaptation policy into existing strategic frameworks, and indeed to facilitate implementation of resilience-based regulatory tools and actions. Further, this study highlights that a policy of coastal naturalization, as opposed to hard structures such as seawalls or armour, can help mitigate against a false sense of security and lower asset and infrastructure exposure to risk.

While this study is focused on one small community in Alaska, implications of the findings may translate to other communities with a similar set of climate related stressors and policy related challenges. Indeed, the case of Homer demonstrates the importance of political buy-in and senior management leadership in order to generate momentum for policy and actions around climate change resilience, and provides insight into how to improve community preparedness to climate variability in general.

Ethical approval
All procedures performed in studies involving human participants were in accordance with the ethical standards of the University of Alberta's Human Ethics Committee and with the 1964 Helsinki declaration and its later amendments or comparable ethical standards.

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