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The Impacts of Climate Change on Tourism Operators, Trail Experience and Land Use Management in British Columbia's Backcountry

Courtney W. Mason [1,*] and Pate Neumann [2]

[1] Tourism Management/Natural Resource Science Departments, Thompson Rivers University, Annex N, Office 119, 805 TRU Way, Kamloops, BC V2C 0C8, Canada
[2] Tourism Management/Natural Resource Science Departments, Thompson Rivers University, Annex N, Office 121, 805 TRU Way, Kamloops, BC V2C 0C8, Canada
* Correspondence: cmason@tru.ca

Abstract: Climate change, natural resource industries, and an expanding outdoor tourism sector have recently increased access to sensitive backcountry environments in Western Canada. Trail managers are struggling to manage trail conditions with the mounting effects of smoke, dust, fire, flood, area closures, and beetle outbreaks in their regions. Outdoor recreation trail managers are linking these events and are thinking critically about the history and interconnectedness of land use management decisions in the province of British Columbia (BC). As the effects of climate change continue to challenge both trail managers and sport recreationists, guides and trail associations have been identified as key education facilitators in the development and dissemination of environmental consciousness. Guided by a community-based participatory research approach, this study used personal interviews with trail managers across the province to highlight how a connection with local ecosystems can develop a more robust land ethic for recreational trail user communities in BC.

Keywords: climate change; land use management; outdoor tourism and recreation; environmental education

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1. Introduction

Backcountry environments in the Western Canadian province of British Columbia (BC) are going through rapid and transformative change. Many of the changes to the temperate rain forests, glaciated peaks, alpine tundra, arid grasslands, and freshwater lakes and rivers that BC is world renowned for are a result of industrialized human activity in the province within the last one hundred and fifty years [1]. The provincial population of just over 5 million continues to increase and access to backcountry spaces for recreational purposes is being made easier through technological innovation and ongoing resource extraction road infrastructure development [2]. [1] Researchers assert that the anthropogenic pressures applied to the environment are also intensifying [4,5]. The growing number of recreationalists in BC is a concern among trail managers due to inadequate funding for trail maintenance, as well as insufficient capacity to manage existing trail infrastructure.

A changing climate is predicted to compound the environmental challenges facing land use managers across the province. Due to warming trends in weather conditions, visitation to the key recreation areas in mountain regions of Western Canada is expected to increase [2]. In addition to visitation, the impacts of climate change on tourism, sport, and recreation in the Canadian Rocky Mountain parks are also estimated to grow by up to 36% in the next 30 years [6]. While there are positive economic benefits to increased visitation due to a warming climate, the estimated response cost associated with climate change impacts in the province is 32 billion CAD, with a further 10 billion CAD to upgrade infrastructure to handle the associated environmental change [7]. These figures do not account for the socio-cultural losses residents of BC will experience as a result of climate change. An increase in

temperatures, lower snowpack amounts, and a longer warm weather season will extend the period of time that recreation trails are accessed. While the timing, availability, and demand for trail-based sport and recreation experiences are predicted to increase, research demonstrates that the visitor-related environmental pressures will become more severe with longer, drier, and hotter summers. According to a recent Environment and Climate Change Canada report, Canada is warming at a more rapid rate when compared to global averages [8]. This research indicates that the effects of increased warming will escalate the intensity and frequency of extreme temperature and precipitation events, such as floods, droughts, heat waves, electrical storms, and, of particular concern in BC, wildfires [9,10].

Due to the unpredictable nature and increased severity of climatic patterns, land use planning is becoming more crucial as the complex and far-reaching effects of climate change further exacerbate tensions between federal, provincial, and Indigenous governments, resource extraction industries, as well as trail managers and operators [11]. In order to support resilience and adapt to the detrimental effects of climate change in backcountry sport and recreation spaces of BC, a fundamental shift must take place in how natural resources are managed. In this study, we provide insight into how climate change is affecting outdoor recreational experiences on backcountry trails and we contend that education can foster an environmental consciousness among diverse trail users. The trail networks assessed in this study are considered multiuse, but most focus their attention on users who engage in hiking, skiing, and especially mountain biking.

There is a body of relevant literature on how outdoor recreation is being impacted by climate change [12–14], most of which is from the perspectives of visitor experience [15,16], but much less of this research is centered on how managers and decision-makers are adapting in their industries to these conditions. While there is also research on how resilience and adaptation to climate change are actioned on local scales, including in BC [17,18] and throughout Canada [19,20], there is very limited research on the impacts of environmental change on user experience that is specific to backcountry trail networks in BC. This study addresses both of these gaps in research.

In addition to identifying the pressing issues trail managers encounter in response to environmental change on backcountry trails, we assess the opportunities for user education and the socio-cultural shifts necessary to reduce the impacts that outdoor recreational experiences have on anthropogenic climate change. However, it is imperative to recognize that all backcountry recreational activities have a degree of transport-related emissions that need to be considered in the development of these critical perspectives on outdoor recreation and sport. In addition, it must be acknowledged that the impacts of climate change are first, and foremost, experienced by the diverse forms of wildlife whose only homes are within these ecosystems, and then by humans who are interconnected with these fragile backcountry ecosystems.

2. Materials and Methods

All aspects of this study were informed by community-based participatory research (CBPR). The CBPR framework is commonly used to examine complex, interrelated socio-cultural challenges [21,22], which suited the complicated nature of our study's examination of the adverse effects of land management approaches on local communities in BC. There are several key criteria to CBPR that were critical to this study: to promote active collaboration of participants in research; ensure the research process is community-driven and culturally appropriate; and to disseminate research in useful terms [23]. Conversations with the identified trail managers took place over several months prior to data collection to understand the main issues and concerns from their perspectives. The discussions with these trail managers revealed the most useful methods of data collection and guided the focus of the study. As one of the key aspects of CBPR frameworks is the input from participants to inform the development of research tools, this consultation shaped the interview questions. The interview guides were co-developed with participants to highlight questions they felt were relevant to the discussion about land use issues impacting recreational practices in

the province. Participants were also actively engaged in recruitment to foster a snowball sampling approach.

Our work relied heavily on community input to direct and shape the study questions and process, which aligns with calls from CBPR to foster a community-driven approach to research. We conducted 21 semi-structured interviews to maximize management perspectives with stakeholders who ranged from business owners, trail designers, and builders, to backcountry guides, government officials, and operations managers of numerous trail-based organizations across the province (see Appendix A). These participants were selected due to their historical and active roles in the management of local and regional recreational trail networks. The researchers directly recruited participants from different locations in the southern portions of the province (see Appendix B). Participants from all major provincial trail networks were included in this study and the researchers assert that the interviewees are representative of the recreational trail management community of mainland southern BC. Interviews were between 25 and 120 min in length and were carried out in person. The interviews were recorded and transcribed verbatim. The data were analyzed to denote common and divergent patterns related to the participants' perspectives. The authors each read through the transcripts multiple times using open coding and then discussed the categories to identify relevant sub-themes. This collaborative nature of transcript analysis and content validation helped establish the trustworthiness of the data [24]. The key themes included the following: (1) the challenges that climate change and increasing user demand pose for trail managers; (2) the educational opportunities facilitated by outdoor recreation experiences; and (3) the collaborative potential that more sustainable recreational practices have to foster better land use decisions and environmental consciousness. Verbatim interview transcriptions were provided to all interview participants to allow for edits before final themes were established and to ensure the accuracy and reliability of their words. While all interviewees were offered anonymity, they chose to be associated with their opinions and their names are therefore included below. Consent for their names to be attached to the data and used in the study further validated the research findings and supported open collaboration and transparency. After the completion of this project, each interviewee received a lay summary of the research findings to share with other stakeholders and community members. At the advisement of participants, these findings, driven by stakeholder perspectives, have been shared at community symposiums and continued to be discussed with regional outdoor sports and recreational clubs. Ethical approval for this study was received from a University Research Ethics Board (#101875).

3. Environmental Change and the Challenges for the Trail Management Community

Researchers continue to prove that climate warming is compounded by human activity [4,25]. [2] In BC, moderate projections indicate that in the next 30-year period, the average temperature will increase by 2.0–2.5 degrees over pre-industrial levels [27]. To put the significance of this into perspective, from 1900 to 2013, over a century, the average temperature in BC rose by only 1.4 degrees [28]. The rapid warming of the next three decades will result in further glacier melt that will increase flooding and drought events. A lengthened fire season is expected with warmer winters, less snowfall, and a rise in disease and beetle infestation of provincial forests [9]. Mountain ecosystems depend on fire for regeneration. However, forest fires were historically seen as a threat to human infrastructure and economies and were routinely suppressed. This has created dense forests rich with natural fuels that have been building up over time. The frequency and severity of forest fires in the mountainous regions of western Canada are projected to increase and it is predicted that the more severe threat of wildfire and increased beetle outbreak will result in a rise in resource extraction [4,29].

Within outdoor recreation and adventure tourism disciplines, the effects of climate change across the globe have been receiving significant attention [25,30–32]. The socio-economic, political, and cultural implications resulting from climate and environmental change are substantial. Within the context of backcountry trail use in BC, the impacts

of climate change on trail management are an under-studied topic. It is evident that throughout the province, trail managers, business owners, guides, government agencies, and trail users are experiencing new challenges. As discussed below by participants, flood, fire and smoke, drought and dust control, as well as beetle infestation, tough summer working conditions for trail crews and trail user travel habits have been identified as some of the most common barriers to overcome.

Tennessee Trent, Trails Manager with Recreation Sites and Trails BC (RSTBC), the organization responsible for the management of recreation trails on public land in the province, speaks about his experiences with a changing climate:

> I've been in this branch maybe six years now, and certainly in the last two years a difference I see. . .both years, have been a very heavy freshet where we're dealing with floods and we work with local government to declare states of emergency and they're fully preoccupied with sandbagging and evacuations and all that and then the fires start. (personal communication, 23 November 2018)

For the purposes of this study, we define a freshet as an increase in stream and river flow as a result of spring thaw, rapid melt due to warming temperatures, or heavy rainfall. In general, they occur in the spring as managers prepare to open up their trails after the winter season. In Trent's experience, the local communities who have declared a state of emergency are still dealing with flood mitigation efforts when the fire season begins. The window between snowmelt and freshet and the onset of forest fires is being reduced. The residents of Cache Creek, near Lillooet, can speak to this directly as the 2017 Elephant Hill fire began while the community was still recovering from spring flooding events. The resources that are being put toward emergency efforts further reduce the capacity of staff to focus on managing trails. Trent explains:

> We're a branch of the provincial government. . .the Ministry of Forest, and in the last two years there have been multi-billion-dollar efforts in forest firefighting and that's a huge draw on resources both in terms of operational dollars as well as person power. A number of our staff, justifiably, have been requested by the Wildfire Branch to go help out on fires in one way or another. . .which they do and we're glad to see them do it because those other provincial emergencies in both cases are in an all-hands-on-deck kind of situation. That again takes away from our ability to deliver our core mandate of managing public recreation on Crown land. (personal communication, 23 November 2018)

The 2017, 2018, 2021, and 2023 fire seasons were historic in BC. In 2017, more than 1.2 million hectares of land burned costing the province 649 million CAD in fire suppression efforts. As a result of the fires, 65,000 residents were evacuated from their homes [33]. It was the worst fire season the province had experienced in recorded history. In 2018, 1.3 million hectares were burned, with a cost of 615 million CAD, and 21,800 residents were displaced. In 2021, 1.4 million hectares were burned, with a cost of 718 million CAD and 32,882 residents were displaced [34]. Then, in 2023, the fire season miraculously surpassed all previous years: 1.6 hectares million burned with a cost of 770 million CAD and 33,000 residents were displaced [34]. When millions of hectares of land are burned in only a few seasons, trail managers are faced with difficult conditions in the aftermath. Trent explains:

> It's definitely impacted our management of trails in a number of ways. Of course, managing the actual emergency around a fire, managing danger tree assessment and management post-fire and other remediation efforts post-fire, whether it's cleaning up fire guards or roads that get built or areas where forest cover just drastically changes or the hydrologic cycle has drastically changed. We're seeing those kinds of things in many trail networks that we're managing around the province. (personal communication, 23 November 2018)

A change in the hydrologic cycle is a direct result of recent fires on the landscape. Water from spring runoff and intense rain events makes its way into rivers and streams more quickly with limited vegetation to help control flow [35]. Sutra Brett, technical trails specialist with the Shuswap Trails Alliance, indicates that the biggest challenge is knowing what to expect with such variable weather:

> So in the spring we get the wind storms and more rain and we have more water problems we fix, but within two weeks of that rain, the fires start and then you can't even go in to do the repairs, and. . .you know you get another wind storm and you say "sorry trees are down". You can't go in and cut them out because of the fires, it just throws a big wrench in the works. The climate stuff, it is different and it is random, what you get is bizarre and not the thing you'd expect. (personal communication, 29 November 2018)

Geoff Playfair, guide and trails activist with Tyax Adventures, a backcountry-based tour operator specializing in providing multi-day hiking, mountain biking, and trail running adventures in the South Chilcotin region of BC agrees with the above mentioned sentiments regarding the challenge of staying on top of maintenance after the fires begin. Both Brett and Playfair noted that the significant backcountry closures in the province in 2017 and 2018 made it increasingly challenging to complete necessary trail work. Once the fires begin and the area is closed, the opportunity is lost to complete planned work. Dale Douglas, owner and operator of Tyax Adventures, says that while they have lost the ability to maintain trails, it is the residents of BC who suffer by losing access to the backcountry (personal communication, 13 December 2018).

Once the fires are out and access is regained, significant work begins for trail managers. While in most cases one can rehabilitate a trail so it is useable again, the standing dead trees surrounding the trail are the greatest challenge. Inevitably they come down in the following wind storms and create excessive amounts of work for trail crews. Playfair observes that they are also a safety hazard for trail users:

> It's a scary place to go on a windy day because everything is coming down all around you. So if its 20 km of trail that burns over, the ongoing maintenance is intense. To keep up with the blowdown it would require a full-time crew with chainsaws being in there every day all summer, pretty much, or you send a crew in and literally cut everything down in one go. Most of the trees are danger trees because every one of them is burnt. That is a big deal that would be probably a $100,000 contract for BC Parks and they likely don't have the budget, so who is going to do that work? Or do you just shut down the trail? (personal communication, 30 November 2018)

While efforts can be made to clear blowdown off the trail, Brett is also experiencing changes in how water moves through the landscape after a fire. He identifies that the organic materials such as trees, shrubs, and roots that typically restrict the amount of sheet flow are gone. When the ground's ability to retain water is taken away, the trail tread surface becomes severely impacted by trail users. Brett states that it is challenging to preserve the quality and integrity of the trail tread until the plant species return to the area (personal communication, 29 November 2018).

While post-fire clean up requires immense resources, the smoke from the fires has also been a substantial concern among managers. Stewart Spooner, Trails Operations Manager for the Kootenay Columbia Trails Society, describes what is quickly becoming a common trend in the summer season:

> It seems like every summer now you get to the second week of August and you can't see anything, you're sucking in smoke. You know that poses all sorts of challenges but for the backcountry riding because it's a short season to start with, a significant part of that is poor air, you know smoky, that's an issue. (personal communication, 30 October 2018)

The smoke is also having a direct impact on bookings for trail-based tourism businesses. Matt Yaki, owner and operator of Wandering Wheels, a mountain bike guiding, tour, and vacation company based in Revelstoke BC, speaks to how the smoke is affecting his product offering:

> It doesn't really add to the experience, right? The customer experience is going downhill in that smoke. There has definitely been an impact... a fairly significant impact for us, especially in the lack of last-minute bookings. (personal communication, 5 December 2018)

According to Yaki, August is the busiest time of year for guided programs around Revelstoke. Tourists who are traveling to BC from out of province typically book their trips well in advance and some are not able to adjust their vacations on short notice due to the smoke. They arrive in Revelstoke and proceed with their vacation regardless, but they do not have the spectacular BC backcountry experience they are expecting.

Previous research found that the number of recreationalists is predicted to increase in regions of higher latitude due to warmer weather in the summer seasons [31,36]. However, what these studies do not address is the negative effects that forest fire smoke has on the travel habits or practices of sports and recreation participants. These impacts are being observed across the province by all trail managers interviewed. Trent explains:

> One of the other impacts from climate change and smoke is the news, people really do change their travel plans even if the emergency isn't what they understand it to be and they could perfectly go ahead with the holiday they planned, they just don't want to have to deal with the headache or the potential smoke or whatever else. So that's certainly something I've heard from operators. (personal communication, 23 November 2018)

Yaki has experienced the effects of lost bookings due to smoke firsthand and has been asking business owners, marketing organizations, and trail managers to work together and advertise the shoulder seasons, such as June, early July, September, and October to travelers planning a trip to BC. He explains his perspective further:

> August has always been dependable with weather and snow melt in the alpine, but we are now thinking that August is not as reliable as it once was because of the smoke. We all know that September is awesome but, the rest of the world doesn't necessarily know that. (personal communication, 5 December 2018)

As outlined, the smoke affects the trail user experience, but it also poses a health risk to both trail users and members of trail crews who are working throughout the summer to keep trails in optimal condition. Spooner describes concerns over his trail crew performing physical labor while the air quality is so poor. Generally, if the smoke is prevalent, crews start early in the day. Depending on the fire hazard, the crews must be shut down by 1 pm and maintain a fire watch for two consecutive hours to ensure they are not posing a threat. The poor working conditions and condensed window of opportunity to complete trail work further reduce the capacity of the trail crews.

While negotiating the smoke is difficult, the actual condition of backcountry trails themselves in extended periods of drought in combination with increased use is creating further management capacity challenges. Matt Hadley, trails technologist and professional trail builder with McElhanney Consulting shares his experience:

> The last two summers have been so incredibly dry that our trails have been starting to fall apart a whole lot more than they used to. (personal communication, 8 November 2018)

All of the trail managers consulted in this study have experienced an increase in the dusty trails throughout BC. Yaki states the dust typically is the worst in August and this adds to the challenging aspects of providing travelers with the unique BC backcountry experience that is being advertised in the marketing material. Instead, trail users are

breathing in smoke and dust. Not only does it ruin the experience, but it is a significant safety hazard for managers to contend with. In high-traffic frontcountry areas such as the Whistler Bike Park, trail managers have installed irrigation systems on the trails to ensure the trail tread retains enough moisture to handle the user volume and control dust. While this results in less work for the trail crew in general maintenance and upkeep, bike park managers have also seen a 50% reduction in the number of injuries on the trails since installing the system (M. Hadley, personal communication, 8 November 2018). This intervention may be feasible in frontcountry environments; however, it is not a realistic solution for backcountry trails. It is also recognized by managers that during periods of drought, using water to support recreation activities is problematic and not an appropriate use of resources (L. Wilson, personal communication, 16 November 2018).

Researchers found that drought and decreased precipitation also facilitate insect outbreaks [37]. The extent and distribution of bark beetle infestation can be intensified by warming temperatures. Evidence suggests that insects and diseases also increase carbon efflux from forest ecosystems, which further promotes the global rise in temperature. The large stands of beetle-kill trees across BC are a concern to trail managers. At Tyax Adventures, the business operates within the South Chilcotin Mountains Big Creek Provincial Park, and according to Playfair, the combination of pine beetle kill and human control of wildfire has left large stands of dry, densely populated forest:

> It is mostly dead pine and it hasn't burned yet. One lightning strike and then boom, away she goes. Those valleys are ripe for it and around Bear Paw Camp, same thing, hopefully the camp survives a fire but that is a narrow neck in the valley and it is kind of born to burn. (personal communication, 30 November 2018)

Dale Douglas, the owner of Tyax Adventures, believes the answer to protecting the infrastructure within the park lies in prescribed burns:

> We could do some controlled burns that would not only improve habitat for the grizzly bears because we'd get rid of the dense forest and get some fresh berry crops growing, it would also protect the park in the long run because you would have these fire breaks, it would protect the infrastructure of the park, and it would protect the infrastructure of the businesses in the park. (personal communication, 13 December 2018)

Trail managers are confronting multiple challenges as a result of changing climatic conditions. Challenges such as smoke, dust, fire, flood, area closures, and beetle outbreaks have all led to a reduction in bookings during peak season and they are further reducing the capacity to manage, maintain, and provide unique backcountry experiences to trail users.

4. Opportunities for Environmental Education and Sustainable Land Use Management

As climate change and resource extraction continue to challenge how recreationists access backcountry environments in BC, the experience and resulting connection trail users are making with local ecosystems is critical in the education of the greater population on the realities of climate change and the exploitation of natural resources. The solution is not simple, and the complicated relationships, both cultural and environmental, further obscure the matter.

Multiple trail managers have established the importance of building respectful use of our environment into our culture. A similar ideology has been discussed in academic literature since Aldo Leopold introduced the idea of a land ethic in his seminal 1949 publication: *A Sand County Almanac*. Leopold recognized that humans are not independent from their surrounding environments, and identified a lack of land ethic in society. A land ethic is described as a code of conduct that emerges from a recognition of the interconnectedness of the relationships between humans and their surrounding environments. In order to extend our personal ethics beyond our own self-interest, we must develop a relationship with the land. Herb Hammond, a forest ecologist and founder of the Silva Forest Founda-

tion, describes a similar kin-centric relationship between human beings and ecosystems where the components and processes of an ecosystem are seen as essential identities to be respected, not as resources to be exploited. Hammond spent his career developing the process of holistic management planning that he calls Ecosystem-Based Conservation Planning. He explains:

> It is built around two really important pieces. One, a hierarchy of relationships between economy, societies and ecosystems. If you start with ecosystems. . .consider economies as part of cultures, and if you respect that hierarchy, then you automatically do something different on the landscape where you live. (personal communication, 29 October 2018)

Hammond insists that land management is not simply the management of resources to be exploited, but rather it is the management of humans, our actions, and our footprint on the land that sustains us. Without the resources in the environment to support our population, we do not have a future. The significance of this is often lost. In the 1940s, Leopold identified that there is important societal education derived from time spent interacting with our surrounding outdoor environment. While these lessons are taking place right in front of us, the value of this outdoor education is not always recognized:

> Every farm woodland, in addition to yielding lumber, fuel, and posts, should provide its owner a liberal education. This crop of wisdom never fails, but it is not always harvested [38] (p. 77)

Leopold identifies a key element that needs to be present for social change to occur. It is crucial to develop a relationship with that which we want to preserve in order to truly respect it. He highlights "we only grieve for what we know" [38] (p. 52). If the residents of and visitors to BC who participate in recreational activities are not aware of what is going to be lost in the coming years due to climate change, they are less likely to take responsibility and adjust their personal actions to reduce the human impact on the environment. This exemplifies the educational opportunities that recreational trails provide to establish connections with regional environments and develop a sense of significant land ethic.

Trail managers identified that in order to build awareness, we need to start the process at the early stages of the education system. Playfair recognized that what led to his personal appreciation for his surrounding environment was outdoor education programs at school that are not as common in our current educational system. He sees an opportunity to rebuild a curriculum that highlights respectful use of our environment, or a land ethic:

> It certainly could start in school systems with outdoor clubs and sport and education programs. . .Whistler had a great one with one of the teachers who is now retired, doing outdoor education and building those skills. You know those sorts of things, if you could build that into our educational system at a basic level it would go a long way. (personal communication, 30 November 2018)

Similar to avalanche education programs that are being introduced in schools across BC, the opportunity exists to further develop outdoor educational programs that highlight leave-no-trace principles, sustainable trail use practices, and instill a respect for the environment that will sustain the economies and cultures of the future in BC.

Hammond also endorses the idea of early childhood education regarding a sustainable land ethic. He believes the political system needs to change, and the way to do that is through education (personal communication, 29 October 2018). Education can also take place on the trail. The business owners and guides interviewed during this research strongly believe that there needs to be more consistency and standardization among businesses that are providing recreation-based experiences in the province. There are significant opportunities for collaboration between trail managers, government officials, and the guiding community. Commercial businesses that operate on the land have the most to lose and therefore have added incentive to ensure respectful use of the land base by the general

public recreating in the backcountry. Brad Harrison, Executive Director of the Backcountry Lodges of BC Association (BLBCA) and chair of the Adventure Tourism Coalition, believes that in order for commercial operators to maintain access to certain regions with increased environmental regulation, they must demonstrate to government that we are part of the solution through our actions (personal communication, 9 November 2018). Harrison contends that part of that solution is in the education of trail users, specifically new trail users. Informing travelers of best practices and respectful travel principles will go a long way. Playfair of Tyax Adventures also reiterated this point. He states that when they hire staff, guides, camp hosts, pilots, and wranglers, each interaction with a trail user is identified as an opportunity to lead by example and demonstrate respectful use:

> When we hire staff, we make sure it's about going out to have an experience on the land that is respectful. And that is actually a conversation that we have as part of the staff training in the spring, getting everyone on that same page so it's a consistent message that goes out in campfire conversations in the evening. It is also a part of the upfront safety talk before heading out on the trip, is all around that whole sustainable riding piece and riding at 70% of your capabilities and it's not about ripping up the trail, you are not in a bike park, you are in a Provincial Park, and those are the pieces of conversation that need to be understood before we start. (personal communication, 30 November 2018)

Yaki added that the value of having responsible commercial operators on the land base extends past the opportunity for education. The invested interest of these operators helps keep the trails open, many of them contributing both financially and through hours of volunteer maintenance to the local trail associations. As emergency crews are further pressured by fire and flood, commercial operators are an additional layer of risk management. Playfair explains how the dissemination of responsible backcountry travel practices and preparedness benefits the industry as a whole:

> It is protecting the experience for people that we are guiding and working with the paying customers, it is helping them be more responsible and respectful of the trail, and in the long run, it is going to be good for everybody. (personal communication, 30 November 2018)

A standardization of industry training would ensure that guides, business owners, and trail managers advocate a consistent message. The recognition of sustainable trail use can be learned on the trail, and refined with cumulative experience.

When discussing user education, it is critical to highlight that BC is the most ethnically diverse province in Canada. Research indicates that 30% of the province's population base has immigrated from another country and many others are first-generation Canadians [39]. Adding to domestic demographic complexity, international tourism has steadily increased over the last decade [40] and the countries where tourists originate from have shifted greatly. For example, BC has become a significant destination for both Chinese and Indian visitors [40]. Both residents and tourists alike want to participate in the diverse outdoor recreational experiences that are becoming more accessible throughout the province. The notion of environmentally "respectful" trail use that many of the trail managers refer to is culturally specific. Environmental practices, and in general an environmental consciousness, vary immensely across nation-states and cultures. Around the globe, different cultures have their own views of how the environment and trails should be used and appreciated. In comparison to Euro-Canadians in BC, Indigenous peoples across the province have different and unique ways of conceptualizing their roles in ecosystems and their environmental practices [41]. It is important to recognize and situate the evolving demographics of trail users in education efforts throughout the province, which include various cultural, age, and gender components. It is also crucial to highlight that the trail managers consulted in this study represent limited perspectives when considering the increasing diversity of recreationalists accessing backcountry spaces in BC. For example, the participants in this study were primarily middle-aged, Euro-Canadian, and the majority were male. While this

demographic profile is representative of the current trail management community in the province, the provincial outdoor recreating population has a much greater representation of women, as well as a growing younger, more culturally diverse, and urban demographic compared to the trail managers consulted for this study [2]. For outdoor education programming to be effective, land managers must recognize these changing demographics and be proactive in sharing the best practices and trail etiquette unique to BC tourism operators, guides, trail managers, and associations as they have been identified as key facilitators in the development of any environmental consciousness.

5. The Role of Trail Managers and Tourism Operators in Sustainable Land Use Management

In order to practice culturally and ecologically sustainable land use, it is important to identify the ways in which the public has historically conceptualized environments in BC. The commodification of natural resources has provided notable economic value to the country and natural resource extraction has been focused entirely on economic gain at the expense of the environment. Studies have revealed that there is significant socio-economic value to local communities in a standing forest through the development of recreation trails and tourism infrastructure [11,42]. While the economic value of trails through a standing forest is proving to be significant, the ecosystem services provided by an intact forest are substantial [43]. Some of these services include flood control, shade resulting in the cooling of rivers and streams, water filtration by wetlands, carbon sequestration, and storage. Many of these ecosystem services are also a major factor in building the stability and resiliency needed to support biological diversity and minimize the impacts of climate change [44]. If humans were to design, engineer, and manage these same services to replace what the boreal forests in BC provide, the cost to do so would be astronomical [45].

Hammond believes a deep fundamental shift in the human value system is necessary to address the current state of land management in BC. He identifies two priorities: (1) to protect ecological integrity; and (2) to restore natural ecosystem composition, structure, and function (personal communication, 29 October 2018). This means providing protected land bases for all ecosystem users, both human and non-human. This is predicated on a more holistic approach to managing these resources and considering other values before simply pursuing extraction policies.

The trail managers interviewed throughout this research agreed that a cultural shift is necessary to rethink how we place value on our surrounding environment. However, precaution must be practiced in the way we use these ecosystems, especially from a recreational perspective. It may not be possible to satisfy all vested interests, but there has to be a willingness to compromise and make space for other values of the land. Trent describes the current perspectives of many user groups:

> A lot of groups or a lot of people don't like to hear "no," right? Even if there's a huge amount of rationalization behind that "no," they don't like to be told that so that's part of this culture that we're struggling with here. Overall, our trail strategy for BC says that we want to create world-class trails for all users and we do, right? But we can't do that for everyone everywhere either and, I guess, part of that is groups being willing to accommodate other, not just users, but other values out there. It might be that they have to give up snowmobiling in a valley around caribou or they have to give up mountain biking in a network near a community because of the Indigenous values in that forest or on those lands. (personal communication, 23 November 2018)

Phil McIntyre-Paul, the Executive Director of the Shuswap Trail Alliance in the interior of the province, believes that before we move forward, we need to first agree that we all have an impact on the environment. If we prioritize the idea that we have to maintain balance and reduce our impact, user groups may be more likely to compromise. He explains further:

> I take hope from all of this and I think we can really pull it off but, it will only work if we actually buy into the idea that we are not going to have a conversation about whether we have an impact on the landscape. We all have to start with the knowledge that we do. . .as soon as you take a step out of your vehicle, as soon as you get in your vehicle, you start the process of incurred impacts. . . we all have to agree on that. (personal communication, 22 November 2018)

McIntyre-Paul identifies the need to reconsider the values of user groups on the land base:

> I think the values we should be thinking about, they are using words like "together" like "reverence." I think these are words that we should be using more. "Enough" I think it is a word that we should be comfortable using in land management conversations. . .. (personal communication, 22 November 2018)

The backcountry cannot be viewed simply as the location in which we recreate, extract, or develop. Above all of these values, there needs to be the collective knowledge to recognize that ecosystems and the sum of their parts have complete control over economies, cultures, and livelihoods.

6. Collaborative Approaches That Support Sustainable Outdoor Recreational Practices

There are many contemporary challenges that have been presented to both trail managers and trail users due to climate change. In the mid-1990s, researchers projected that in order to navigate these challenges successfully, a collaborative approach to land and resource management must be taken to combine the resources of multiple stakeholders and solve a set of problems that may not otherwise be addressed individually [46]. While there are multiple stakeholders with overlapping interests on the land in BC, there appears to be a gross imbalance of power and control over management decisions that impact recreation managers and recreationists in the backcountry. Of the multiple stakeholder interests involved, none have the power to individually solve the set of problems that shape the current socio-political, environmental, and economic challenges being encountered. A collaborative approach is needed more than ever to move ahead with management solutions. This style of approach is not foreign to the managers who participated in this study. Harrison has been working on this strategy with his involvement with the Adventure Tourism Coalition. He sees the current constraints that land managers confront as a catalyst to work more effectively with both government and industry:

> You know, the one thing with these land management issues, and it is not just about wildlife, or industry, or tourism, it is everyone involved. It is going to force people to work together. I see a benefit in that. We are going to have to work with forestry and mining to maintain access, the public is going to have to work with commercial, and the government is going to have to work within their ministries in a more effective fashion. (personal communication, 9 November 2018)

Hammond emphasizes the importance of collaboration on a broader scale:

> Without collaboration and cooperation. . .the world is not going to survive if we don't learn how to do that. But learning how to do that means balancing the playing field too and that's a social responsibility of government. (personal communication, 29 October 2018)

While it might be an overwhelming process with multiple layers of government jurisdictions that are constantly changing, McIntyre-Paul believes a lot of the issues land managers are facing, such as the capacity to manage the current levels of outdoor recreation infrastructure in the province, can be tackled with leadership from local communities. He contends that trail managers and trail associations have to be creative to develop relationships with all current and potential users (personal communication, 22 November 2018). Establishing a set of principles to develop a mutual understanding of the process is fundamental to collaborative approaches to trail management of recreation experiences in the province.

7. Conclusions

As the effects of climate change continue to challenge both trail managers and trail users, collaborative land use planning is becoming increasingly important. Trail managers are struggling to cope with the effects of environmental change, the corresponding reductions in bookings during peak season, and the altered backcountry recreation plans. The compounding effects of climate change have further reduced the capacity of trail managers to maintain current levels of trail use and trail infrastructure. Some participants acknowledged that these environmental changes are a direct result of the last one hundred and fifty years of industrialization and consumptive land management practices that have shaped the province.

A critical challenge that managers encounter is to encourage more residents and visitors to BC to develop a connection to local and regional recreational lands that will not further exceed management capacity. As established above, this is essential to instigate collective action against climate change. How people value the environment is crucial to how they might respond to the impacts of climate change. A connection with local environments and ecosystems will develop a more robust land ethic for many residents of, and visitors to, the province. The potential that recreational experiences provide for education is notable. Even though the demographics of trail users in BC are changing, it must be acknowledged that the concept of environmentally "respectful" trail use that trail managers have defined in this study is inherently culturally specific. However, the lack of knowledge about the evolving demographics of diverse communities of trail users is not a sign of disrespect, but rather a difference in the cultural production of how sensitive backcountry trail environments could, and should, be used. This area of inquiry requires further research. Additionally, this study was limited to mainland BC. While we did have one interviewee from Haida Gwaii, future research should include more island and coastal trail networks. Studies that consider trail networks and manager perspectives should especially focus on Vancouver Island due to its significant population base, high levels of tourist visitation, and the notable size of the island's recreational trail networks. Furthermore, more research on interprovincial comparisons within Canada would provide valuable results in broader pan-Canadian contexts.

As discussed, early childhood education programs are a key opportunity to instill a comprehensive understanding of the environmental changes taking place in the province as well as the potential impacts of sustained recreational use. This issue further signifies the importance of land managers to maintain capacity on the backcountry trail infrastructure in BC as the shifting environmental conditions, driven by climate change, will exacerbate the current pressures on carrying capacity. In order to support management, there is a significant opportunity for collaboration between all levels of stakeholders who have an interest in backcountry environments in BC.

A fundamental principle established throughout this research is the need to shift away from the historical short-sighted decisions of past natural resource extraction policies that have been focused on economic gain at the expense of the environment. Instead, a holistic approach must be considered where the components and processes of an ecosystem are seen as essential identities to be respected, not only as resources to be exploited. The importance of putting ecological values ahead of self-interest is paramount when economies are viewed as a component of human cultures, and emphasize that human cultures are sustained by ecosystems. This can only be achieved by moving away from current industrial approaches to resource and recreation management to preserve the integrity of the ecosystems that represent our homes, our cultures, and the livelihoods of future generations.

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Appendix A. List of Interview Participants

Lyle Wilson	Owner/Operator Nipika Mountain Resort	Invermere, BC
Michael Roycroft	Area Manager for Specialized Facilities and Trails	Canmore, AB
Stewart Spooner	Kootenay Columbia Trails Society	Rossland, BC
Martin Littlejohn	Executive Director of the Western Canadian Mountain Bike Tourism Association	Vancouver, BC
Herb Hammond	Forest Ecologist, Silva Forest Foundation	Slocan Park, BC
Matt Hadley	Trails Technologist, McElhanney Consulting	Canmore, AB
AJ Strawson	Executive Director of the International Mountain Bike Association—Canadian Chapter	Squamish, BC
Brad Harrison	Executive Director of the Backcountry Lodges of BC Association, Chair of the Adventure Tourism Coalition.	Kamloops, BC
Ted Morton	Owner, BC Enduro Series, Revelstoke 3 Day Heli Assisted mountain bike race	Kamloops, BC
Aaron Cooperman	Owner, Sol Mountain Lodge	Clearwater, BC
Lisa White	Tourism business owner, activist, Haida Gwaii Land Protectors	Old Masset, BC
Matt Yaki	Owner, Wandering Wheels Mountain Bike guiding company	Revelstoke, BC
Tennessee Trent	Trails Manager, Recreation Sites and Trails BC	Nelson, BC
Phil McIntyre-Paul	Executive Director, Shuswap Trail Alliance	Salmon Arm, BC
Naheed Henderson	Director of Communications, Tyax Adventures	Pemberton, BC
Tom Eustash	Maintenance Manager, Simpcw First Nation	Chu Chua, BC
Sutra Brent	Sustainable Trails Specialist, Shuswap Trails Alliance	Salmon Arm, BC
Geoff Playfair	Guide, Tyax Adventures	Lillooet, BC
Karen Playfair	Finance and Operations, Tyax Adventures, LORCA	Lillooet, BC
Dave Butler	CMH Director of Sustainability	Cranbrook, BC
Dale Douglas	Owner/Operator Tyax Adventures	Pemberton, BC

Appendix B. Map of Study Area

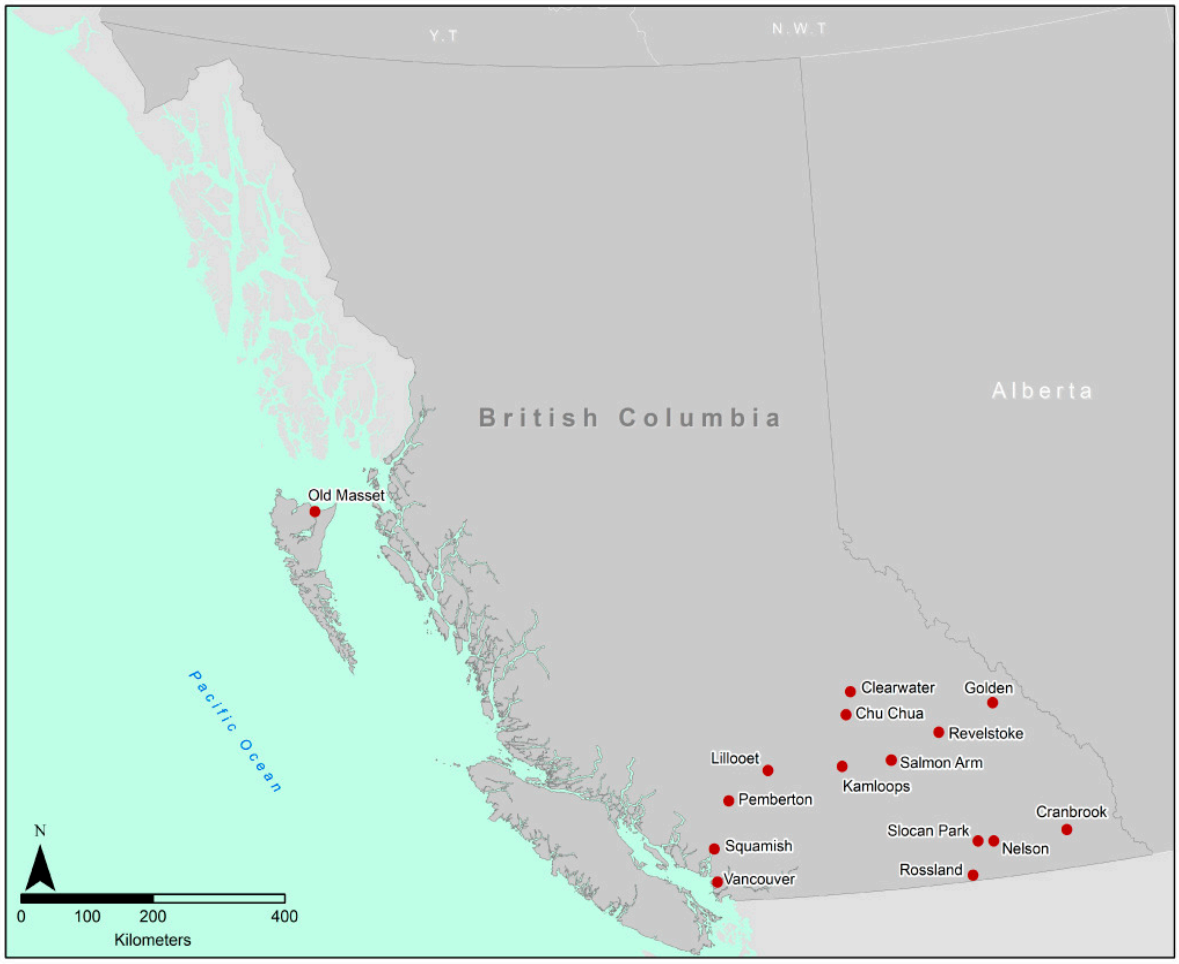

Figure A1. Map by Olea Vandermale.

Notes

[1] Trail design and management research suggests that there are not standardized definitions for what constitutes the backcountry. In this study, backcountry trails are defined as naturally surfaced, multi-use trails, signed and maintained, and that travel through remote alpine, subalpine, and forested regions. Typically, these trails require more planning to access and exist outside of municipal city limits. In contrast, frontcountry trails are defined as easily accessed, heavily managed networks of trails, close to communities that require limited planning, are high-use, and have well-established trail infrastructure, signage and maintenance [3].

[2] The extreme climatic events occurring in BC are more than just regular variation in weather. It is important to distinguish between weather and climate. Weather is the day-to-day state of the atmosphere and it can be predicted to fluctuate within spatial and temporal scale, whereas climate is how the atmosphere behaves over an extended period of time, and this takes long-term variations of weather into account [26].

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