Bear aware trail signs for Yukon College

Comparing the effectiveness of graphic versus written messaging

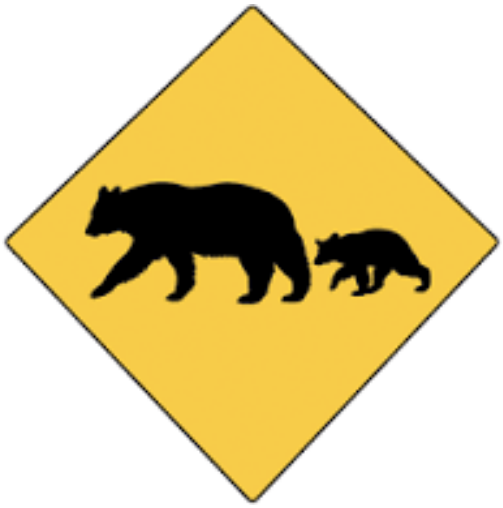

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Table of Contents

Introduction

Yukon College's Ayamdigut Campus is nestled in the heart of the City of Whitehorse, in the boreal forest along McIntyre Creek. The College shares the site at Yukon Place with a Seniors' Residence and the Yukon Arts Centre. It is a bustling centre of human activity. The area is criss-crossed with trails that lead into the nearby green-space which is inhabited by a variety of birds and wildlife. There has been a history of human-bear conflicts over the last decade or so and both grizzly bears (*Ursus arctos*) and black bears (*Ursus americanus*) have been destroyed on, or relocated from, the campus. A recent study of risk to humans and bears at Yukon Place (Gilbert & Smith, 2015) identified a long list of both natural and human-related attractants that may be associated with conflicts and Yukon College has been taking steps to address these.

Coexisting with bears requires deliberate consideration of the needs of both humans and bears (Clarke & Slocombe, 2009). The perception of safety that people often feel when nothing really bad has happened yet could easily be dispelled by one negative human-bear encounter (personal communication, Sylvia Dolson, Get Bear Smart Society, 2016). The likelihood of a negative encounter may be higher with an uneducated community using the nearby green-space than it is when students and staff know how to travel through bear country safely and make efforts to manage bear attractants.

Yukon College has responded to the recommendations in Gilbert and Smith's study by supporting the use of bear deterrents (electric fencing and netting) around some of the key

attractants (gardens and dumpsters). Gilbert and Smith (2015) also suggest using trail head signs to educate trail users about bears and safe travel through bear habitat. There are several access points to the college campus trail system and opportunities along many of the trails for interpretive signage. Other communication approaches such as posters, social media campaigns and hands on training could be used within the college community to educate students, staff and visitors about the trail system and safe travel.

At a glance, designing trail signs may seem like an easy task. Bear aware trail signs are in use across North America; there may not be a need to re-invent the wheel. Locally, Environment Yukon educates the public through their website, which features species specific information and bear safety information. They conduct outreach at trade shows, fairs and in schools as well as through publications such as their "*How You Can Stay Safe in Bear Country*" booklet and their multi-fold "*Keep Urban Wildlife Wild & Alive*" pamphlet. In addition, Environment Yukon coordinates the Wildlife Viewing Program which offers nature walks, talks and wildlife viewing opportunities throughout the territory. The Centre for Human-Wildlife Conflict Solutions (locally known as WildWise Yukon), a non-government organization based in Whitehorse conducts door to door backyard attractant surveys, works with the City of Whitehorse and Environment Yukon on waste management issues and maintains web-based resources for anyone interested in learning more about bears (wildwise.ca). Bear Smart societies across Canada offer a range of resources, including signage ideas for other organizations and communities to use.

However, the Yukon Place campus has some unique aspects as its student and staff body represents a variety of languages, cultures, abilities and world views. Yukon College may soon be Yukon University, possibly attracting an even more diverse student and staff population.

A trail sign may be as simple as a graphic alert that bears frequent the area, however, because these trails intersect an educational environment, there is an opportunity to create interpretive signage which allows trail users to become more familiar with their environment and then, possibly, make conscious choices which increase their own safety and reduce human-bear conflict (HBC).

This study aims to assist with the design of locally relevant signage that is accessible to the broadest possible audience. To achieve this goal I took a three step approach. I began with a literature survey, reviewing over 20 studies to gain an understanding of how bear safety education has been approached and analyzed in the past. Second, I designed and distributed a survey to the college community to test the effectiveness of different styles of message delivery. Lastly, I consulted with professionals working with bears on parks interpretation and with communications experience on specific messaging for trail signage.

Literature Survey

I reviewed over twenty articles relating to human-bear safety and conflict management and found four prevalent themes. First, all work related to the design of educational materials begins with an explanation of why education is needed; the intent, possible outcomes and gaps in research related to program design and delivery. Second, the authors discuss the role of

human attitude and how it affects uptake of information and human behaviour. Third, some investigate the need for evaluation and adaptive management. Lastly, a few have ventured to give advice on how to design effective messaging. Human-bear conflict (HBC) resolution and government websites are littered with advice and samples of trails signs but with little rationale about how to settle on an appropriate design.

Making the case for bear education

To understand why education is needed it is important to understand the historical and current relationship between humans and bears and any resulting HBC. Most of the papers I reviewed began with a subjective analysis of the problem and then moved on to consider various methods of reducing HBC, their effectiveness, likelihood for buy-in and methodology. I found near perfect consistency in this analysis. I will summarize here.

Humans and bears coexist in ever-changing, overlapping territory. Humans have treated bears with a varying degree of reverence but this coexistence has gone along, relatively peacefully and uninterrupted for millennia. Evidence of reverence and respect for bears is found in many Aboriginal practices, the use of which has been interpreted to be necessary to maintain a "reciprocal and essentially social relationship" between human and bears. (Clarke & Slocombe, 2009). However, over the past two centuries non-First Nations governments have usurped the role of wildlife management on lands long since occupied by First Nation people with only a very recent shift towards co-management in some areas.

These have been two relatively awful centuries in which to be a bear. As human populations have increased and human developments changed the landscape and ecology of land used by bears, negative human-bear encounters have also increased (Gore et al., 2006; Spencer et. al., 2007). Conservationists are now recognizing a more acute need, globally, for conservation (Overbey, 2015). From a geographical view-point grizzly bears occupy a fraction of their ancestral North American habitat and are now extirpated in many parts of their original, southern range (COSEWIC 2009). In some areas, where conservation efforts are increasing the number of bears, the recovering ratio of bears to humans is also said to be increasing the number of negative encounters (Campbell, 2012; Spencer et. al., 2007).

Unlike bears, which may defend their young and/or a resource in their immediate area, humans tend to defend an entire territory, resources and young included. When bears break in to garbage dumpsters and access other attractants in or near human settlements we consider them "nuisance" bears and there is often a strong lobby from humans to 'manage' (destroy, relocate or, more recently, haze) them. In these situations, public support for conservation and coexistence may be replaced by criticism aimed at governments and conservation officers for not instituting bear management protocol to protect the public and greater concern for costs than conservation (Dunn, Elwell & Tunberg, 2008). I observed this kind of pressure at the 2015 Yukon Renewable Resource Council Annual General Workshop, where Environment Yukon's conservation officers were pressed by members of several RRCs to develop a bear management protocol and to stop relocating bears into any First Nation's Traditional Territory without appropriate consultation.

To understand how the public expects government and other stakeholders to approach the human-bear issue, we need to understand what conservation and coexistence mean to individuals and interest groups (Peine, 2001). Governments are, albeit slowly, accepting that consultation is an important step towards shaping both education and planning initiatives. What management choices the public will accept and how to shape policy accordingly are not easy questions to answer.

Many management tools have been implemented over the years but few have been reported to have had a positive effect on bear reducing HBC, as defined by Can et al. (2014), *"any situation where wild bear use (undesirably) or damage human property; where wild bears harm people; or where people perceive bears to be a direct threat to their property or safety"* (p. 501). Population control (increasing the bear harvest quota) has not worked (Obbard et al., 2014) and reducing harvest quotas has only increased unfounded complaints received by conservation officers according to Howe et al. (2010). Enforcement of hunting regulations and bylaws and 'bear friendly' waste management are slow to be accepted by individuals and funded by governments. All of these tactics tend to lose political champions if ever they attract them to begin with (Peine, 2001) . Aversive conditioning and hazing are relatively inexpensive and have potential to be effective at reducing HBC but it may only work in conjunction with education initiatives (Slagle et. al, 2013).

While some psychologists deny that human behaviour change is influenced by education (Ruben Anderson , personal communication, March 2016) some studies do suggest that, trauma aside, education is *what* shifts behaviour (Overbey, 2015; Pienaar et al., 2015; Dunn et

al., 2008; Espinosa & Jacobson, 2012). Education aside, Mr. Anderson advises focusing any effort, where change is the objective, on what can reasonably be accomplished. Bear education and outreach is a tested management tool which tends to be highly supported by government and non-government organizations and one that fits well within the mandate of an educational institution.

Worldwide, non-government organizations and private institutions are developing education tactics about bears, both to increase human tolerance of bears and, therefore, indirectly to protect bear populations. These education campaigns also help to increase human safety, reduce property damage caused by bears and reduce costs associated with dealing with the problem (Campbell, 2012; Dunn et al., 2008; Spencer et. al., 2007).

Human attitudes – how they affect the effectiveness of educational programs (Psych 101)

Many of the studies I reviewed make frequent reference to human attitudes and the theories that attempt to explain how we acquire them. Martin Fishbein developed the expectancy-value theory (EVT) in the 1970s to describe attitude and defined it as a combination of expectancies (the degree to which we think we'll succeed) and values (beliefs or feelings that drive us to do the things we do) (Cable et.al. 1987). Whatever theory we employ, attitudes, which are informed by salient beliefs, influence our support (or lack of support) for potential management strategies. Wildlife managers may set out to shape the public's behaviour but the acceptance of any management strategy will be influenced by the belief system of the target group. Attitudes vary depending on the context of a situation (Overbey, 2015; Don Carlos et al., 2009). To

understand attitudes several authors point out we need to understand the lives of the people we are studying or working with.

Attitudes towards wildlife within communities may be predictable by, for example, size, location, economy or demographics. Women and elders may perceive themselves to be more vulnerable than others and that perception may contribute to more negative attitudes about coexistence with wildlife (Zajac et al., 2012; Campbell & Lancaster, 2010). Attitude is influenced by experience and may only change when something dramatic happens such as a mauling, property damage or other personal loss (Sylvia Dolson, Get Bear Smart Society, B.C.). Furthermore, human-wildlife conflict (including HBC) is often more about conflict between groups of people who have different attitudes (and goals, levels of empowerment, wealth etc.) than it is about conflict between humans and wildlife (Madden, 2004), making the attitudes of managers and policy makers (pro-active vs. reactive) equally important to understand.

More importantly, attitude influences behaviour and it is behaviour that most education campaigns aim to change. Theory of Planned Behaviour (TPB) suggests that any behaviour can be predicted by our attitudes towards the behaviour, subjective norms (perceived social pressure to engage in the behaviour or not) and perceived behaviour control (Campbell, 2012; Huges et. al., 2009). Past attempts to address behaviour through education have assumed that an educator can change behaviour by talking at an audience, assuming the audience is passive and receptive. More successful attempts acknowledge the audience as active and understand that individuals interpret content through their own lens (Lackey & Ham, 2004). Behaviour will not shift unless people recognize a consequence to their collective actions (Peine, 2001).

Across North America, on-site education programs (in campgrounds, National Parks, day use areas etc.) are used to inform the public about wildlife and human-wildlife interactions. If negative human-wildlife encounters are rare in these settings, visitors may have little motivation to adopt preventative behaviour and the effort to educate may be undermined. It is, therefore, important to identify other opportunities to influence behavior change. Repeat park visitors and trail users might be more effectively educated through interactive campaigns at home, for example, on trails and in institutions that are a part of daily life, than they are within a park or other vacation setting (Hughes et al., 2009). If sources are varied and credible and the message is tailored to the audience, change may happen (Lackey & Ham, 2004).

Evaluation (adaptive management)

Evaluation is the foundation for adaptive management. For education to be effective we need to understand how well it reduces HBC, changes human behaviour and fosters coexistence (Gore et. al., 2006). Evaluation helps to direct our efforts and funding appropriately and builds credibility within an organization (Gore et al., 2008). My literature survey suggests it is hardly ever done and, even less frequently, done well. Evaluation tools are often subjective. Researchers have attempted to evaluate program effects by monitoring behaviour change but have noted that behaviour change may be influenced by other unrelated factors (for example, residents lock garbage because a bear broke in to someone's house and not because the brochures told them to) (Cable et al., 1987). Monitoring the volume of calls to authorities may also be influenced by unforeseen variables (one highly publicized event, a year with a low berry crop, a group of hunters displeased with lowered harvest quotas) (Gore et al., 2006). Initiatives

which encourage self-reporting also introduce bias (Baruch-Mordo et al., 2011). While many studies suggested that a shift in behaviour indicates effective messaging, other studies refuted the idea and only one study suggested that measuring how many facts are acquired and regurgitated is the appropriate way to make a clear assessment (Cable et. al., 1987).

What does work?

The literature I reviewed makes many suggestions for organizations undertaking education initiatives. Understanding the audience and making content relevant is important (Don Carlos et al., 2009; Ham, 2007). Recognizing benefits to both a management agency (increased exposure, public approval, increased funding) and the public (reduced risk, greater enjoyment of activities, free education) will break down barriers created by the public's perception of behaviour control and result in more positive outcomes (Cable et al., 1987), as will public involvement in message design (Spencer et al., 2007). Information presented must be enjoyable, organized and compelling (Ham, 2007). Outreach is most likely to have positive results when a variety of "tactics, tools and techniques" are used (Madden, 2004). As well, budget must be considered and affordable initiatives prioritized (Campbell, 2012).

The World Parks Congress reports that collaboration is the key to success. This multi-national forum encourages organizations to exchange ideas and information through a global network, create partnerships and linkages, share knowledge of the state of human-wildlife conflict, build skills locally, employ best practices and identify gaps in research and knowledge. Further, the

World Parks Congress suggests that success in reducing human-wildlife conflict will be greatest when approaches are diverse, flexible and adaptable to changing circumstances (Madden, 2004).

Further advice is given about message design. Ham (2007) notes that theme related thinking (which happens when an audience is exposed to theme-based education) has a large impact on beliefs, attitudes and behaviours. Many authors note the importance of including the benefits of the presence of wildlife (black bears in particular) in messaging (Slagle et al., 2013; Zajac et al., 2012; Bruskotter & Wilson, 2014). Messages should increase public trust in the agency and increase perception of personal control (Zajac et al., 2012). They should clearly state their intended goals (Gore et al., 2006), appeal to peoples' emotions (Campbell, 2012) and address real, local risks (Zajac et al., 2012; Spencer et al, 2007). In contradiction to what Hughes et al. (2009) tell us about on site information, Dunn et al. (2010) suggest that information should be provided at the site where it is needed and relevant because most education techniques do a poor job of highlighting their key messages and people often do not retain information that is not used frequently.

Other authors offer more specific advice. Lackey and Ham (2004), and Dunn et al. (2008) advise making signs bold, brief and visible. Dunn et al. (2008) note that more information is needed about what to do during a bear attack and what constitutes a food source for bears. The Get Bear Smart Society in B.C. is one of many organizations that advocate for the inclusion of bear-related information (behaviour, eating habits and bear safety) in all outreach efforts.

Methods

Location

The trails behind Yukon College (Figure 1) link to a broad system that covers a large area of Whitehorse. The trails are used year-round by hikers, runners, cross country skiers, ATV and snow-machine operators and cyclists travelling at high speeds, student groups and dog walkers (who may or may not be using a leash). There are access points to this trail system both on and off campus.

Figure 1: Trails system at Yukon College. The Trans-Canada trail is marked in white and the Boreal trail in yellow. Credit: Google Earth imagery.

There are numerous trails which lead trail users through several ecosystems, from steep, dry, south-facing slopes similar in composition to a steppe environment, to creek-beds overgrown with vegetation.. This topographically varied terrain combined with areas of dense vegetation means that there are many parts of the trail system with poor visibility and sightlines, as noted in Gilbert and Smith's 2015 study. The section of McIntyre Creek near the Canada Trail can be loud when the water is fast and high, making it hard to hear wildlife approaching or foraging along the trails.

Some biotic factors increase the chance of bear activity in the area. Soapberry (*Shepherdia canadensis*) and highbush cranberry (*Vibernum edule*) are among the natural bear attractants that are found throughout this trail system and proof of their powers of attraction have been found in bear scats along the Trans-Canada Trail south of the bridge.

Applying information from the literature

Understanding and predicting human behaviour is beyond the scope of this study. However, the literature I reviewed does imply that behaviour is derived from attitude and this is helpful for us to understand. We can assume that trail users who approach signage with an attitude of curiosity and openness to learning will benefit from the messages we choose to convey. For the purposes of getting closer to a practical product that Yukon College can use, it is probably important to take Ruben Anderson's advice and focus in on the simple things that *can* be achieved. The most appropriate thing to do is to appeal to trail users who are interested in learning. Trail signs should be bold, brief, visible, relevant to the local circumstances (geography, culture, ecology etc.), designed in collaboration with and tested on the community

they serve. The literature suggests that a coordinated and well-researched approach to message design, as well as a consistent evaluation of the effectiveness of education efforts, is lacking.

Bear aware survey

Using software provided by Survey Monkey I designed a survey which asked participants to rank their knowledge of bears and bear safety before and after viewing one of three examples of messaging (visual only, visual and text combined and text only). I obtained approval from the Yukon College Ethics Review Board to conduct this anonymous survey and followed their template in preparing an informed consent document (Appendix 1). The survey (Appendix 2) started with personal background questions (staff or student status, language, prior experience hiking in bear country, previous history of exposure to bear education materials). It then asked participants to rank their knowledge in three relevant areas (bear behaviour, what bears eat and knowledge of using bear deterrents). Next, it asked participants to identify their birth month and used this information to assign respondents to one of three samples (visual only, visual with text, text only). After viewing their sample participants were asked some skill testing questions relating to all three subjects and also were asked to rank their knowledge about the three themes again.

I tested my draft survey on six Yukon College ENVS students and two staff members and made revisions before launching the survey. I was looking for feedback on areas of confusion and comments on survey design. In March, 2016 I then asked four college instructors to distribute the survey to their students via email and set up a public survey station with two laptop

computers in the Yukon College Pit and in the upstairs main hallway on two separate days for three hours each day. I set up over the lunch hour both days to catch students coming out of class. Finally I sent an invitation by email to Yukon College staff with a web link to the survey.

Consultation

In order to develop specific messaging for the trail signs in consultation with experts and the college community I took three approaches. Two approaches were intentional and the third was serendipitous. First, I compiled a list of messages commonly found on trail signs in other areas across Canada and organized the messages into three categories; bear behaviour, bear diet and bear safety. I asked professionals in related fields to review and edit the messages and rank them in order of relevance and importance. I had responses from two (an interpretive planner with Yukon Parks and communications manager and teacher with 12 years experience working for Parks Canada). Second, I presented my methodology and survey results to three Yukon College instructors and two students at a public presentation and asked for feedback on the ideas I presented and input regarding message delivery and placement. Finally, the comments box at the end of the survey, intended originally for feedback on survey design, generated a number of comments which relate to trail sign design which I have included with the comments received at my public talk (Appendix 4).

Results

General

I received 125 responses to my Bear Aware survey and of those, 113 were complete. The sample was composed of 88 participants who identified themselves as staff, 40 as students and 2 as visitors. Participants saw one of three samples during the survey and among the 113 participants who completed the survey, the sample size allocated using their birth month was 40, 31 and 42 for the image only, image and text and text only sample groups respectively.

Background question results

I found 99% of participants reported the ability to read English fluently. Japanese, Korean, Spanish, French and German were also identified as fluent languages. Close to 90% of participants reported experience hiking in areas inhabited with bears and over 70% reported using the trails on Yukon College campus although almost 5% reported not being aware of the trails. As well, most participants reported previous exposure to information about bears and bear safety was (Table 1).

More than 60% (64% and 67%) reported good to excellent knowledge of bear behaviour and bear foods before seeing their sample, however, when asked to rate their comfort with their knowledge about how to stay safe around bears, participants reported a wide range of response (Table 2).

Table 1: Summary of responses to survey Q.5 which asked participants to identify sources of exposure to information about bears.

Please check all that apply		
Answer Options	Response Percent	Response Count
I have watched the "Being Safe in Bear Country" video	51.8%	59
I have, or have had, a hunting license	31.6%	36
I have read bear safety materials (brochures, flyers, etc.)	93.0%	106
I have had a bear encounter (not including sightings)	46.5%	53
I carry bear spray when I hike	60.5%	69
I consider myself knowledegeable about bears	44.7%	51

Table 2: Summary of response to survey Q.9.

Are you comfortable with your knowledge of how to stay safe around bears?		
Answer Options	Response Percent	Response Count
Yes, very comfortable	40.0%	48
I would feel safer with more information	47.5%	57
No, but I hike in bear country anyway	8.3%	10
No, I avoid using trails because I'm afraid of bears	7.5%	9

I found 52% of participants reported confidence using bear spray and 30% indicated that they had knowledge of how to use bear spray but would need a reminder to feel confident. Another 19% reported no knowledge of how to use bear spray.

Confidence after viewing samples

Most participants answered skill testing questions about bear behaviour and bear foods correctly. When asked questions relating to bear behaviour, those who saw sample 2 (images and text together) answered correctly more often than those who saw sample 1 (images only) or 3 (text only) (n=97%, 78%, 88% respectively). When asked questions relating to bear foods, similar results were recorded (87%, 80%, 81% respectively). Participants viewing all three samples also reported increased confidence in their knowledge of bear behaviour and foods. Those participants who reported relatively low confidence (i.e. not "good" or "fair") in knowledge at the beginning of the survey declared the greatest improvement in their knowledge after seeing their assigned sample. Participants who saw sample 2 (images and text) reported the highest confidence relating to both bear behaviour and foods at the end of the survey (Table 3).

Finally, participants who saw sample 2 (images and text) reported the greatest confidence in their ability to use bear spray at the end of the survey (Table 4). However, more participants reported not feeling confident in their ability to use bear spray after seeing all three samples than they did before seeing the samples.

Table 3: Comparison of results from answers to skill testing questions about bear behaviour and foods before and after seeing different samples of messaging.

	Knowledge of behaviour before				Knowledge of behaviour after		
Self assessment	Images only	Images + text	Text only		Images only	Images + text	Text only
Excellent	8%	13%	5%		8%	23%	7%
Good	45%	58%	62%		50%	58%	62%
Fair	23%	19%	24%		23%	16%	31%
Not good	25%	10%	10%		18%	3%	0%
	Knowledge of foods before				**Knowledge of foods after**		
Answer	Images only	Images + text	Text only		Images only	Images + text	Text only
Excellent	15%	16%	19%		13%	19%	17%
Good	45%	55%	50%		40%	65%	60%
Fair	23%	23%	21%		40%	13%	21%
Not good	18%	6%	10%		8%	3%	2%

Table 4: Comparison of confidence in ability to use bear spray before and after seeing the survey samples.

Confidence in ability to use bear spray							
	before seeing sample				after seeing sample		
Answer	Images only	Text + images	Text only		Images only	Text + images	Text only
Yes	40%	58%	60%		43%	71%	57%
No	20%	10%	21%		23%	16%	33%
Yes but needs a reminder	40%	32%	19%		35%	13%	10%

Discussion

My results suggest there is a well-founded need to provide bear safety information at trail heads near Yukon Place. The survey found the majority of respondents (60%, Table 2) described themselves as not being comfortable with their knowledge of how to stay safe around bears and some of the comments volunteered at the end of the survey indicated that signage would be helpful (Appendix 4).

It is important to make the information on trail signs accessible to as many people as possible. The survey results reveal a number of things which may help design effective and appropriate trail signs. Considering the multi-lingual nature of the college community, trail signs will be more accessible if they are available in translation. One way this could be done is to have a QR code displayed on the main trail head sign which allows users who are carrying smart-phones to access a translated version of the same sign.

While small sample sizes limit the inferences I can draw from the survey results they do reveal some trends which are worth considering. Participants responded most positively to the sample that combined images with text information. One participant noted their preference for this format in the comments section and several in passing conversation. The combination of text and visual information increases access to people across of spectrum of language and literacy skills. Further, past studies have indicated that keeping messages bold, brief and factual is important, which poses some content challenges. It is, therefore, worth considering separating different types of messaging (safety information from more interpretive signage).

Trail heads may be the best venue for stand-alone bear safety messaging, especially for those trail users with no prior experience hiking in or knowledge of how to travel safely through bear country. Other opportunities to provide bear safety training at the College could include an orientation week bear spray demonstration with Environment Yukon Conservation Officers and/or WildWise Yukon, and a bear safety page in the student planner (with translation provided on a webpage reached via a QR code) and on the college website. A permanent information display in the Pit, student lounge and student residences may also be considered. QR codes could also be used to provide a link to web pages that had information on bear sightings or warnings for designated trails. This is a larger undertaking involving collaboration with an organization that has the capacity to monitor those trails and update the central web site which will be accessed with the QR code. Developing a pilot project using this strategy might constitute a directed study for another student. In a simpler form, a message board could be placed at trail heads for individual trail users to record wildlife sightings and encounters on. Both methods involve citizen science. The Boreal Trail was originally developed as an interpretive trail. Facts and traditional knowledge about bear habitat and ecology and behaviour could be displayed within the existing interpretive trail system. A final product will require collaboration. Developing specific content, design and layout for signage is a project which could draw from students and expertise in the RRM, Northern Science, Northern Outdoor and Environmental Studies and Multimedia Communications programs.

The survey was helpful in gathering background information about the participants, however, small sample sizes limited the ability to effectively analyze many of the results and bias may

have been introduced through the survey distribution methods, limiting the ability to assume that the surveyed group is representative of the larger college community. In addition, answers to questions about bear behavior and foods before seeing a sample are inconsistent between sample groups. For example, 8% of participants in the image only group reported excellent knowledge of bear behavior at the beginning of the survey, whereas 13% reported the same result from the image and text group and 5% from the text only group (see Table 3). In a random sample, I would expect to see consistent results across all three sample groups for all questions asked. Further analysis is required to determine if these results are statistically significant.

My survey relied on people to voluntarily participate and I ended up with a small number of respondents who had (self-described) little knowledge of bears. Prior knowledge of bears most likely influenced the answers to the self-assessment and skill testing questions and little information can be gleaned from the results if this is the case. A larger pool of people without bear knowledge is needed to effectively determine differences in response according to message type.

Finally, this study raises many questions which may be pursued by future students. A lack of evaluation of program effectiveness was noted in many of the studies I reviewed. My survey results suggest that many participants have a high degree of prior knowledge about bears and bear safety and past research indicates that, once formed, attitudes and, therefore, behaviour are difficult to change. It may be interesting and worthwhile to monitor the college community's response to trail sign education and to adopt an adaptive management approach,

adjusting the messaging over time according to its determined effectiveness. Most survey participants answered all of the skill testing questions correctly, however, there was, in most cases, only slight improvement in their self-reported confidence in their knowledge about bear behaviour and bear foods. It is possible that the images and wording I chose for the survey were of poor quality or that it is just difficult to change existing beliefs. This raises questions about how to positively influence an already educated community.

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Appendices

Appendix 1: Participant Consent Form

Participant Consent Form

Project Title: Bear Aware Survey

Researcher(s): Heather Ashthorn, student researcher, RRM Program, Yukon College

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Scott Gilbert, PhD, Supervisor, Yukon College

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Purpose of the Research:

Bears live and travel through the forests surrounding Yukon College. Past negative encounters with bears on campus, including the relocation of two bears and shooting of another by Conservation Officers in 2006 prompted a study of bear risks in the area. One of the recommendations that came from this study was that the college develop and install tail head signs on campus that educate trail users about bears and safe travel through bear habitat. By

educating the college community and other trail users, the authors of the bear risk assessment propose that the community may shift from demonstrating a 'frontier' mentality (bears are a resource that humans have an inherent right to exploit) to a bear safe management culture which aims to reduce human-wildlife conflict and promote co-existence.

To complete the course requirements for the Renewable Resources Management Program, I have chosen an independent study. This research project aims to determine the most effective messaging possible for educating the college community with trail signs. I will be questioning participants about their knowledge of bears and bear safety before and after viewing sample signage. You will be shown either written or graphic trail signage generated by the College's multimedia students and asked, through a series of simple questions, to describe what you have learned. The results of this study will be used to develop signs for the campus trail system.

Procedures:

Your participation should take approximately 5 minutes. Using a popular on-line survey tool (Survey Monkey), you will be asked questions about your background, such as languages spoken, your knowledge about bears and bear habitat and how often you use the campus trails. You will then be asked to look at an example of trail signage. Finally, you will be asked to answer a few more questions about what you learned from the signage. Your participation is both anonymous and confidential and you are welcome to withdraw from the process at any point.

Please feel free to ask any questions about the procedures and goals of the study and

your role as a participant

Potential Risks:

There are no known or anticipated risks to you by participating in this research.

Potential Benefits:

Your participation in this study will help Yukon College become a model bear smart community. Good trail signs help to educate trail users about the habitat they are travelling through and any potential risks they might face. We will use the information gathered in this survey to create appropriate signage for our shared trail system.

Compensation:

Thank you for your time. We would like to treat you to a coffee from the college bookstore. Please show them your coffee card when you go for your free coffee.

Confidentiality/Anonymity:

This is an anonymous survey. We will not ask you for any identifying information.

Right to withdraw:

Your participation is voluntary and you skip questions you don't want to answer.

You may withdraw from the survey for any reason, at any time without

explanation or penalty of any sort. Please click on the "withdraw" button at any time if you choose not to continue.

Whether you chose to participate or not will have no effect on your position

[e.g., employment, class standing, access to services] or how you will be treated

Follow up: (see consent guidelines Section 11)

Results of the study will be posted on the Yukon College website in the spring of 2016. All Yukon College students will receive notice at that time.

Questions or Concerns:

If you have any questions or concerns, please contact the researcher(s) using the

information at the top of page 1

Questions or Concerns about Ethical Conduct:

This project has been reviewed on ethical grounds by the Yukon College Research Ethics Board on [date]. Any questions regarding your rights or ethical concerns you may have as a participant may be addressed to the REB Chair by emailing ethics@yukoncollege.yk.ca.

Documenting Consent:

By completing and submitting the survey, your free and informed consent is implied and shows that you understand the above conditions of participation in this study.

Appendix 2: Bear Aware Survey

Questions

1. Are you a Yukon College:
    - Student
    - Staff
    - Other (visitor, researcher etc.)
2. Which language/s can you read fluently?
    - English
    - French
    - Other (please specifiy)
3. Do you have hiking experience in areas where wildlife live?
    - Yes
    - No
4. Do you use the trails behind the college?
    - Yes
    - No
    - I didn't know there were trails on campus
5. Please check all that apply
    - I have watched the "Being Safe in Bear Country" video
    - I have or have had a hunting license
    - I have read bear safety materials (brochures, flyers, booklets, etc.)
    - I have had a bear encounter (not including sightings)
    - I carry bear spray when I hike
    - I consider myself knowledgeable about bears because (comment)
6. I carry a smart phone and would consider using it at trail heads to access information about bears, bear safety and/or bear activity in the area.
    - Yes
    - no
7. How would you rate your knowledge of bear behaviour?
    - Excellent
    - Good
    - Fair
    - Not good, I need more info
8. How would you rate your knowledge of what bears eat?
    - Same scale as #7
9. Are you comfortable with your knowledge of how to stay safe around bears?
    - Yes, I am very comfortable
    - I would feel safer with more information
    - No, I avoid trail use because I'm afraid of bears

10. Do you know how to use bear spray?
    - Yes
    - No
    - I think I know, but now that you mention it, I could sure use a reminder
11. What is your birthday
    - Jan-Apr (gets directed to sample 1)
    - May – Aug (sample 2)
    - Sept – Dec (sample 3)

    Participant now sees the sample that relates to their birth month and is asked the following questions after viewing.

12. Please check all that apply:
    - Grizzly bears are larger than black bears and have a hump on their back
    - Black bears and grizzlies are the same except for colour
    - Black bears are larger than grizzly bears
    - Bears are not good climbers
    - Bears will eat human garbage if it is available
13. How would you rate your knowledge of bear behavior?
    - Excellent
    - Good
    - Fair
    - Not good
14. Please check all that apply:
    - Bears have a very limited diet and are picky eaters
    - Bears easily get used to eating human foods and garbage
    - Bears are vegetarians
    - Bears love the berries of mountain ash and soapberry
15. How would you rate your knowledge of what bears eat?
    - Excellent
    - Good
    - Fair
    - Not good
16. Do you feel more comfortable about using bear spray after seeing or reading the information in your sample?
    - Yes
    - No
    - Not really, I need more info

Sample content

Note that Sample 1 displayed images only, Sample 2 displayed pictures and text together and Sample 3 displayed text only.

Bear Behaviour

Grizzly bears have a hump over their front shoulder, which is muscle that makes them strong diggers. They also have long claws for digging and a wide, rounded face.

Black bears tend to be smaller than grizzly bears. They tend to have a straight facial profile. They do not have a hump like a grizzly's. They can be black, brown, blonde or even white, but are most often black.

Bears are smart and can figure out how to find what they need in almost any situation. They are strong and are very good problem solvers.

Bears, especially black bears, are excellent climbers. Black bears will tree their cubs to protect them.

Bears will eat garbage if it is available to them.

What Bears Eat

Bears eat many things, including berries and fruit. They love Mountain ash (Sorbus domestica) berries.

Soapberry (Sheperdia canadensis) is one of their favorite foods in the Yukon Territory.

This is a close up of a fruiting soapberry bush.

Bears can easily lose their fear of people and become accustomed to eating garbage if it is left unsecured.

Bear Safety

Bear spray should be carried somewhere that you can access it easily. A belt holster is a great way to do this.

When you are using bear spray hold and point it away from your body.

Point the bear spray canister towards the bear and aim for its eyes, nose and mouth. It works best at close range.

Appendix 3: Bear sign wording and content suggestions

Summary of comments/suggestions from 'the experts" on wording and content		
Ratings: + = important, ++ = very important, +++ = most important		
	Sara Nielsen - Parks Interpretive Planner	**Hillarie Zimmerman - Communications expert; 12 years experience w/ Parks**
Ecology		
Black & grizzly bears live in forested areas; grizzlies are better adapted to open, treeless habitats	"Black bears and grizzlies live and travel through this forest"	++ Target message to place and audience Same as Sara
Bears have large, overlapping, home ranges that change throughout the years and seasons	So what?	Too general, not relevant
Bear habitat and human habitat often overlap	Make active, more interesting	Incorporate into message 1
Bears, especially grizzlies, have a very slow reproductive rate	Make specific to this site	Make relevant or scrap
Denning occurs October – April (sometimes later in fall and earlier in spring); bears may emerge from their dens even during the winter months	Where? Does this affect me snow shoeing, hiking etc.?	Good for interpretive panel but not trail head sign Belongs in bear safety section
Diet = berries, horsetails, willow catkins, insects, roots, fish, ungulates, small mammals, human foods & waste; bears eat constantly throughout spring, summer and fall in order to survive winter and successfully reproduce.	What's an ungulate? Latter part more important. Links with habitat msg. "May not be aware of your presence" and smell curiosity	++"Bears eat a lot of things, including many plants you will see along this trail. Look around you and try to identify this plant…It is…and a favourite food of both black bears and grizzlies. Bears also eat human foods…"
Behavior & communication		
Grizzly & black bear ID (show profile or photos of each)	+ More important to learn defensive vs. non defensive behaviour of bears and appropriate reactions	++ "2 species of bear live here. They look different and sometimes behave differently. If you encounter a bear it may be important to know what kind of bear it is. Please scan the QR code here or visit wildwise.ca for more info about what to do in an encounter. Look closely at these profiles and prints to learn some of their physical differences." Grizzly bears are great diggers. The hump on their back is muscle that helps them dig and which makes it easy to tell them apart from black bears.

Bear behaviour is usually predictable (unlike human behaviour)	Bear behaviour is "often" predictable. Not sure what I think about this one.	Link to safety message or scrap
Bears communicate verbally and physically, with body language (swatting, biting, playing etc.), have social behavior much like humans and will treat humans the same way they treat other bears	++	Too much info
Excellent hearing & smell, eyesight similar to humans	++ "BUT" eyesight similar to humans	Scrap
Strong & versatile (can bend car doors, break through structures, dig, use tools, etc.)	++ Ex. Rip open coolers but can't figure out bear canisters	
Black bears tend to be more tolerant of humans and will tree cubs; grizzlies tend to use aggression when they feel threatened but are also able to climb	More tolerant "because they can tree cubs" Neat genetic history and theory of evolution in forest vs. open to support this message	
Bears are easily habituated to food sources & human made attractants & even humans. They will return to any area where they received a food reward.	++ works with "A fed bear is a dead bear"	
Bears are not always aware of their surroundings & may be surprised by an encounter	Image of bear absorbed in his iPhone	
Bears may defend a critical space (berry patch, carcass, den site) but are not territorial. Defensive behavior may appear aggressive but is most often a bluff.	++ Defensive vs. non defensive behavior	
Safety		
Know the trail and bear ID	Split into 2 different themes	Knowing the trail is not important for college trails
Check history of bear activity in the area if possible	++ bulletin board/wildlife sightings report	
Carry unexpired bear pepper spray and know how to use it; bear spray is the most effective non-lethal bear deterrent available	"How and when" to use it	++
Reduce the chance of attracting bears by securing food and other attractants (don't feed the bears); bears have a keen sense of smell and are smart enough to know how to find an easy meal.	"never feed a bear and keep a clean camp"	
Make noise, travel with others and keep dogs on a leash (they may chase a bear back to you or be seriously injured during a bear encounter)	++ Prevent encounters – let them know you're coming…be verbal…let them know what you are	++
Watch for bear signs and avoid areas where there are signs of recent activity; do not approach bears or stop	++ Pay attention! (IF ON TRAIL AHEAD OF YOU, GO BACK THE WAY YOU CAME OR MAKE A WIDE BERTH. NEVER	+ Make specific – tracks, poo…and then what? If you see a bear, stop etc.

to take photos on the trail; pay attention and keep moving if you see a bear	APPROACH A BEAR) – …THIS IS 3 MESSAGES. CONFUSING.	
Know the difference between a bluff and a predatory attack, make your presence known, retreat during a non-threatening bear encounter, defend your life during an attack, etc. etc.	+++ Bluff = defensive, predatory = non-defensive	
Report all encounters to the TIPP line.	+	
Other Comments	• USE ACTIVE VERBS. I.E.:'BEARS EAT' VS … 'ARE ALL GOOD HABITAT, …ARE FOUND HERE… • TOO MANY MESSAGES WILL DILUTE THE IMPORTANT ONES. NEED ONE STRONG THEME AND 3-5 sUPPORTING MSGS PER PANEL MAX. •	• Ecology messages are overly general • Divide behaviour & communication into physical & behavioural characteristics • Divide safety into prevention & action • Most behaviour messages should be linked to safety

Appendix 4: Survey and presentation consultations

Summary of comments and suggestions from consultations	
Source	**Comment/suggestion**
Presentation	Keep messages consistent with Environment Yukon/Parks/Staying Safe in Bear Country messaging
	Create a learning opportunity during orientation week (example: CO's could demonstrate bear spray use)
	Set up a kiosk at trailheads
	Expressed support for using QR codes on trail signs
	A permanent display inside the college may become ineffective when humans become habituated to it
Survey	I recommend including photographs of black and grizzly bears, mountain ash & soapberries , and how to use bear spray as part of the training and/or eventual signage/cell phone apps.
	Maybe could you mention that bear have a great sense of smell and can detect food left near campsite or other place from miles away!
	Like signs and information boards we see at trailheads in National Parks, it may be good to have signs to remind people that they are entering to bear country. So people will be more cautious and read information if they feel necessary.
	I think mountain biking through trails is most dangerous bearwise as you could easily surprise them. I think cyclists should have bells.
	On the topic of bear spray, somewhere you need to include it cannot be carried with you on a plane, and if you are carrying it in a passenger vehicle, you need to let people know. It needs to be secured in a container like a dry bag when you do not have it on your person.
	We're doing fine with our current materials, we're blowing this out of proportion.
	I would like more information on how bear spray works- specifically if it harms the bear in the long term? Does it cause blindness?
	I am in total opposition of learning how to 'attack' bears when they are living and walking in their own habitat and it is humans who have invaded their place. I would like to see more instruction about how to respect bears, what to do if they are in need, how to promote a respectful environment where humans and bears can live. Thanks.

	A little more information on bear behavior would be helpful. For example, how to determine if a bear is aggressive or not. I understand it might be difficult to depict something like that on a sign, but I think that would help people decide how to deal with a bear encounter.
	Details are not enough, average for "wake-up" from torpor, time when day /night when most active, details of hypophagia(?) fall eating frenzy, living with livestock and wildlife, this is great if you live in the city and maybe hike in groups of 5 plus, behavior needs much more detail...
	Put some random fun facts on the side "bears eat X calories per day (i can't remember the number)" something about bear torpor how they can still wake up
	Maybe make note of the danger in leaving food/garbage out? If there is any?
	You might want to mention wind direction when using bear spray as if used when the wind is blowing from behind the bear and towards yourself, you will actually spray yourself and not the bear!
	I personally think a combo of graphic/photo combined with simple wording would make a good combo for bear aware signs. Great idea for the college trails!

Appendix 5: Suggested text for trail signs

Trail head signs – focus on safety

Black bears and grizzlies live and travel through this forest. Please follow these simple steps to keep humans and bears safe while you are also in the area.

Prevention

- Pay attention. Bears can be quiet and hard to see. Tracks and poo are sure signs that there are bears in the area. (photos of both)
- Make noise. Let them know you're human and you're here. Talk, sing, clap and shout. It is safest to travel with other people.(cartoon image of people singing and a bear running away)
- Keep dogs on a leash. Even well trained dogs may chase a bear towards you.
- Never approach or feed a bear.

Action

- Be prepared. Did you remember your bear spray? Bear pepper spray is inexpensive, easy to use, non-lethal and may save your life if you have a negative encounter with a bear. Make sure your canister is not expired and know how to use it properly. (Consider using a bear spray use info-graphic)
- Please scan the QR code here or visit wildwise.ca to learn what to do if you encounter a bear. (The QR code could take the user to the WildWise or Environment Yukon bear pages and to translation options)
- Report sightings and encounters. (Provide TIPP line and CO services numbers and consider creating a trail monitoring system for the campus trails and QR code which provides updated info – must include a disclaimer "The following trail reports may help you plan safe travel in the area but do not guarantee your safety or predict current bear activity. Please report any sightings or encounters you have to _____ . The information you provide will help us understand patterns of bear activity in the area and…."

Interpretive signs – divide into 3-4 themed panels and place along designated interpretive trail

Bear ID

Two species of bear live here; black bears (*Ursus americanus*) and grizzlies (*Ursus arctos*). They look different and sometimes behave differently. If you encounter a bear it may be important to know what kind of bear it is. Look closely at these profiles and prints to learn some of their physical differences."

- I suggest using the information from EY's *How to stay safe in bear country* booklet (p. 4-5). Good info here, no need to recreate.
- Also…Grizzly bears are great diggers. The hump on their back is muscle that helps them dig for roots and other foods. It makes it easy to tell them apart from black bears.

Bear behavior

- Bears communicate vocally and with body language (swatting, biting, playing, aggression), just like humans. They are social animals and may treat humans the same way they treat other bears.
- Bears have excellent hearing & smell. They may know you are in the area long before you know they are. However, bears are busy animals and are not always aware of their surroundings. They may be surprised by an encounter.
- Bears are strong, capable and intelligent. They can break into cars, buildings and unsecured garbage containers and use tools to get what they need.
- Bears do not defend a territory but may defend their food or cubs. Defensive behavior may appear aggressive but is most often a bluff. Read *How to stay safe in bear country* to learn about what to do if a bear approaches you. (consider more specific messaging if room will allow, for example:
    - If you encounter a bear, back away slowly and quietly. If the bear charges it is probably bluffing. Talk to the bear in a calm voice and tell it you are leaving and use your bear spray if it gets within 30 ft. of you. You will want to run but don't. If the bear attacks to defend food or cubs lie down on your stomach and play dead until it leaves. If it attacks and is not defending food or cubs, fight back in any way you can. Aim for its eyes, nose and mouth.) – **This may be best placed on a bear safety panel**.
- Denning occurs October – April (sometimes later in fall and earlier in spring) but bears may emerge from their dens even during the winter months. Always be ready to encounter a bear when you travel in the Yukon wilderness.

Bear foods

- Bears eat a lot of things, including many plants you will see along this trail. Look around you and try to identify this plant…It is…and a favorite food of both black bears and grizzlies. (use photos of foods found along the trail, including soapberry and salmon)
- Bears will eat human foods if they are available. They quickly become used to being near humans and to eating un-natural foods, including garbage. (show picture of stomach contents from EY)
- Bears often return to an area if they receive a food reward, a situation which is dangerous for both bears and humans.

Human-bear systems

- Focus on the history of human-bear interaction in the area. This is an opportunity to work with people who have lived experience with bears and to incorporate TK. Clarke and Slocombe discuss the meaning and expression of respect for bears in First Nations culture. See references.
- Opportunity to discuss the evolutionary story of grizzlies vs. black bears (example: Grizzlies evolved in wide open habitats but have been forced out of most of these areas by humans and have learned to live in forests and other environments. They tend to stand on their hind legs to see what or who is coming, a strategy which works well on the prairies and not as well in the bush. They are shy but are also likely to defend their food and young aggressively because there is nowhere to hide in a flat, open environment. Black bears evolved in forested areas and will tree their young to keep them safe. They tend to be braver and more curious than grizzlies. More than 80% of reported encounters in and around Whitehorse are with black bears and fewer than 5% are with grizzlies.
- Opportunity to discuss the ecological services provided by bears (fertilization of riparian zone, seed dispersal, decomposition, regulation of prey species populations etc.) – needs more research than covered in this study.