FACTORS INFLUENCING CLIMATE CHANGE ADAPTATION RESEARCH UPTAKE BY YUKON COMMUNITIES

Using adaptation planning to evaluate mechanisms for research uptake

Meagan Grabowski, Northern Climate ExChange, Yukon Research Centre, Yukon College

Douglas Clark, Yukon College and School of Environment & Sustainability, University of Saskatchewan

December 15th, 2016

TABLE OF CONTENTS

PLAIN-LANGUAGE SUMMARY:

There are more and more researchers in the North who want their work to benefit northerners, and wonder if their results are relevant to the communities they work near or with. With the impacts of climate change being felt by those who live in the North year-round, it is important that information which could help people adapt is being absorbed. We did an exploratory study on the uptake of research by communities through the lens of climate change adaptation plans to inform a potential larger study around the North.

We reviewed the five climate change adaptation plans written in the Yukon to see whether researchers, published (peer-reviewed) research papers, or original research were included. We then focussed on one of the plans for a set of eight interviews with people involved in the process in some way (from authors to workshop participants). Themes that emerged from the interviews were barriers to research uptake that included: the perception of climate change research, relevance and accessibility of research, communication, educational history and "human chemistry".

We found overall that there is a potential disconnect between the exercise of planning and the adaptation actions people are doing. When an impact of climate change is immediate and requires action (i.e. permafrost thaw has made a house shift, or the highway washed out so food at the store hasn't been restocked) then people impacted adapt as needed. These adaptations happen without people consulting an adaptation plan, or the latest research on permafrost dynamics or northern food security. There are two main consequences of a potential disconnect like this: 1) adaptations that don't consult the research might not be as effective or might not address underlying problems (maladaptation) and 2) the understanding that research and planning is important might diminish. The people involved in the process might be discouraged, and not participate further. And the potential users of information might not continue to see value in the research if they're not able to access or use it due to things like capacity or time.

While studying climate change adaptation plans is only one way to understand how much of research is usable by people living in the North, it did point out some things that prevent research from being absorbed. This is an unfortunate finding in many ways, but also shows that with more positive interactions between researchers and community members, the two groups might work together to ensure adaptations are effective. There are many good examples of research uptake between specific groups, such as miners and palaeontologists, that other disciplines could learn from. When climate research uptake is considered case by case within the social and political context, with lots of personal interaction, it can have much success. In future projects like this, study participants are likely to know one another well, so researchers need to respect their professional reputations while still asking the right questions and honestly reporting what they find.

TECHNICAL SUMMARY:

There is an increasing awareness that northern research must be done within a community-based framework in order to prevent potential maladaptation to climate change. However, the means to conduct research based on needs of a particular community is often obstructed by financial, institutional and logistical barriers. Identifying these barriers is an important step. As one way to look at uptake of climate adaptation science by communities, we used existing climate change adaptation plans in the Yukon. This was an exploratory study that will inform a potential larger project about climate research uptake in circumpolar communities. We used a two-fold approach to evaluating mechanisms of research uptake using climate change adaptation planning: **1) categorical plan review** and **2) interviews** focussed on one of the five plans reviewed to identify barriers to research uptake.

This project was an exercise in problem orientation as set out by the policy sciences' problem analysis framework. In this framework, a problem exists if current trends are not leading towards the desired goal. Overall, we defined the problem as a disconnect between the planning exercise and adaptation actions which has prevented the goals of the climate change adaptation planning process from being met. By adaptation actions, we mean the adaptation occurring as needed without research or planning inputs. This disconnect could increase the risk of maladaptation, as uninformed adaptation actions may not address underlying issues that research could shed light on.

In this study, we sought to identify the barriers and facilitating factors to research uptake through the lens of climate change adaptation planning in the Yukon. The climate change adaptation plans provided opportunities to examine a circumstance where researchers, planners, government members, community members, and other stakeholders interacted around the topic of adaptation. And in the case of those directly involved, stakeholders interacted to compile and verify scientific information with local information. By reviewing the plans and asking questions of those involved in the Dawson plan **we identified the following barriers: perception of climate change research, relevance and accessibility of research, communication, educational history and "human chemistry".**

Future research on climate science uptake should consider the specific context of the uptake mechanism in question. For instance, if the mechanism for uptake is meaningful communication, the needs of the individual community will differ. If the mechanism is partnerships, the background of the individuals involved in those partnerships could be important. Climate science uptake is a context-specific, case by case challenge, that based on our study requires a series of positive interactions between researchers and users of information. Future research on this topic must be mindful that study participants are likely to know one another well, so mitigating risk to their professional standing while not self-censoring the research is a challenge that must be addressed.

INTRODUCTION:

There is an increasing awareness that research in the north will have to be done in a community-based framework in order to prevent potential maladaptation to climate change (Ford et al. 2015, Loring et al. 2016, Pearce et al. 2009, Berkes and Jolly 2001). However, the means to conduct research based on needs of a particular community is often obstructed by financial, institutional and logistical barriers. Identifying these barriers is an important step.

There have been attempts to make research, particularly done by academics, more accessible and relevant to northerners (Ford et al. 2015, Pearce et al. 2009, Duerden 2004). In northern Canada, there is an abundance of individuals and communities whose lifestyles are influenced by the impacts of climate change (Hovelsrud and Smit 2010). There is also a cited lack of capacity and resources to mitigate and adapt (Ford et al. 2015) and a need for co-management between institutions (Berkes and Jolly 2001). However, many climate change adaptation plans are being created in the Canadian North not by outside expertise but by local community concerns. This indicates the capacity of northern communities themselves, to not only observe impacts (Loring et al. 2016) but also to develop and implement adaptation strategies.

As one way to look at uptake of climate adaptation science by communities, we used existing climate change adaptation plans in the Yukon. This was an exploratory study that will inform a potential future project about climate research uptake in circumpolar communities. We used a categorical plan review and interviews focussed on one of the plans to identify barriers to research uptake. We reviewed five climate change adaptation plans in the Yukon, and compared their inception, process, writing and implementation. Assessing the proportion of the process or plan which contains research collaboration or scientific information integration demonstrates how much research becomes trans-boundary between the research community and local communities. We also identified why or why not research was accessible to the climate change planning and adaptation process.

METHODS:

This project was organized as an exercise in problem orientation (Clark 2002, Lasswell 1970). In this framework, a problem exists if current trends are not leading towards the desired goal. Problem orientation also takes into account social process, decision process, and author standpoint when considering the problem definition.

The methods for this study were two-fold: **1) a review** of the Yukon Climate Change Adaptation Plans and **2) interviews** focussing on one of the plans.

PLAN REVIEW

We reviewed five Yukon Climate Change Adaptation Plans according to the following categories (see Table 2):

Category 1. involving researchers – academic, government or private researchers included as co-authors or supporters

Category 2. incorporating literature - cites peer-reviewed academic research

Category 3. original research done either by authors or collaborators specifically for the plan

The Yukon Climate Change Adaptation Plans were done in five Yukon regions (Dawson, Mayo, Atlin, Whitehorse, and Champagne-Aishihik First Nation) between 2007 and 2016. Each plan is different, and the goal was never integration of scientific information, but every plan involved some level of interaction between the planners, plan region residents and researchers.

The plans for Dawson, Mayo, Atlin and Whitehorse were led by the Yukon Research Centre's Northern Climate ExChange (NCE). Authorship of these plans differed between plans but there was at least the following common structure: a lead planner, a local collaborator, and, in most cases, a researcher. The Champagne-Aishihik First Nation (CAFN) Climate Change Adaptation Plan is the most recent plan, and the CAFN government created the plan. Thus, it differs from the previous four plans.

A key component of the NCE led plans were the Local Advisory Committees (LAC) and the Technical Advisory Committees (TAC) which were meant to serve as local and technical advisors to the plan (Figure 1).

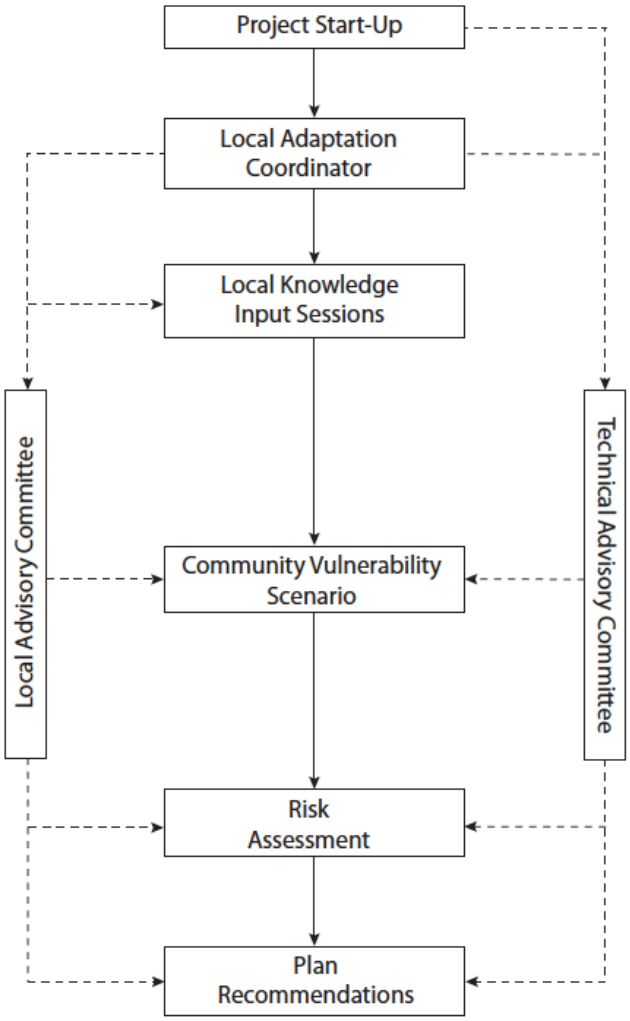

Figure 1. Dawson plan process. Schematic for how LAC and TAC advised the planning process (Hennessey et al. 2011).

INTERVIEWS

Interviews took place from September-December 2016. A total of 24 interview invitations were sent to the plan authorship list, support list, members of the LAC and TAC, and any additional people identified by the respondents. It was noted during interview scheduling that many respondents have since moved onto different jobs (10/24) or places of residence (3/24). Some respondents did not have time to participate in the study (2/24), and several did not feel they had participated in the plan enough to warrant speaking to it (5/24). A total of eight interviews were conducted, seven oral (in person or by phone) and one written. The majority of those interviewed (6/8) were men, and just over half (5/8) were based in Whitehorse or out of Territory (not Dawson City). One interviewee was not part of the Dawson plan, but was involved with the CAFN plan.

Table 1. Interview invitation outcomes. Note: contact was followed after invitation (if no response) up to three times via email or phone.

Invitation outcome	Number of respondents
Interview completed	8
Declined due to lack of time	4
Declined due to lack of participation in plan	5
Contact subsided	3
No response	4
Total	24

The Dawson plan was chosen as the focus on because it was first plan and enough time has elapsed to allow those involved to reflect on how the process went. However, this also meant many respondents had to refresh their memories on the process. The other reason the Dawson plan was chosen was that there was a direct collaboration in the main authorship team between the planners and researchers. As a result, according to the plan review categories, it had the highest proportion of scientific information included (Table 2).

Interviews were recorded, partially-transcribed (point form, with illustrative quotes verbatim), and underwent thematic content analysis (Clark et al. 2016). These themes were organized into barriers or facilitating factors of information uptake using NVivo (Table 3). Additional analysis was done using matrix coding queries to determine alignments in the barrier identifications between case classifications of interviewees, namely participants' role in the plan (author, support, TAC, LAC, or workshop participant) and their home base (Dawson region, Whitehorse, or out of territory). Participants' data are confidential so permission to use specific quotations was requested by the researcher and granted by the participant for each use. Several participants opted to be named for attribution of their quotes. Otherwise, participants are only referred to by alphanumeric codes.

A research ethics application was submitted to the Yukon College Research Ethics Board on May 29, 2016 and approval was granted on September 08, 2016 (protocol # 2016-05).

Dawson Region focus

Dawson City is a town of 2,158 people, 19.6% of which are First Nations (Yukon Statistics, 2016). It has a unique history greatly influenced by the en masse arrival of mostly American prospectors in 1898, which boomed the City to being the largest in Canada West of Winnipeg at the time and the first capital city of the Yukon Territory (Coates and Morrison, 1988). The population declined shortly after the Gold Rush, however gold and tourism remain the main economic drivers in town. During the Gold Rush, many First Nation individuals and groups were pushed to the fringes of the main activities. Over the past several decades there has been a period of both First Nation self-government growth and cultural revival, with the signing of the

Umbrella Final Agreement for Tr'ondëk Hwëch'in First Nation in 1993 (Coates 1991, Umbrella Final Agreement 1993).

The Dawson region is underlain by shifting discontinuous permafrost, and connected to the Yukon's current capital city Whitehorse by one highway built in the 1950's. While many people are able to subsistence hunt, fish, harvest or garden, most rely on the highway, as groceries and other supplies (including building or industrial materials) are trucked in from the south. There is also a heavy reliance on fossil fuels for energy, as diesel generators provide power.

FINDINGS:

PLAN REVIEW

We reviewed the plans for mechanisms of uptake via the categories outlined, which were not an evaluation of plan implementation or effectiveness. In many ways the intent of the plans was not to incorporate scientific information, so the categories for inclusion of scientific information were applied with the understanding that this was not the goal of the plans. However, the plans do provide an example of direct interaction between local knowledge and technical knowledge, and often make recommendations for future research. Research uptake is therefore both a function within such planning processes, and a potential product of them.

According to Category 1 (involving researchers as co-authors or supporters) the plans differed greatly, with the Dawson plan having the highest proportion of researchers in the authorship/supporters list (71%) compared to 42-59% in other plans (Table 2). This plan also had the highest proportion of those researchers as academic collaborators (based at universities or colleges) at 59%, as compared to government or private researchers. Other plans had between 23-47% academic researchers. The Mayo plan had the highest proportion of government based researchers (55%), while other plans had between 15-35%. The contribution of researchers from different sectors shows the diversity within the epistemic community that has emerged in the Yukon with a focus on climate change.

Category 2 of the plan review focussed on incorporation of scientific literature into the plans. Here, scientific literature was defined as peer-reviewed literature. The Dawson plan had the highest proportion of peer-reviewed literature at 43%. Other plans varied between 0-37%. This suggests a few key questions which were used to guide interview questions: 1) was literature not available/accessible? 2) was literature not the appropriate scale to be useful? 3) is scientific information available in other forms (i.e. private company reports, government reports) more so than peer-reviewed literature?

The final Category (3) was whether original research had been done for the plan, and if so by whom. Original research appears to have been done for all of the plans, as region-specific information had to be created about environmental conditions and historical trends. However, as some information is considered "common knowledge" to certain regions or even the Yukon, it is not cited and therefore the source is unknown to readers. During interviews we received feedback that a technical editor had been hired for the plans who made determinations about

what needed to be cited and what didn't. One participant also pointed out that as the plans were written to the audience of northern users, the proportion of climate knowledge that would be considered "common knowledge" might be higher than in other locations (D1). Partnerships were created or identified in order to fill gaps in information, and where it is possible to determine the origin of information based on a partnership this has been indicated (Table 2). Often in the end of the plans, further partnerships or collaborations were identified and suggested, and the vast majority of plans acknowledged the lack of information and need for increased engagement and collaboration with specifically academic researchers.

INTERVIEWS

The main themes that emerged from the interview process identified barriers to the uptake of information. Some barriers identified relate to issues with accessibility or communication of research, whereas others demonstrated uptake hinges on the "human chemistry" (Frank Duerden) of a project or plan and the background of those involved. In some circumstances barriers were observed by the majority of interviewees but by a single interview were not perceived as a barrier (i.e. low accessibility of information perceived by most interviewees but one or two found information readily available). Table 3 lists barriers as identified by a high number of interviewees, with quotes from different interviewees to illustrate each barrier.

Participants from all roles identified the following barriers: capacity, communication, educational history, and perceptions of research. Only support and authors identified accessibility to information as a barrier, and authors and TAC identified undefined roles as a barrier.

Participants from all locations identified the following barriers: capacity, communication, educational history, perceptions of research, and relevance of info. Only those in Whitehorse and Dawson identified accessibility as a barrier. Participants in Dawson did not identify undefined roles as a barrier.

Table 2. Summary of plan review findings according to the 3 Categories.

Plan	TAC?	***Category 1.*** involving researchers	***Category 2.*** Proportion of sources cited that were peer-reviewed	***Category 3.*** original research (collaborators)
Dawson	Y	Total: 17/24 Academic: 10/17 Private: 0/17 Government: 5/17 Other: 2/17	15/35	Yes (unclear, YRC, CAVIAR)
Mayo	N	Total: 11/26 Academic: 4/11 Private: 1/11 Government: 6/11	7/35	Yes (Hennessey, Stuart and Duerden; Wellman and Gagné)
Whitehorse	N	Total: 17/29 Academic: 8/17 Private: 1/17 Government: 6/17 Other: 2/17	17/46	Yes (unclear, SNAP, Appendix C)
Atlin	Y*	Total: 13/23 Academic: 5/13 Government: 2/13 Private: 3/13 Other: 3/13	13/36	Yes (PCIP)
CAFN	N	Total: 13/27 Academic: 3/13 Private: 2/13 Government: 2/13 Other: 6/13	0/15	Yes? (unclear)

*Atlin had a Technical Advisory Committee, but it was not a formalized part of the consultation process (i.e. was used throughout as necessary)

Table 3. Barriers to uptake identified by the interviews supported by a selection of feedback from the interviewees.

Barrier	Details
Perceptions of research	"Climate change and its causes are commonly accepted and understood by the public. The specific technical and local impacts much less so." (interviewee D10) "…people have a finite appetite for hearing things are wrong in the world…" (Al von Finster) "To some extent there are people in the community that don't have the time or don't have an interest in devoting attention to a thorough understanding of climate change" (Bill Kendrick)
Relevance of information	"while information was available, it wasn't always synthesized or compiled in a way that was really useful for the scale of the project" (interviewee D1) literature was "not specific enough" (Alison Perrin) "Given there wasn't much direct Klondike-specific impacts information we adapted or extrapolated to our locality. That seems to have worked well." (interviewee D10)
Accessibility of information	"tonnes of good science done in this area, but a lot of it just sits within the bowels of universities scattered across North America in dusty masters' theses and stuff like that, that really aren't searchable unless you know what exists and how to find it" (interviewee D4) "…science isn't context specific and is filled with uncertainty" (Ryan Hennessey) "[full Yukon data synthesis] would require time, and efforts, and resources, and permissions..." (interviewee D1)
Communication	"…the problem is not the science but the communication…" (Frank Duerden) "…the challenge is presenting a complicated topic, not only in the written word, but in a few short pages." (Bill Kendrick) "…turning something fairly complex into something palatable by the local population, so you filter a lot of stuff out in the process" (Frank Duerden)

	"If you can speak to the community in the community's language in a way they can understand it then you can insert a lot of science, because a lot of the science (particularly climate change) isn't far off empirical observation, and that's what, particularly for the elders or the guys who are out hunting and all the rest, that's what they're seeing." (Al von Finster)
Educational History	"…the route towards those positions [academia] doesn't emphasize, I don't think, a high level of community engagement…" (interviewee D4) "…choosing [research] partners invested in the North and invested in us as institutions." (Alison Perrin) "...you're battling the climate change skeptics in many of these places, not the whole population obviously right…people whose grasp of science is pretty thin…" (Frank Duerden) "…depended more on the background of the people…and by background I mean where they came from, and where they'd been educated, how they'd been educated…" (Al von Finster)
"Human Chemistry"	"…there's a lot of human chemistry in this stuff you know..." (Frank Duerden) "…everyone thinks their priority is the most important, when the interrelation of the priorities is the issue. Some priorities are more "real" than others. For example, managing substance abuse, access to clean water and the effective provision of services, the preservation of First Nations tradition and culture, and the orderly disposition of land (including managing wildlife for subsistence purposes) are common "real" priorities for Yukon communities. For the planner, who is obligated to act in the public interest (or public interests), these priorities need to be balanced effectively with other considerations such as climate vulnerability."; "Even the best science might not matter to the community, if it isn't in line with their priorities, beliefs, or needs." (Ryan Hennessey) "…in their immediate future problems, it's things like is my truck going to break down, am I going to lose my job. When you ask people in sort of the long term, you know, what are you worried about for your grandchildren, then things like climate change come up really high on the list, but when it comes to day to day stuff it disappears." (interviewee D4) "…but if it looks like the planning process is being taken over by the loud voices, then you're going to lose 80% of your community" (Al von Finster)

DISCUSSION

In this exploratory study we sought to identify the barriers and facilitating factors to climate adaptation research uptake through the lens of climate change adaptation planning in the Yukon. The climate change adaptation plans provided opportunities to examine a circumstance where researchers, planners, government members, community members, and other stakeholders interacted over time around the topic of adaptation. Planning process authors and participants worked together to compile, integrate, and in some cases verify scientific information with local information. Consequently, these planning processes appear to be an informative, data-rich model for examining questions about climate science uptake by northern communities. One potential limitation of this initial study is that our interview questions emphasized the activities and interactions leading up to the production of the Dawson plan, so there are further relevant questions that could certainly be asked about plan implementation over time.

What do our findings say about the broader question of community uptake of climate science?

Two things that influence communication and uptake heavily are the individuals interacting, or "human chemistry", and the educational history of those involved. Individuals bring different backgrounds, experiences and educational biases to the table, often resulting in specific interactions being an opportunity or barrier for uptake of climate change adaptation information. Individuals are also preoccupied with their daily lives, priorities and concerns such as will my truck break down, or how stable is my employment (interviewee D4). Bigger picture thinking and tasks regarding climate change impacts are not always integrated into the daily working life of individuals. According to an example by one respondent, if a water line breaks in the town, the individual called in to deal with it doesn't necessarily consult the Climate Change Adaptation Plan before deciding how to properly remedy the situation with climate change in mind (interviewee D4). However, this alters with the immediacy of the problem. The reality of climate change adaptation is it occurs as necessary. When the highway washed out and food abundance was limited, which occurred after the Plan was written, people stopped to consider the implications of relying on highway transport for food and the community has shifted towards local food production in multiple ways (highway washed out on Wednesday June 6th, 2012; Keevil 2012). Whether conversations stimulated by the creation of a Climate Change Adaptation Plan had already started these shifts is difficult to determine and responses varied.

The perception of research emerged as a key theme in this study. Not just the understandability or translation of information, but the perception of the urgency of climate change adaptation. Even though "climate change and its causes are commonly accepted and understood by the public", the "specific technical and local impacts" may not be perceived (interviewee D10). This connects to a potential lack of relevance and accessibility of information. Information in many cases was not "specific enough" or required extrapolation (Alison Perrin, interviewee D10). And much information was difficult to access and synthesize (interviewee D1, interviewee D4, Frank Duerden).

The difficulty of accessing information on research that has been done was identified as an issue, particularly research by universities that focus on peer-reviewed journals with paywalls as their main results reporting outlet. Or a large body of data that remains unpublished and is therefore not accessible. Paywalls are when access to a published paper requires an often substantial fee per paper, journal subscription, or access through an institution which has a subscription (i.e. a university or public library) to obtain a copy. There was a suggestion that more funding agencies should require the return of unpublished data when a defined number of years after a study have passed (interviewee D1). In the North, there are also a number of bodies that have data (private companies, governments, etc.) that might not 1) be searchable, or 2) be accessible. There is a general perception that even though a large volume of researchers have worked and continue to work in the Yukon, the results of that work rarely remain.

Another large theme that emerged was "the problem is not the science but the communication" (Frank Duerden). What respondents identified as good communication varied, but many indicated the institutional barrier of emphasis on peer-reviewed publications (often pay walled), or even of data that doesn't get published "sitting under desks" (interviewee D1, interviewee D4). Shorter communications in "plain English", or particularly visual (from maps to videos) tools were mentioned (Frank Duerden, Bill Kendrick). As one individual stated, you can produce the best reports in the world but they will just sit on a shelf and collect dust (Frank Duerden).

Despite identified barriers, the categorical plan review and interviews indicated several long-term northern researchers that have developed good rapport with communities. One example of good communication was identified between paleontologists and miners (interviewee D4). A facilitating factor is direct, person-person interaction (i.e. placer miners might find fossils that paleontologists are interested in, the two parties meet in person, and there are follow-up discussions on identification etc.). Yet this and other good examples of relationships demonstrate that the link to climate change may not appear during those potential uptake events.

The likely results of a planning and action disconnect, the problem as defined by this study, are that climate change adaptation plans will not be regularly consulted or utilized. They will tend to sit on shelves and collect dust, just as the Dawson Climate Change Adaptation Plan set out not to do in its foreword (Hennessey et al. 2011). That doesn't mean that adaptation actions aren't underway, but indicates actions are potentially not informed by the planning effort or the available scientific information.

Further implications of these findings indicate a gap between the effort put in by many individuals throughout research and adaptation planning processes, and the goals desired by the planning and support team towards implementation. This is potentially a disappointing outcome for those who dedicated time and effort to the planning process, and could reduce their willingness to be involved in further climate change adaptation plans. It also may reduce perceptions of the value of research and planning in the communities where the plans were written. If the perception is that a high volume of research has occurred and not a lot of tangible results remain to help community members in their adaptations, it could be inferred that benefits of research are not adequately distributed to the communities. This might deter communities from wanting to host researchers in the future, being open to participation in research, and/or dedicating time for research uptake.

What do our findings suggest for future research on climate science uptake in the north?

In this study we found climate change adaptation may differ to the exercise of planning for adaptation. This aligns with models for adaptive governance to climate change, which emphasizes the experience rather than the expertise to field test policies related to climate change adaptation (Brunner and Lynch 2010). Similar to Adger et al. (2009), we found adaptation can be limited by social and individual factors, especially with regards to perception of risk. Additionally, it is important to recognize that real people cannot be categorized as either laypeople or experts (Raynor and Malone 1998), and that many people who live in the north have relevant experience to offer. Adaptation in the circumpolar, which is generally made up of small, rural communities, becomes an increasingly specialized process for each community, and practical information for local-level decision continues to be lacking (Tryhorn and DeGaetano 2011).

Future research on climate science uptake should consider the specific context of the uptake mechanism in question. For instance, if the mechanism for uptake is meaningful communication, the needs of the individual community will differ. In some cases, communication may only occur if complemented by informal interactions with community members (Brunet et al. 2014). Communication is also not a unidirectional process from experts to laypeople (Raynor and Malone 1998), but researcher uptake of community information might be equally important. If the mechanism is partnerships, the background of the individuals involved in those partnerships could be important. Additionally, to ensure local participation in partnerships there might need to be a "decentralization of power" (Brunet et al. 2016). Based on our study, climate science uptake is a context-specific, case by case challenge, that requires a series of positive interactions between researchers and users of information.

Additional questions regarding barriers to community uptake are about what actions are currently underway to adapt to climate change, and what information is missing that those actions might need to prevent maladaptation. For example, if hunters are using a trail that impacted by permafrost thaw and adapt by going around degraded areas creating a web of trails, what information could be acquired to help maintain access to hunting grounds while minimizing habitat degradation impacts. Also, what are the social or logistical constraints to these ongoing adaptive strategies (Pearce et al. 2010)? There are also questions that remain with regards to people in positions to implement adaptations, and what they might need to increase the capacity to consult plans and implement better-informed actions. Connections then should perhaps not be between researchers and the general community (re: communication barrier) but between researchers and specific employers in the community to whom their research relates.

Finally, our exploratory work here revealed some important considerations for the conduct of such future research in the Yukon, and likely elsewhere in the circumpolar north. First, the community of climate adaptation researchers, practitioners, and engaged community members is small, so everyone knows one another and their work. This means researchers need to be attuned to, and respectful of, participants' potential sensitivities that their work is being critiqued. Sampling design and data collection methods need to be chosen with this potential risk to participants in mind (Canadian Institutes of Health Research et al. 2014). At least one potential

participant declined to be interviewed because of this concern. Iterative verification of findings with participants will also be critical, offering opportunities to identify and mitigate such risks where they may inadvertently have appeared. To be clear, this doesn't mean that researchers should self-censor their areas of inquiry or their findings; simply that they need to be thoughtful, strategic, and respectful about the conduct of their own research.

ACKNOWLEDGEMENTS:

This research was funded by the Northwest Boreal Landscape Conservation Cooperative as an exploratory study to inform a larger project in Alaska on community uptake of climate change related research. Meagan Grabowski was based at the Northern Climate ExChange at Yukon Research Centre, Yukon College, for the duration of this project.

STANDPOINTS:

Meagan Grabowski is a contract researcher for Yukon Research Centre who conducted the background research, interview process, analysis and final reporting for this project. She completed her MSc Zoology at University of British Columbia (2016), and is a lifelong Yukon resident. She has worked in the Yukon for WCS Canada, Yukon Parks, Science Adventures and taught Environmental Science at Yukon College. She is a founding member APECS Canada (2012-present). She is also currently a Jane Glassco Northern Fellow (2015-17), conducting independent research on the influence of permitting on researcher-community relationships. This project was designed as a training opportunity for Meagan to complement that Fellowship, and was supervised in all stages by Dr. Clark.

Dr. Douglas A. Clark has 14 years of experience designing, implementing, and leading community-oriented and applied social science research projects in northern Canada (Yukon, Nunavut, NWT, northern Manitoba). He has a sixteen-year working relationship with Champagne and Aishihik First Nations (CAFN) that predates his academic career and encompasses three successful previous community-oriented, participatory research projects on resource management issues within their traditional territory. Through his research chair in SENS he is constantly creating more and richer opportunities for knowledge co-production and application with northern communities.

REFERENCES:

Adger, W.N., Dessai, S., Goulden, M., et al. 2009. Are there social limits to adaptation to climate change? *Climatic Change* 93: 335-354.

Berkes, F. & Jolly, D. 2001. Adapting to Climate Change: Social-Ecological Resilience in a Canadian Western Arctic Community. *Conservation Ecology* 5(2): 18.

Brunet, N.D., Hickey, G.M., & Humphries, M.M. 2016. Local participation and partnership development in Canada's Arctic research: challenges and opportunities in an age of empowerment and self-determination. *Polar Record* 52(3): 345-359.

Brunet, N.D., Hickey, G.M., & Humphries, M.M. 2014. Understanding community-researcher partnerships in the natural sciences: A case study from the Arctic. *Journal of Rural Studies* 36: 247-261.

Brunner, R.D. & Lynch, A.H. 2010. Adaptive Governance and Climate Change. American Meteorological Society. Boston, Massachusetts.

Canadian Institutes of Health Research, Natural Sciences and Engineering Research Council of Canada, and Social Sciences and Humanities Research Council of Canada. 2014. Tri-Council Policy Statement: Ethical Conduct for Research Involving Humans. Government of Canada. Ottawa, Canada. Page 20. Accessed at: http://www.pre.ethics.gc.ca/pdf/eng/tcps2/TCPS_2_FINAL_Web.pdf

Clark, S.G. 2002. The policy process: A Practical Guide for Natural Resources Professionals. Yale University Press. New Haven, Connecticut.

Clark, D., Workman, L., and Jung, T. 2016. Impacts of reintroduced bison on First Nations people in Yukon, Canada: finding common ground through participatory research and social learning. *Conservation and Society* 14(1): 1-12.

Coates, K.S. 1991. Best Left as Indians. McGill-Queen's University Press. Canada.

Coates, K.S. & Morrisson, W.R. 1988. Land of the Midnight Sun: A History of the Yukon. Hurtig Publishers Ltd. Edmonton, Canada.

Duerden, F. 2004. Translating Climate Change Impacts at the Community Level. *Arctic* 57(2): 204-212.

Ford, J. D., Stephenson, E., Willox, A. C., et al. 2015. Community-based adaptation research in the Canadian Arctic. *WIREs Climate Change* doi: 10.1002/wcc.376

Hennessey, R., Jones, S., Swales, S., & Duerden, F. 2011. Dawson Climate Change Adaptation Plan, Revised Edition. Northern Climate ExChange, Yukon Research Centre, Yukon College, Whitehorse, Canada.

Hovelsrud, G.K. & Smit, B. (eds). 2010. Community Adaptation and Vulnerability in Arctic Regions. Springer. Dordrecht.

Keevil, G. 2012. Food scarce in Yukon towns cut off by flooding. The Globe and Mail. Accessed at: http://www.theglobeandmail.com/news/national/food-scarce-in-yukon-towns-cut-off-by-flooding/article4249680/

Lasswell, H.D. 1970. The emerging concept of the policy sciences. *Policy Sciences* 1: 3-14.

Loring, P.A., Gerlach, S.C., & Penn, H.J. 2016. "Community Work" in a Climate of Adaptation: Responding to Change in Rural Alaska. *Human Ecology* doi: 10.1007/s10745-015-9800-y

Pearce, T., Smit, B., Duerden, F., Ford, J.D., Goose, A., & Kataoyak, F. 2010. Inuit vulnerability and adaptive capacity to climate change in Ulukhaktok, Northwest Territories, Canada. *Polar Record* 46(237): 157-177.

Pearce, T.D., et al. 2009. Community collaboration and climate change research in the Canadian Arctic. *Polar Research* 28: 10-27.

Rayner, S. & Malone, E.L. (eds). 1998. Human Choice and Climate Change: An International Assessment, Volume 4, What Have We Learned? Battelle Press. Columbus, Ohio.

Tryhorn, L., & DeGaetano, A. 2011. "2100? It Doesn't Keep Me Up at Night!": Lessons for the Next Generation of Climate Assessments. *Bulletin of the American Meteorological Society* 92(9): 1137-1148.

Umbrella Final Agreement. 1993. Accessed at: https://www.aadnc-aandc.gc.ca/DAM/DAM-INTER-HQ/STAGING/texte-text/al_ldc_ccl_fagr_ykn_umb_1318604279080_eng.pdf

Pearce, T.D. et al. 2009. Community collaboration and climate change research in the Canadian Arctic. *Polar Research* 28: 10-27.

Yukon Finance, Bureau of Statistics. 2016. Info sheet no. 60 – November 2016. Accessed at: http://www.eco.gov.yk.ca/stats/pdf/populationJun_2016.pdf