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Weather Awareness: On the Lookout for Wildfire in the Canadian Rocky Mountains

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Mountains are crucial places in which to observe, experience, and learn about rapid weather and climate shifts, felt to varying degrees in different contexts. Fire lookout observers, immersed in the mountain environments of Alberta, Canada, for 5 to 6 months of the year, many of them returning to the same place for over 3 decades, have a distinctive and little-studied perspective on weather experience and how seasonal changes, sudden weather shifts, and subtle weather irregularities are experienced first-hand in alpine regions. Drawing on recent fieldwork in the Canadian Rocky Mountains, this article sheds light on fire lookout observers' awareness of mountain weather in their everyday lived experience and in their observations of wildfires as severe weather events. A focus on wildfire smoke as one way of experiencing wildfires allows us to touch on the implications of smoke dispersal for communities near to and far from wildfires.

Keywords: *Canadian Rocky Mountains; wildfires; fires; smoke; fire lookout observers; weather awareness; visibility; extreme weather events.*

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Introduction

Scenic viewpoints and lookouts are historically and cross-culturally significant vantage points for watching the movement of people and events. Mountains are especially good observation points for watching the movement of weather on the land and in the sky, as Miyata (1987) illustrated for Japanese folk practices throughout history; they offer an immersive setting for experiencing fast-changing weather. The prominent mountains along the front ranges of the Rocky Mountains, which also define the western border of the province of Alberta, Canada, create natural vantage points for several mountain fire lookouts. These, together with lookout towers (20–120 feet tall; 6–26 m tall) spread across the province, form a network of 127 fire lookouts.

Central to Alberta's fixed fire detection system, lookout observers are tasked with spotting lightning strikes and the early detection of smoke plumes that may signal the start of a wildfire within their 40 km^2 area of responsibility. The fixed detection system is complemented by a mobile detection system of helicopter and ground patrols that scan areas lookout observers cannot see due to topographical barriers. While many countries with wildfire risk have historically relied on lookout observers as key players in early wildfire detection, this form of fixed detection is increasingly rare, because it is costly to maintain and upgrade lookout sites to current health and safety standards. Many lookout observers have been replaced with remote cameras, surveilled on computer screens in city offices. Not only does this lead to the loss of significant expertise and a unique way of life, but detection by camera is reported to be slower and less reliable (Walsh 2016).

Of course, some fires are left to burn. Fire plays a vital role in the ecological health of the circumpolar boreal forest, of which Canada's boreal forest makes up a third. The importance of fire as an inherent and necessary disturbance is widely recognized and incorporated into Alberta wildfire management through the use of prescribed burning (intentional burning in an attempt to mimic historic burn patterns and reduce fuel loads) and decisions to let certain fires burn when communities and other valuable resources (eg parks and protected areas and industrial sites) are not in jeopardy. This paper, however, addresses situations in which early detection and immediate suppression of fire are the primary management objectives.

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Weather as experience

Increasing attention is being paid to extreme weather events in the midst of rapid directional climate change, yet such research is sometimes said to be too distant from everyday lived realities (Ingold 2014; Neimanis and Walker 2014; Hulme 2016), failing to address how weather is felt, sensed, and engaged with in the very bodies of those experiencing it. Schultz and Janković (2014: 157) suggested that "fixing the planet often receives more emphasis than being resilient to individual weather events." Emerging research on everyday weather experience attempts to capture the immediate and mundane quality of weather (de La Soudière 1999; Strauss and Orlove 2003; Ingold 2005, 2010, 2011; Hsu and Low 2008; de Vet 2013; Streever 2016). Weather (short-term atmospheric conditions) can be distinguished from climate (longer-term atmospheric conditions). Yet, cross-cultural accounts of daily weather experience show that this distinction is often blurred (Strauss and Orlove 2003). Everyday experiences of atmospheric phenomena thus offer clues to understanding the immediacy of weather and the longer-term ramifications of climate. In this paper, we explore how weather is experienced by lookout observers in their everyday practices and how this contributes to identifying weather irregularities. We focus on wildfires as an extreme event experienced predominantly as smoke.

The dispersal of smoke through the air by wildfires makes them environmental events that typically have an effect beyond their local domain (Ogilvie and Palsson 2003: 51). Air quality degraded by wildfire smoke can occur as far as 835 km away from a fire (Sapkota et al 2005), placing many people at risk beyond the fire's initial extent. Wildfire smoke includes particulate matter, a cause of respiratory problems (Wegesser et al 2009) and a contributor to elevated atmospheric aerosol levels significant to global warming (Steffen et al 2015). Wildfires in the Rocky Mountains are predicted to become larger, more frequent, and more intense (Funk et al 2014; Pronto 2016). While such predictions point in part to climate change as a cause, other factors, notably the exclusion of fire from landscapes where burning was historically practiced as forest management by indigenous peoples (Pyne 1997; Stewart 2002), have led to a change in fuel composition in forests, also significantly affecting fire size and intensity (Arthur 2013).

In 2015, when this study took place, several very large fires—and the smoke they produced—made news around the globe, particularly in Indonesia, Siberia, and western North America. The Indonesian peat fires (June–October) released a tremendous amount of carbon dioxide (CO_2). Calculating carbon emissions depends on a series of complex factors (Konecny et al 2015), but the fires are thought to have released 1.75 billion metric tons of CO_2 equivalent daily, which is more than the entire US industrial economy (Global Fire Emissions Database 2015). Communities across the Indonesian archipelago could not see the sun for months. Thick smoke and haze from the peat fires drifted north, covering large swaths of Southeast Asia and causing significant health problems, provoking protests in Malaysia, Singapore, and Thailand. In Siberia, where ravaging fires killed 30 people and displaced upwards of 4600, strong winds pushed wildfire smoke across the Pacific Ocean into the American Pacific Northwest (Siberian Times 2015). In the United States, smoke from the Okanogan fire in Washington State reduced visibility in the surrounding areas to <1 km for 5 days, as is discussed in more detail later in this article.

Study area and fieldwork

The research reported here was part of a longer-term interdisciplinary study at the confluence of philosophy (phenomenology), anthropology, and meteorology, in turn inspired by fieldwork with the Mountain Legacy Project (http://mountainlegacy.ca/) in the Canadian mountain landscape. The Mountain Legacy Project compares a vast collection of historical survey photographs from mountain peaks to new images taken from exactly the same locations (MacLaren et al 2005; Trant et al 2015). It was during fieldwork in 2014 along the front ranges of the Alberta Rocky Mountains that the idea to study the weather knowledge of mountain fire lookout staff emerged.

In summer 2015, along with Mary Sanseverino, one of us (K.A.W.) visited 13 mountain fire lookouts and 1 fire lookout tower located along the eastern slopes of the Alberta Rocky Mountains from Grand Cache in the north to Waterton Lakes National Park (along the border with the United States) in the south (113°39′36″–119°12′36″W; 49°0′0″–53°58′12″N), as shown in Figure 1. This geographical area was chosen for its concentration of veteran lookout observers and mountain lookouts. Lookouts are accessible by helicopter or on foot, and the latter method was used. Different terrains were traversed, from subalpine meadows to rocky outcrops and well-trodden hiking trails. The hikes ranged from 7 to 20 km round trip, averaging 15 km. Hiking (Figure 2), as a complementary research method, aligns with the recent social science methodological practice of walking (Lund 2005; Ingold and Vergunst 2008; Lund and Lorimer 2008; Smith 2014). Hiking into the lookouts allowed the weather of the day to be observed and provided a sense of the surrounding environment, its geological and hydrological features, and its flora and fauna. It allowed more time to adjust to the elevation gain; walking through the landscape, instead of peering down from the aerial vantage point of a helicopter, offered a different perspective on, and more solid sense of, each lookout observer's area of responsibility.

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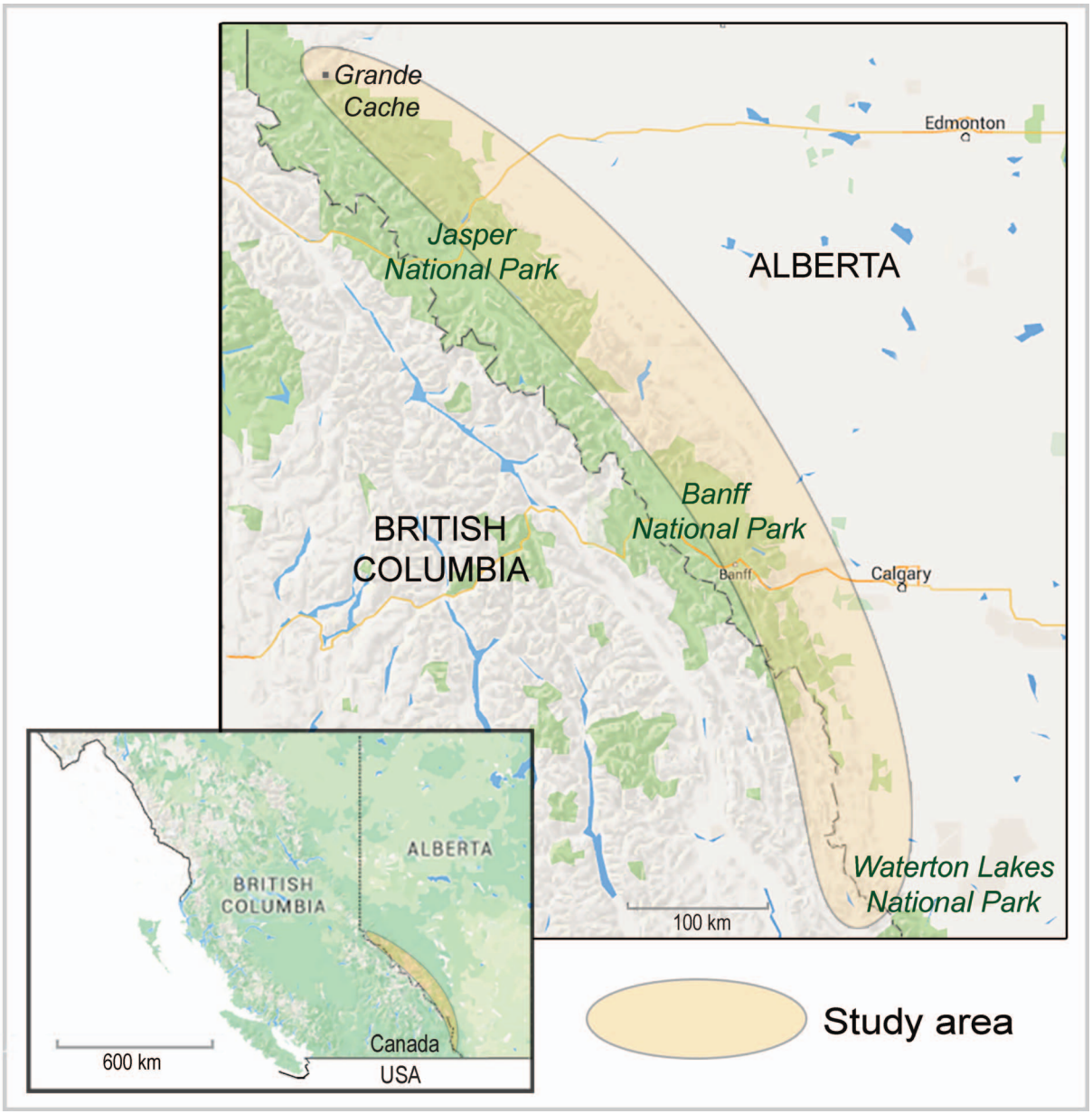
FIGURE 1 Map of the study area in detail and context. This map outlines the study area along the eastern slopes of the Alberta Rocky Mountains from Grand Cache in the north to Waterton Lakes National Park (along the border with the United States) in the south (113°39′36″–119°12′36″W; 49°0′0″–53°58′12″N). (Base map data © 2016 Google; map by Mary Sanseverino)



One of us (K.A.W.) conducted open-ended, semistructured interviews with lookout veterans with 20 years of experience or more ($n = 10$), with lookouts who had less than 20 years of experience ($n = 4$), and with retired lookouts ($n = 2$). In total, 4 to 5 hours were spent at each lookout, where informal conversations, photo elicitation, and participant observation complemented the interviews. Two weeks of additional participant observation (Dewalt and Dewalt 2011) was conducted at 2 lookouts at the end of the field season. Living at the lookout, one of us (K.A.W.) adopted the role of an apprentice, observing and participating in daily lookout practices and watching different weather unfold, to understand the broader context and situate the interviews within it. Walking, as a contemplative research method, continued beyond the field research and into the analysis stage; analysis was conducted while walking and listening to the interviews multiple times prior to transcribing them, a process called ambulant listening (Walsh 2016).

Air awareness: eyes in the sky and on the land

Despite living in relative remoteness for 5 to 6 months at their postings, lookout observers form a community of

FIGURE 2 Hiking through subalpine terrain, southern Rocky Mountains, July 2015. (Photo by Mary Sanseverino, University of Victoria)

practice (Wenger 1998; Grasseni 2009) through regular communication by radio and telephone, shared competencies, and common practices of looking for fire and communicating the weather. Thus, while most lookout observers live alone at their lookouts, occasionally accompanied by a companion (human or pet), their experiences can be understood as part of a larger social group.

Although lookout observers' first priority is to look for wildfires, they constantly monitor the weather for their twice-daily observations, which record wind speed and direction, precipitation, relative humidity, temperature, and sky conditions (cloud types and formations). These measurements are used to calculate fire weather indices, notably fire danger levels. While they remain alert to signs of extreme weather events, lookout observers' routines are intimately bound up in the everyday weather unfolding in the mountains. Weather is something that is sensed, felt, and inherent in their work. Lookout observers are particularly attentive to fire weather: "conditions that influence fire ignition, behavior or suppression" (Whiteman 2000: 242). An ability to feel humidity on their skin before incoming precipitation, or sense dryness in their eyes and throat as winds dry out valley grasses and forest duff, are just a couple of examples of how lookout observers come to feel fire weather in their bodies.

Discernment: the practice of looking

Lookout observers must have excellent eyesight, a strong ability to see colors, and a good sense of depth perception, critical to distinguishing smoke size and color from other weather phenomena such as ground fog, road dust, or pollen clouds that may appear as false smoke or "spooks." Lookout observers systematically scan their areas (one such area is shown in Figure 3) for

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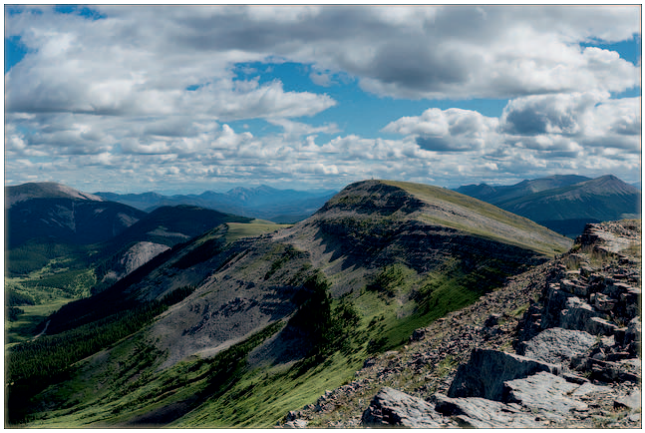
FIGURE 3 View south from a mountain lookout, in the southern Rocky Mountains, July 2015. Lookouts vary tremendously, each with its own unique weather pocket and views. (Photo by Mary Sanseverino, University of Victoria)



smoke—initially with the naked eye, and only using binoculars to check suspicious areas. As one observer (Sulphur Lookout, 2015) described his role: "We pay attention to inattentiveness."

Other phenomena, notably phenological indicators, also draw the attention of lookout observers: Different grass stages through the seasons, with their different colors, and the progression of trees from budding to leaf-out and leaf fall, have different implications for fire danger. The timing of wildflowers and the movement of migrating and resident animals also contribute broader understanding of seasonal change at the lookout and a sense of stewardship. The importance of phenological knowledge—an understanding of the seasonal timing of phenomena—has long been recognized as an important component of traditional ecological knowledge among indigenous peoples and long-time residents of place (Turner and Lantz 2003), as lookout observers have become in these mountain ranges.

Lookout observers are attuned to clouds that may give a fleeting indication of an important weather shift, incoming precipitation that could put out a fire or fill a rain barrel, and high winds that might exacerbate a fire. They are particularly attentive to movement in the air—smoke or lightning that may signal the start of a forest fire, as well as phenomena that may obstruct views of their area of responsibility.

Visibility is of utmost importance, determining how far lookout observers can see from their vantage point. Various forms of precipitation carried in on the wind—drizzle, rain, hail, and snow—are reported by lookout observers as "obstructions to vision." Haze, fog, and smoke impact visibility the most, constantly changing how far lookouts can see, as well as how they see things. The angle of the sun relative to the lookout observers' line of sight, and the degree of light reflection also affect their ability to see smoke, which may stand out or disappear, depending on the background. There are occasions when a lookout observer's visibility is entirely obscured, leading to what are called "socked-in" conditions.

An intimate relationship with weather

For fire lookout observers, disciplined watching is a daily systematic practice (Mauss 1934; Bourdieu 1972; Grasseni 2004) bound up in the fluxes and flows of weather. Reflections on everyday phenomena articulate the relationship between local experience and wider shared acknowledgement of weather. One lookout observer described it like this:

> *I lay thinking last night about the topic. . . I think I have a hard time separating weather from myself. I drank the rain water. . ., I drank the weather. I think these are the feelings that stick with me—being right in the sky—seeing the hugeness of it, being in its flow around the globe, bathing, breathing, drinking dust from distant deserts, volcanoes, nuclear disasters, pollen clouds swirling in the heat. (Botany Lookout, 2015)*

These remarks are consistent with views of anthropologists such as Tim Ingold about the experience of weather: "We inhabit our environment: we are a part of it; and through this practice of habitation it becomes part of us too" (Ingold 2011: 95). Lookout observers refer to their relationship with the weather as an intimate one and readily accept—in stark contrast to mainstream Canadian society, one might argue—being "ruled," "bossed," or "humbled" by the ambiguity of the weather. Although lookout observers were hesitant to identify specific weather pattern changes resulting from climate variability or climate change, most attested that weather patterns are increasingly unpredictable and unreliable (Powder and Ranger Lookouts, 2015); many acknowledged a reduction in the spring snowpack and hotter, drier summers—and thus, longer fire seasons. Nearly all lookout observers also spoke of the increased number and intensity of wildfires. They spoke of weather irregularities or "weird weather," much like the perception of "strange weather" that anthropologist Sarah Strauss (Strauss and Orlove 2003) noted for the Swiss mountains. Long-time residency of mountain places and daily attention to its weather in their professional tasks and daily lives have, perhaps, given lookout observers good grounds to signal some of these recent irregularities.

Weird weather

A prominent weather anomaly was the 2013 flooding of Alberta's Bow and Elbow Rivers within the reach of several mountain lookouts. It followed an earlier 2005 flood, said to be a "once in a century event" (Powder Lookout, 2015). In 2013, depending on the geographic location, 200–270 mm of rain fell over 3 days (Environment Canada 2013). Communities were evacuated, including many neighborhoods in the city of Calgary, and highways and

roads were washed out. At mountain fire lookouts, rain gauges overflowed, hillsides eroded, visibility was zero, and rain thrashed the cabins, making for what was described by some lookout observers as a "real auditory event."

So much snow fell in September 2014 that local people called it Snowtember. Over 3 days, 28 cm of snow fell at the Calgary airport, and 40–45 cm fell in the western parts of the city (Environment Canada 2014), and just as much at nearby mountain lookouts, shutting them down for the season. The snowfall was the highest September deposit before the autumn equinox in 130 years of weather records (Environment Canada 2014).

Alongside increasingly unpredictable precipitation patterns in the Rocky Mountains, a mountain pine beetle (*Dendroctonus ponderosae*) outbreak, aided by warmer winter temperatures, has changed forested ecosystems across much of the boreal region of Canada, including sections of the eastern slopes of the Rocky Mountains. One lookout observer saw a cloud of mountain pine beetles fly through her lookout area the day before our interview. While efforts were made in the province of Alberta to reduce the insect's impact by burning and clearing damaged trees, this has left a visible patchwork of dead or cleared trees (*Pinus* spp) across the landscape, which has led to emerging or novel ecological conditions (Nealis and Peter 2008; Nealis and Cooke 2014). A notable change in local weather (warmer temperatures and increased winds) at some lookouts within proximity to these patchworks was also mentioned.

An especially strange year

In 2015, the weather was affected by the El Niño climate pattern, which brings warmer, wetter weather to the northern Pacific coast and drier, hotter conditions along the eastern slopes of the Rocky Mountains in Alberta. It was referred to by some lookout observers as a "weird season." Observers were reminded to take extra care to drink lots of water, as the risk of dehydration—always present at high elevations—was stronger in this dry season. With less snowmelt in the spring, and less precipitation throughout the spring and summer, lookout observers could not collect as much water, and the helicopter deliveries of drinking water, food, and other supplies (which arrived every 3 weeks) had to deliver wash water as well.

Less snow cover in the spring also meant an earlier start to fire season, with many lookouts opening 3 weeks early. One lookout observer could not build a snow slide for her grandchildren, who eagerly anticipate this event every spring. In the absence of the usual May blizzard, another lookout planted her garden a month early. Two tornadoes also touched down in the Alberta foothills, in July and August. Tornadoes are a relatively rare, but increasingly frequent phenomenon in the region (Hume 2008). On a few occasions throughout the summer, lookout observers experienced "cross-over" conditions, when the relative humidity (a percentage) dipped below the temperature (in degrees Celsius). Under those conditions, the fire danger reaches the highest level, forest fuels are said to burn like "matchsticks" (Sulphur Lookout, 2015), and fires can "take off in a matter of minutes" (Snowy Lookout, 2015).

Up in smoke

Perhaps the strangest weather event of the summer for lookout observers was when they were engulfed in smoke for 5 days in August 2015 with 0–1 km visibility from the large Okanogan Complex fire burning in Washington State, across the US-Canadian border (Figure 4). Considered an extreme weather event from the lookout observer perspective, this was the longest recorded stretch in 35 years of severely limited visibility due to smoke haze along the eastern slopes. Lookout observers, as well as inhabitants of nearby valley communities, were advised to stay indoors and refrain from outdoor physical exercise that would tax the lungs. Indeed, Alberta Health Services issued an air-quality advisory for most of the province (from the US border to Edmonton).

This smoke event occurred when K.A.W. was conducting participant observation for this research. During hikes up and down from the valley below, the smoke could be felt on the mountaintop and down in the valley. Hiking more slowly than usual, fewer hikers were noticed on a normally busy trail. At the lookout, birds and animals were nowhere to be seen, and the forest seemed quieter than usual. A certain anxiety resonated among the lookouts: Weather conditions heightened the fire danger, and thus the probability that a small spark could develop into a wildfire—but lookout observers could see little beyond the lookout itself. The smoke obscured their view and confined them indoors. The sun was obscured until the fourth day, when a small orange dot poked through the purple-gray haze. On the fifth day, winds started to clear the smoke away, and the lookout surroundings became increasingly visible. The August 2015 smoke event is one example of the potential for widespread dispersal of smoke from large wildfires, which are predicted to burn with increased frequency and intensity around the world due to hotter, drier, and longer summers (Funk et al 2014), and the added air-quality health risks that accompany them, particularly for nearby mountain valley communities.

Conclusion

Extreme weather events pose increasing threats to mountain communities (Kohler and Maselli 2009), intensifying the already erratic and challenging quality of mountain weather. Wildfires are one example of such

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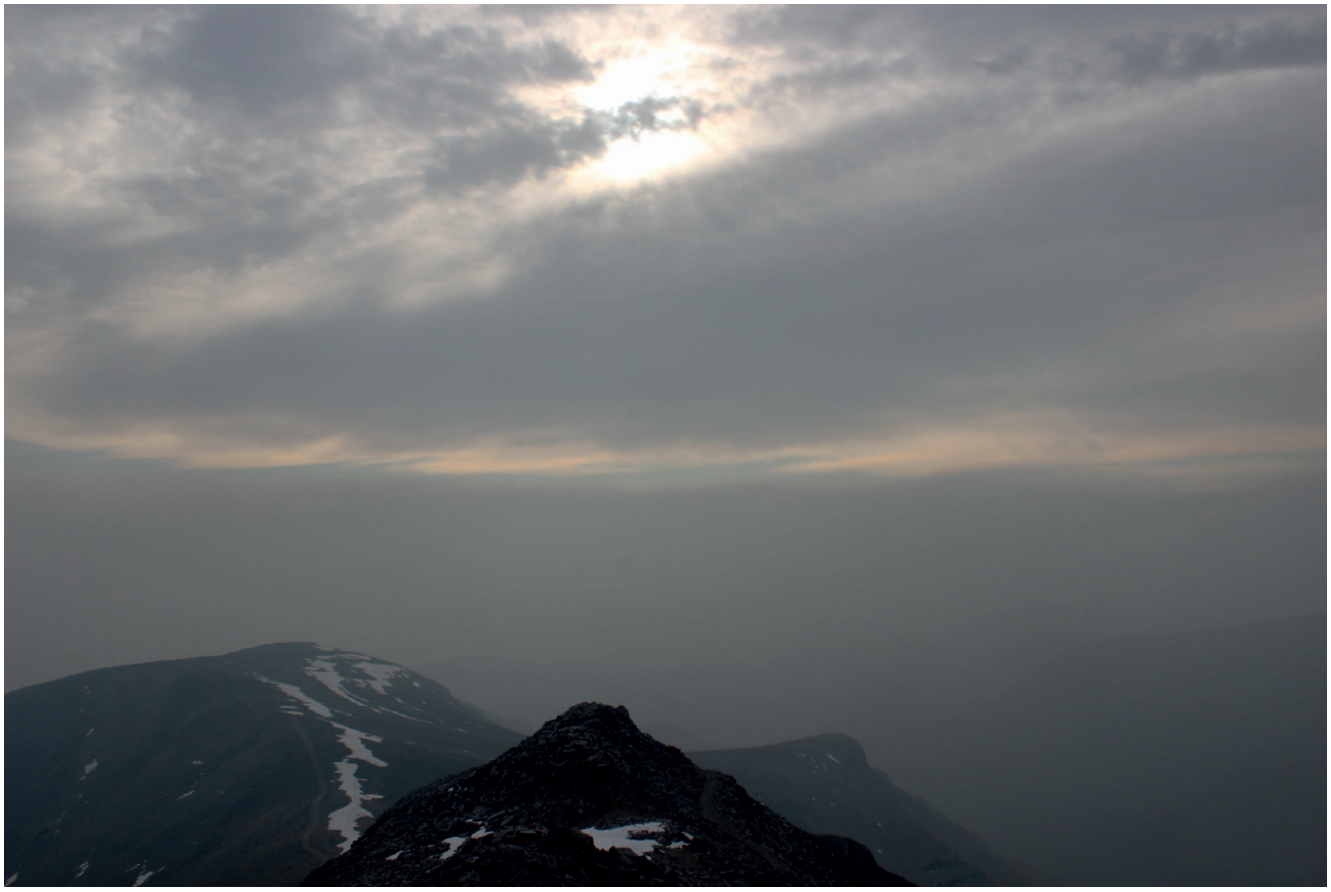
FIGURE 4 View from a mountain lookout with visibility reduced to 1 km by wildfire smoke from Washington State Okanogan fire, August 2015. (Photo by Kristen Walsh, University of Victoria)



events. Lookout observers offer a unique perspective on wildfires, experienced predominantly as smoke. This experience extends to communities in the mountains and beyond who might similarly experience wildfires at a distance, and it contributes to thinking about experience at the periphery of wildfires, and extreme weather events more broadly.

As part of staffed mountaintop observatories, lookout observers are keen watchers of changing weather and climate patterns. Alberta is one of the last jurisdictions in North America—and in the world—to broadly deploy well-trained observers to live on site at forest fire lookouts throughout the entire fire season, maintaining that, when it comes to fire detection, nothing compares to direct human observation. In most parts of the world (including all other Canadian provinces), lookouts have been closed, or their capacity reduced to only a few weeks of service a year (British Columbia, Canada), are staffed sporadically by rotating volunteers (much of the United States), or operate only during the day (Australia). Much like the mechanization of lighthouses in coastal regions, the demise of staffed wildfire observatories removes a regular, consistent, human observation of shifting conditions.

Reporting on the experiences of the remaining fire lookout observers is one way of documenting their distinctive understanding of mountain phenomena, and their operation as a community of practice across a landscape. This knowledge not only provides a different kind of wisdom for sustainability—one grounded in daily practices that cultivate an awareness of weather, and particularly an awareness of air—but it also instills a profound sense of mountain phenomena in others who visit the lookouts: hikers and recreationists, as well as the observers' friends and families.

This study may benefit other regions, where the lived experience of communities mirrors that of lookout observers or where remote mountain locations are staffed for the purpose of systematic observation. These observations will enhance the increasingly sophisticated data sets available through remote sensing. Up-close observations by people able to detect subtle patterns are sometimes overlooked in the rush to acquire ever larger amounts of distant data. As Debarbieux and Rudaz (2015) noted, the common perception of mountain peoples has changed substantially throughout history. While they were

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once cast as poorly adapted to society, today the reverse is true: Their acuity, common sense, and adaptability are sought-after components of resilient responses to environmental change.

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