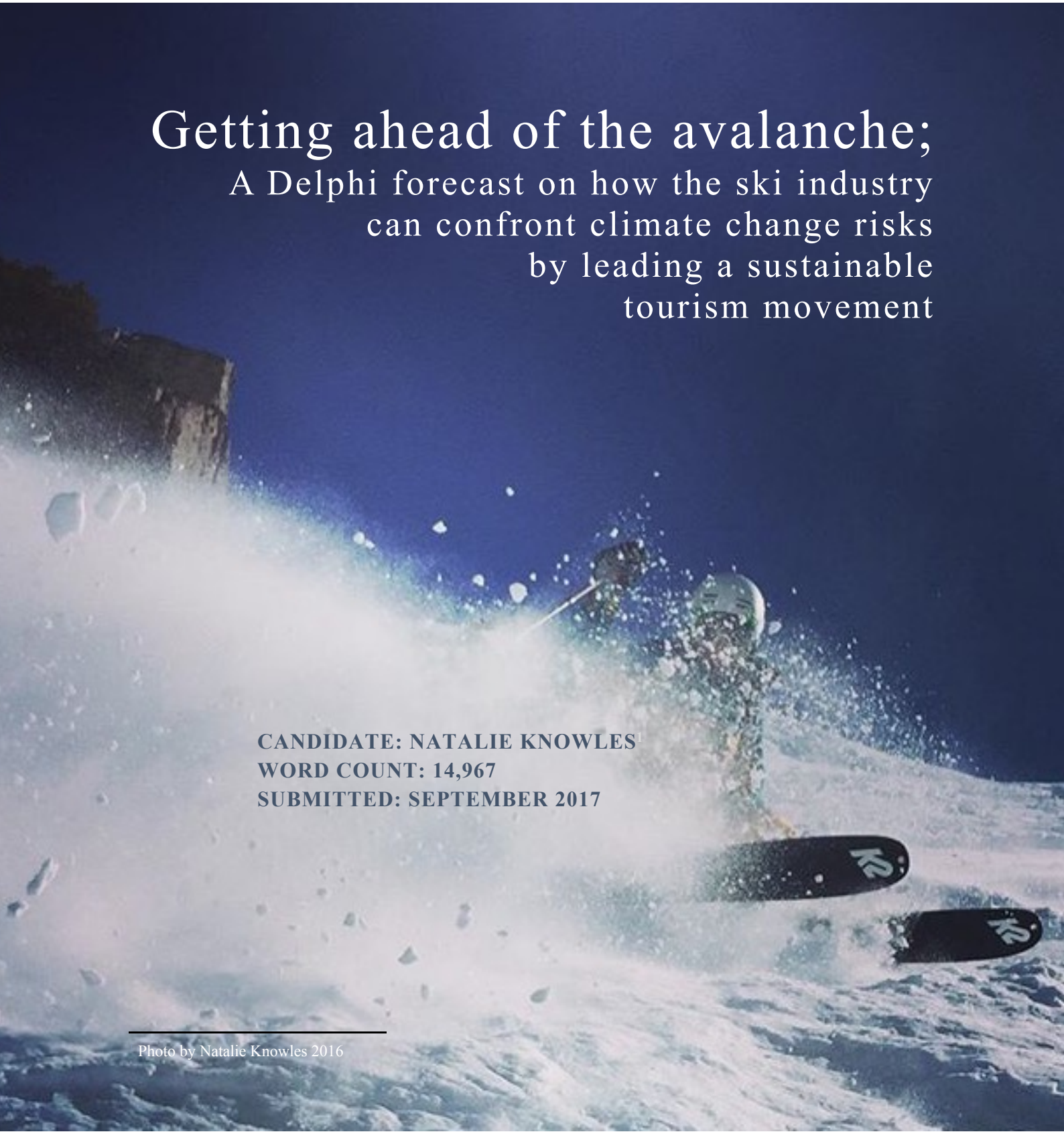
SCHOOL OF GEOGRAPHY AND THE ENVIRONMENT

Getting ahead of the avalanche;

A Delphi forecast on how the ski industry can confront climate change risks by leading a sustainable tourism movement



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Abstract

Sustainable tourism has the potential to enhance biodiversity value, local community development and global economic growth (UNEP 2011) but lacks concrete examples of implementation. Facing an existential climate crisis, the North American ski industry will be one of the first sectors forced to attempt sustainability. Using Jensen's (2001) 'Enlightened Stakeholder Theory', this paper argues that the ski industry has an opportunity to shape change to its advantage and attain long-term value maximization while contributing to ski-tourism based socio-ecological system climate resiliency if the natural environment is managed as a primary stakeholder. The Delphi survey method allows a panel of industry experts to forecast upcoming consumer trends and impending nature, community and climate stakeholder influences to envision a future ski industry. Based on this desired future, this paper conceptualizes innovative management practices, communication strategies and technologies to better manage natural environment and community stakeholders.

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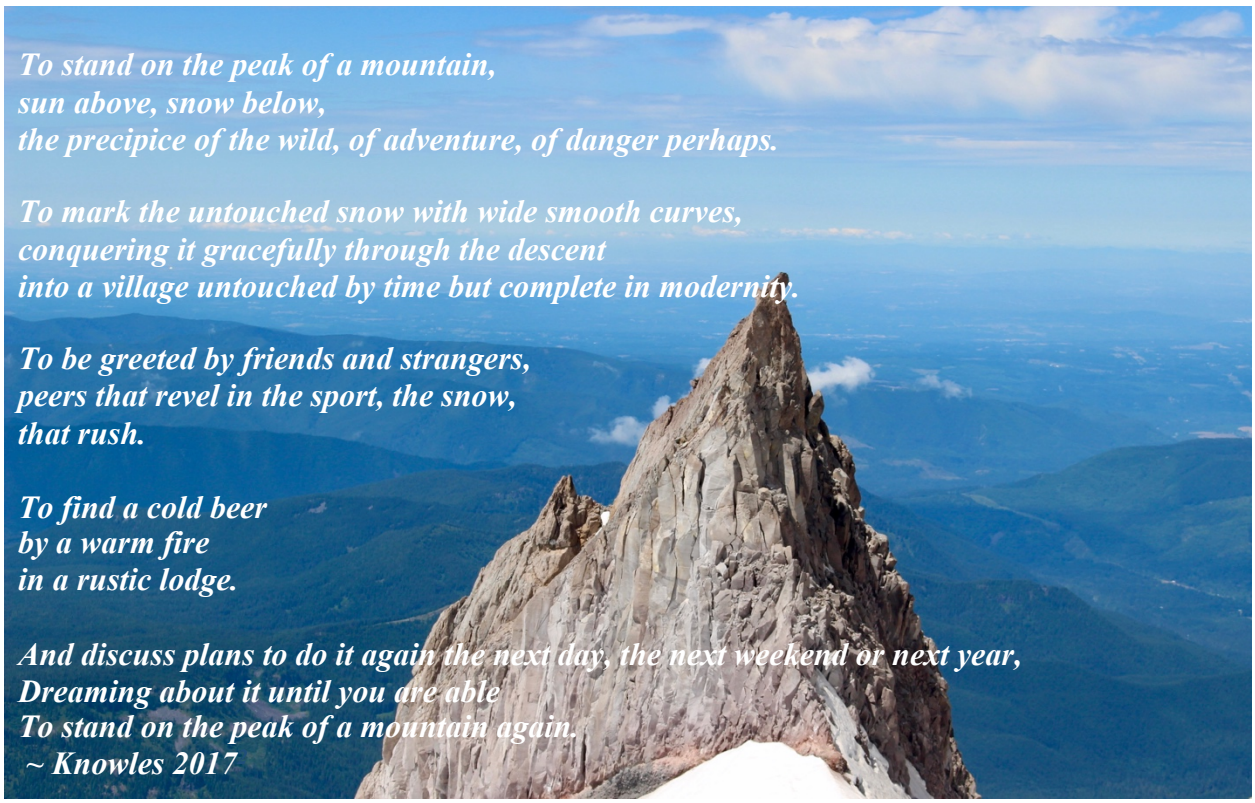
Introduction



It may seem idyllic, romantic even, but that is because it is supposed to be. Ski resorts and operators[3] are in the business of selling an 'intangible mountain experience' not a product or a service (Murphy 2008). As ski resort conglomerate Intrawest states "our ability to consistently deliver exceptional experiences form the foundation of our financial success" (Richins & Hull 2016;16). The amenities, facilities and customer service help generate this experience but the landscape appeal, the openness of mountains and opportunity to move within the wilderness are prime forces of recreation satisfaction (Pigram & Jenkins 2006) not to mention snow, weather and slope conditions (Spector et al. 2012) and the mountain culture and small town atmosphere (Richins & Hull 2016; Gill 2000). Since nature, climate and community have the ability to "affect or [be] affected by the achievement of the organization's objectives" they are what Freeman (1984;46) defines as **stakeholders** to the ski industry while the 'intangible mountain experience' they create is an **asset.**

[2] ***Image 1:*** *The Peak of Mt Hood Oregon, looking out over Mt Hood National Forest in July 2017. This mountain, an active stratovolcano, is one of the few ski areas in North America able to provide summer skiing (Picture: Candidate 1011918)*

[3] For the ease of this paper, the term 'ski industry' incorporates both 'ski operators'; lodges with Helicopter and Snow Cat skiing, and 'ski resorts'; lift based skiing providers. The term 'ski area' will be a neutral term describing ski operators and/or ski resorts. Additionally, 'skiing' or 'skiers' will encompass snowboarding and snowboarders as well.

Cooperation between, and development of the ski-industry and its stakeholders and assets helps ski-tourism-based socio-ecological systems maintain function. Ski areas rely on the idyllic mountain communities, striking wilderness resources, and alpine climates to remain desirable destinations. Mountains, second only to coasts as the top tourist destinations, account for 15-20% of the global tourism economy generating over $200 billion annually (Planet 2008; Richins & Hull 2016). The influx of tourism to mountain communities creates a stable economy and increased standards of living but human encroachment on these remote, sensitive settings impacts the high levels of endemic alpine biodiversity (Sato et al. 2013; Buckley 2005). Alternatively, outdoor recreation positively impacts surrounding wilderness as mountain communities and ski areas expose more people to nature, provide resources, and protection from more exploitive industries, and increase the alpine environments' value.

Currently the ski industry faces an existential crisis as climate change threatens the core business asset, the 'mountain experience', and with that, community, climate and nature stakeholders. Drops in ticket sales from shorter winters, unpredictable weather, and poor conditions negatively affect local businesses, jobs and economies (Wobus et al. 2017; Norrie & Murphy 2016; Burakowski & Magnusson 2012). Lack of capital means the industry increasingly looks for short-term growth by expanding development, snowmaking and new activities on fragile environments to make up for lost revenue, further harming stakeholders and diverging from climate resilience in the process.

Climate resiliency has been defined in two steps by Ninan and Inoue (2017;4) based of work by Folke (2006) and Nelson et al (2007) as the capacity for a socio-ecological system to:

1. **absorb stresses and maintain function** in the face of **external stressors from climate change**
2. **adapt, reorganize, and evolve** into more desirable configurations that improve the sustainability of the system, leaving it **better prepared for future climate change impacts**.

Using Jensen's (2001) 'Enlightened Stakeholder Theory', I argue that ski industry long-term value maximization goals are concurrent with ski-tourism-based socio-ecological system climate resiliency goals when the industry manages the natural environment as a primary stakeholder.

Sustainable tourism has the potential to support local communities, enhance the value of biodiversity and create growth in the world's economy (UNEP 2011). The sustainable

tourism concept has been critiqued by many as theoretically sound yet not pragmatically applicable (McCool & Moisey 2001; Pigram 1990; Gill 2000). “Rather than opposing change, or merely accepting and accommodating change” (Pigram & Wahab 1997;29) the ski industry, being a top tourism destination and directly vulnerable to climate change has an opportunity to translate the sustainable tourism idea to action, (Pigram 1990) and manage change to its advantage.

Currently the North American ski industry is focused on step 1, absorbing the external stresses of unpredictable weather and snow conditions by attempting to maintain function and profit through growth-first strategies, geographic diversification, corporate consolidation, and climate maladaptation such as artificial snow-making. These actions hinder the legitimacy of the industry and are neither economically nor environmentally sustainable in the long-term or in heightened climate change conditions (Clement et al. 2015). This means the ski industry is not maximizing long-term value and is rendering the ski-tourism based socio-ecological system vulnerable to climate change.

While some individual ski areas have begun addressing step 2; adapting, reorganizing, and evolving into more sustainable configurations that improve the resilience of their organization to future climate change scenarios, the North American ski industry must collectively move towards sustainable tourism. As the ‘canary in the coalmine’, North American ski industry success at shifting to long-term sustainable management and reaching climate resilience has the potential to influence not only the global ski and tourism industry but can inspire real climate action and sustainable development across the many sectors that will inevitably face similar existential climate crises.

Research Question

Why and how should North American ski areas act to strategically manage nature, climate and community as stakeholders now and in the future? How can environmental, social and economic resiliency best be realized in mountain ski contexts?

- How are nature, climate and community stakeholders tangibly valued and what threatens their value?
- What is the current state of climate mitigation, environmental management and corporate responsibility in this industry and what future does that lead the industry towards?
- How does the current trajectory differ from desired future scenarios of socio-ecologic resilience and corporate value maximization?
- What existing, bespoke or future management practices, communications or technologies can be deployed to assess trade-offs and manage nature, climate and community stakeholders in the long-term?

This paper seeks to conceptualize the adaptation, reorganization, and evolution necessary to reach climate resilience and long-term ski industry value maximization. To do this the Literature Review identifies nature, community and climate as primary stakeholders to the ski industry and evaluates the current relationships with, management of, and trade-offs between them in respect to Jensen's (2001) Enlightened Stakeholder Theory. Using the Delphi Method to survey a panel of industry experts, the Results and Discussion then forecast future ski industry circumstances based on predicted nature, community and climate stakeholder influences, and debate potential management practices, communication strategies and technological innovations necessary to reach the desired sustainable tourism future.

Literature Review

A Brief History of the North American Ski Industry

In North America, mountain socio-economic system development historically stemmed from resource extraction and exploitation economies, particularly logging and mining (Richins & Hull 2016). Hundreds of towns from Tremblant QC to Telluride CO, Stowe VT to Squamish BC, were discovered by surveyors and founded to house loggers or gold, silver and coal miners in the mid 1800s. Norwegian immigrants, most famously Jon "Snowshoe Thompson" Torsteinson-Rue, brought skiing to eastern North American in the late 1800's as a mode of winter travel (Fox 2013). Its popularity, soon evolving into a recreational pastime and then a sport, moved west in the early 1910's as railroads made their way across both Canada and the US.

North America's affluent began travelling to the European Alps on vacation, bringing back stories of skiing's glamour, adventure and culture, as the mining boom turned to bust in the early 20th century (Denning 2015a). Seeing potential for a new industry fed by the excitement of the 1932 Lake Placid Winter Olympics, some resource extraction towns, starting with Averell Harriman's development of Sun Valley ID (Clifford 2002), made a dramatic shift from the hard, dirty life of mining and logging to the elegance and prestige of the new winter recreation and tourism industry. Like the resource extraction industry before, this emerging ski economy blossomed using new natural capital frontiers to create prosperity, but instead of exploitation, skiing was built on ideals of access to wilderness, winter sport and adventure, and building desirable communities to attract a new type of recreation tourist.

Following the end of World War II the ski industry grew rapidly. In 1959 Hans Gmoser invented heli-skiing, opening up the amount of skiable terrain available and a new type of ski experience (CMH 2017). Cat-skiing evolved from this a decade laters (SSS 2017). By the 70's and 80's North American skiing was reaching a peak with over 950 ski areas and over one billion dollars in annual revenues (Clifford 2002; Hudson 2000). Polish sociologist Ziemilski said [speaking about the Alps], "Alpine skiing made the local economy more stable by enabling year round economic activity … and encouraging the development of a service economy" (Denning 2015b;6). Local ski communities grew and prospered while the environmental impact seemed negligible (Steelman & Rivera 2006) and the snow endless.

Taking a Turn Downhill; The Contemporary Ski industry

Currently the USA has 463 open ski areas, 264 fewer than in 1985, while Canada has less at 321 (NSAA 2016; Norrie & Murphy 2016; CSC 2015). The number of skier days[4], 52.8 million in the USA (NSAA 2016) and 19 million in Canada (Norrie & Murphy 2016; CSC 2015) are also decreasing with the US and Canada each down 2 million skier days since 2000 (Hudson 2000). While rising lift ticket prices, an aging skier demographic and competition from other activities play a role in the decline, the average ski area operating season was 12 days shorter in 2016 than 2013 (NSAA 2013-16).

A large body of research (Brown & Mote 2009; Campbell et al. 2010) suggest what Diffenbaugh et al. (2013;379) describes as "an imminent shift towards low snow years in the Northern Hemisphere" which "could have important impacts on natural and human systems in snow-dependent regions". Recent climate change projections by Wobus et al. (2017;12) using five climate models and two emission scenarios taking into account "natural snow and ski resorts ability to make snow, demonstrate that season lengths for winter recreation activities will decline at nearly all sites in the continental US" by 2050. While these projections will have regional and elevational variance, the general shorter and more inconsistent seasons "could result in millions to tens of millions of foregone recreational visits annually by 2050" which under the highest emission concentration scenario could lead to "a loss of more than 2 billion USD annually for downhill skiing" (Wobus et al. 2017;1,12).

As a general rule of thumb ski areas require 30cm base of snow to operate (more for Heli and cat skiing) and 100 continuous operating days with at least 50% of the runs open to be cost effective (Mayer & Steiger 2013; Elsasser & Burki 2002; Scott & McBoyle 2007). Mayer and Steiger (2013) also add that operating during the two-week Christmas holidays is vital to ski area profitability. Weather, snow quantity and slope conditions directly affect skier experiences with mountain environments. Even a perception of poor quality snow or prediction of bad weather reduces ticket sales (Spector et al. 2012). Burakowski and Magnusson (2012) predict significant declines in winter revenue over the next 50 years due to climate change while Scott et al. (2006) only foresee economic stability with increased reliance on artificial snow and minimal warming. Wobus et al.'s (2017) study doesn't attempt to predict business models or include the indirect climate effects but still finds shortened

[4] The industry measures consumer numbers, use and demographics through 'skier days'. A 'skier day' is considered to be one day of skiing purchased at a ski area with a season pass considered ~20 skier days.

seasons affecting large revenue periods; Christmas/New Year's holidays and spring break, and recurring marginal condition seasons "could result in a facility's closure".

Image 2: *Summer Skiing in California (Photo: Knowles 2017) After 4 season of drought, early closures and revenue losses, record snowfall in 2017 allows Squaw Valley Ski Resort to stay open thru July this year.* Rutty et al. (2015) *warns good snow years lessen skiers' perception of climate risk.*

In his book *Getting Green Done,* Auden Schendler (2009;29), Aspen Ski Co.'s VP of Sustainability, defines sustainability as "staying in business forever". Two important takeaways from Wobus et al.'s (2017;1) research define how the ski industry may approach sustainability:

- Climate change may cause the ski industry to adapt to alternative recreational activities altogether.
- "Limiting greenhouse gas emissions could both delay and substantially reduce adverse impacts to the winter recreation industry"

The UN World Tourism Organization (2004;2) encourages "truly sustainable tourism that reflects a 'quadruple bottom line' of; environment, social, economic and climate responsiveness." If the ski industry plans to continue indefinitely, how it reacts to climate risks will profoundly impact its own success and that of future mountain socio-ecological systems.

Climate change is a massive threat to the ski industry but when "you start to think about what it means to stay in business forever you have to consider a universe of issues" (Schendler 2009;29). Climate change indirectly devalues nature and community assets (Wobus et al. 2017), for example warm winters are exacerbating Mountain Pine Beetle infestations in Colorado lodge pole pines (Mitton & Ferrenberg 2012). Ski areas must spend time and

money fighting the infestations because the dead pines are more susceptible to larger forest fires. Fire risks bring higher insurance costs, devaluing real estate and recreational resources, not to mention the possible fire-fighting labour, damage and personal injury expenses. The direct and indirect effects of climate change are why banks and investors are now seriously assessing environmental risk and long-term industry feasibility in financial negotiations with ski areas (Scott 2005; ISVA 2003).

In an interview with Clifford (2002;57), Joe Houssian former Intrawest CEO, a major holder of ski resorts across North America said, "A hundred years ago, when people came into a valley and cut down all the trees and mined all the minerals and then got out of town is quite different than our business". Without long-term profitability, ski areas, like the logging and mining institutions before them, may be forced to 'get out of town', taking with them the jobs, resources and security they create, drastically altering the social character of the community (Norrie and Murphy 2016), and leaving behind environmental and economic uncertainty. Houssain goes on to say "We're in the environment business, we're in the nature business. We can't come into a town, into a mountain valley and change it. That is what attracts people to the place to start with, so we can't leave it in a worse condition than when we found it. Our objective is to put it in a better condition and to provide to the community things they would not otherwise have had" (Clifford 2001;57).

Do Trees Have Standing? Is Snow a Stakeholder?

Community members have long been considered primary stakeholders in most industries (Freeman 1984). Their rights as humans, citizens, consumers, neighbours, employees and stockholders are uncontested. They can voice their grievances and take action in their own best interest. The natural environment does not have rights nor the capability to speak or act. Christopher Stone (1972;455) believes that "until the rightless thing receives its rights, we cannot see it as anything but a thing for the use of 'us' – those of us who are holding rights at the time". The fact that the natural environment does not have rights to defend its best interests while corporations, also unable to speak or act, have the right to use nature and climate resources at the expense of the natural environment and future generations, for corporate best interest is unfair and flawed (Stone 1972).

The flaw is that corporations are given a spokesperson to voice their rights on their behalf while the natural environment is, at best, considered a resource used to generate asset value. This is *not* to say the current structure leaves the natural environment's interests 'wholly unprotected' but rather protection is not 'at its behest', not all 'injury to it' is taken into account and relief does not run to the 'benefit of it' (Stone 1972;458). In other words, the only way to challenge poor stewardship of the natural environment is through the social or financial costs placed upon another entity with rights; another company, government or individual. This means environmental degradation not impacting a rights-holder goes unnoticed. If a rights-holder protests negative impact to the natural environment, the cost of damage is reimbursed to the protester rather than remedied by "making [the natural environment] whole" again (Stone 1972;462). If given rights, all impacts would be identified and remediated directly back to the natural environment.

Primary Stakeholders	***Nature***	***Climate***	***Community***
Proximity	Endemic flora, fauna, and biodiversity, Alpine ecosystems, Natural capital and resources	Climate, Carbon Levels, Microclimate, Weather, Snow conditions	External; Community, Local Business, Skiers Internal; Employees, Stockholders
Urgency	Current and Future Generations; resources, recreation, aesthetics	Current and Future Generations; core business, recreational resource	Current Generations; cooperation, social license to operate
Legitimacy (Risk)	Government regulation, environmental activist, Community	Direct Financial, Reputation and Image, Government regulation	Employee retention, Community support, Local Economy
Power	Controls Resources	Physical Force	Coercive Power

Figure 1*: Nature, community and climate characteristics placed within Haigh and Griffith's (2009) Primary Stakeholder criteria. (Knowles 2017)*

Based on Freeman's (1984) stakeholder theory and work by Mitchel et al. (1997) and Driscoll & Starik (2004), Haigh and Griffith (2009) respond by suggesting the natural environment be considered a primary corporate stakeholder. Haigh and Griffith's (2009) primary stakeholder criteria includes:

- **Proximity** – stakeholder is visible and spatially imminent
- **Urgency** – the degree a stakeholder requires immediate attention
- **Legitimacy** – treatment of stakeholder influences risk and license to operate
- **Power** – stakeholder has coercive power, physical force or controls resource

Zsolnai (2006 and Dodson et al. (2015) add future generations as primary stakeholders but while the natural environment and future generation interests are closely intertwined (Turker

2009) future generations lack the power to affect immediate corporate endeavours. Instead Jacobs (1997) suggests future generations' interests, for example First Nations' concept of thinking seven generations ahead (Clarkson et al. 1992), may be a valuable way to view the environment as a stakeholder for sustainable corporate development.

Haigh and Griffith (2009;348) understand that while "there are countless elements to the natural environment, we refer to the natural environment in the singular, and leave it to future research to ascribe status to individual elements". In this context, I consider **Nature** – ecosystems and biodiversity and **Climate** - carbon levels and microclimate, to each be distinct elements of the natural environment that greatly influence future generations. Nature, climate, and community interconnect with each other but individually demonstrate the qualities necessary to meet primary stakeholder standards (see Figure 1). The unique ways each affects and is affected by the ski industry requires ongoing management priority (Haigh & Griffiths 2009; Freeman 1984).

In the 40 years since Stone's article, Philippe Sands (2012;3) replies that the changes have not been enough and the call for "growth now, the protection of nature tomorrow" is even louder. Ski areas building a 'mountain experience' asset indirectly provide resources, value and protection to the natural environment, but when the industry declines, ski areas seek short-term profits resulting in behaviour that neglects or mistreats the environment and future generations. A 1997 paper reported that "to meet public need, resorts will require more intermediate, advanced and expert skiable terrain and additional specialized terrain for a variety of new winter and summer activities" (Clifford 2002;33). Clifford (2002;35) believes with overall skier numbers stagnant, the expansions are "to poach skiers from other resorts" for short-term growth "saddle[ing] ski operators with a heavy capital investment and little likelihood that they can grow sufficiently in overall skier days to pay for it" leading back to decline and short-term management strategies (see Figure 2). This neoliberal growth-first approach (Peck & Tickell 2002) negatively affects the tourism function of a ski area and limits its ability to proactively respond to other global change pressures, conflicting with the principles of corporate and socio-ecological sustainability (Gill & Williams 2011; Murphy 2008).

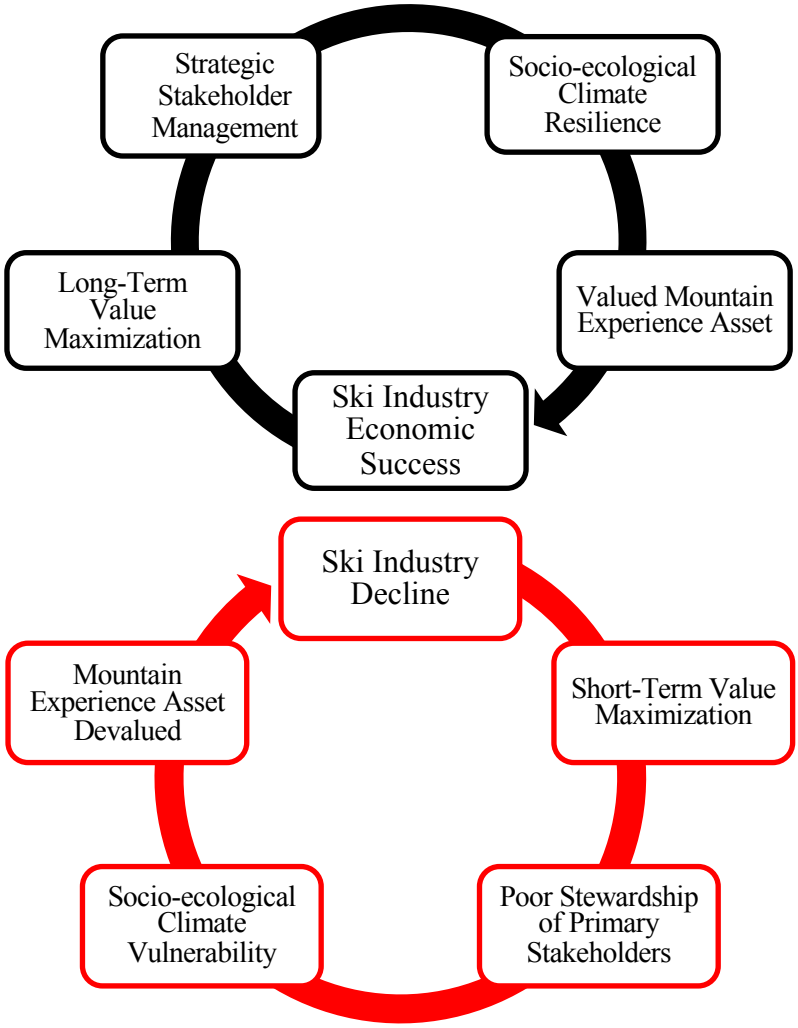


Figure 2: *Positive feedback loops of ski industry success versus ski industry decline exacerbated by long-term and short-term value maximization respectively.*

Nature, climate and community stakeholders highlight how stewardship creates long-term business sustainability because "their stake encompasses the most fundamental elements required by organizations, without which organizations would not be sustained" (Haigh & Griffiths 2009;355). By shifting the frame from asset to stakeholder, ski areas should assess their impacts on nature, climate and society objectively and resolve the damages directly by making them 'whole again' (Stone 1972) to the benefit of future generations and in a positive feedback loop, the fundamental 'experience' asset for industry sustainability (See Figure 2).

NATURE:

Ski areas create what Hart (1966) terms a 'recreation resource' – capturing and enhancing a particular landscape's tangible and intangible values. Planning and development turns natural

resources into recreation resources. As Clawson and Knetsch (1966;7) say, “there is nothing in the physical landscape or features of a particular piece of land that make it a recreation resource; it is the combination of the natural qualities, and the ability and desire of man to use them that makes a resource out of what might otherwise be a more or less meaningless combination of rocks, soil and trees”. Skiing is unique among sports in that it’s enjoyment is based on attractive physical surroundings as well as the activity itself (Mintel 1996).

Recreational resources for skiers come from the infrastructure; roads and ski lifts, vehicles; snowcats and helicopters, and human knowledge; guides and trails, that allow access and connection to the mountains. Providing skiers with positive recreation experiences in alpine environments influences personal attitudes towards nature, and stimulates a drive to protect the mountain ecosystems they recreate in (Dunlap & Heffernan 1975; Faich & Gale 1971; Theodori et al. 1998). With over 70 million skier visits in North America annually (CSC 2015; NSAA 2016a), the potential to spur pro-environmental values is massive. “Perhaps more than any other activity, skiing and snowboarding have lured the masses to the forested slopes that make up much of our public lands estate. For many of those skiers and boarders the view at the top of a ski resort - sprawling ridge lines and snow-capped peaks that extend in almost every direction - is their first and often most powerful connection to the incredible beauty and vastness of our National Forest System” said Forest Service Chief Tom Tidwell (Peters 2014).

Image 3: *Skiers at the Ajax Peak of Aspen Mountain Colorado look out over Aspen Highlands, Pyramid Peak and the Maroon Bells in the White River National Forest while planning the next run. (Photo: Knowles 2017)*

Extrapolating a land-sparing perspective from its use in agriculture, concentrating large numbers of people onto a very small amount public lands means greater engagement with less biodiversity impact, although there is a debate for dispersed recreation (Phalan et al. 2011). Still, a large percentage of ski areas in North America exist on public lands, taking up very little space but paying back between 1.5-4% of their revenues in rents and land tenures (MFLNRO 2012; US Senate 2015). In the US, ski areas take up 1/10th of 1% of the National Forest System (Peters 2014) yet the 11 ski resorts in Colorado's White River National Forest alone, pay $17.7 million in rents annually (Blevins 2016). This amount more than fully covers White River National Forest's annual operating budget, although it is sometimes unclear where the funds end up (Clifford 2002). Many ski areas also donate to organizations such as the National Forest Ski Conservation Fund. A few even contribute to academic biodiversity conservation research directly. For example Canadian Mountain Holidays a BC Heli-ski operator supports mountain goat and caribou monitoring in their land tenure (CMH 2017).

Expanding use of and support for alpine and subalpine ecosystems might, as naturalist John Muir said 'drive the more exploitive uses out' (Cohen 1984;206). Recreation resources make the surrounding land incredibly valuable, not only to draw tourists to the area but to sell real estate, with 'ski-in-ski-out' homes near prominent resorts selling for multiple millions. In Fernie BC, natural scenery and healthy environments are the most important factors attracting second-home purchases followed by quality of life and sense of place values (Gill 2000). Second-homeowners also bring strong conservation and environmental ethics to mountain communities, a willingness to pay for parks and recreation expansion, and ironically an ethos to stem further development (Nepal & Chipeniuk 2005, Gill 2000)

Recreation and tourism growth paradoxically presents significant risk to the same areas (Pigram & Jenkins 2006). In the boom of ski area development in North America before the Clean Air, Water and Endangered Species acts the ski industry considered themselves to be a low-environmental-impact sector of the economy (Steelman & Rivera 2006). In 1998 members of Earth Liberation Front an 'eco-terrorist' group, set a Vail Resorts ski lodge on fire to protest expansion plans that would conflict with endangered Canadian lynx habitat. Beyond causing 15 million dollars in damages, the fire ignited public scrutiny and scientific inquiry into the ski industry's impacts on nature (Steelman & Rivera 2006; Clifford 2002).

Recent studies assessing winter recreation encroachment on alpine and sub-alpine ecosystems' show endemic species, biodiversity hotspots and sensitive alpine habitats such as high-altitude wetlands facing habitat loss and fragmentation, lower species richness, and decreased productivity (Sato et al. 2013; Sato et al. 2014; Wipf et al. 2005; Martin 2013). A lack of data on environmental conditions preceding ski recreation, tourism and development (Pigram & Jenkins 2006) combined with major knowledge gaps in alpine biodiversity, species stressors and tolerance levels, (Sato et al. 2013; Sato et al. 2014; Wipf et al. 2005) mean a general understanding of skiing's environmental impacts was (and still is) limited (Buckley 2012). Ski areas do not have the information necessary to manage nature properly, putting species at risk now and the ski industry at risk of paying the price later.

High profile cases of new, proposed, and expanding ski areas showcase the effects negligent development in mountain areas has on nature, and the financial and social costs to remedy these impacts. Telluride Ski and Golf Company was fined $1.1 million plus $2.7 million in restoration costs for building a golf course over endangered wetlands (Clifford 2002). Beavercreek Ski Resort, developed in Colorado in the 1970's, displaced large elk herds' winter grazing and nesting grounds (Clifford 2002). By 1990 starving elk charged across Interstate 70 in search of food and space, forcing the Colorado State Patrol to close the highway to avoid causing danger to the animals or drivers. The proposed $450 million Jumbo Glacier Resort, set to be built in BC's Purcell Mountains was shut down last year, after 25 years of planning, over potential impacts on grizzly bear populations and the Ktunaxa First Nations community (Lavoie 2015). Silverton Heli-ski attained permission in May 2017 from the Colorado Bureau of Land Management to swap 5,556 acres of public land for 16,250 acres, but currently faces major backlash from local community and environmental groups (Blevins 2017b).

COMMUNITY:

Buy-in from internal and external community stakeholders is fundamental to a company's economic success (Freeman 1984). Gaining support for ski areas involves creating a desirable community setting that attracts repeat guests, retains staff and turns local residents into ambassadors (Murphy 2008). This means maintaining a small-town atmosphere while developing jobs and amenities.

In 2012 the US winter sports industry was estimated to generate 12.2 billion in revenue (POW 2017), a huge asset to mountain areas usually devoid of broad scale intensive economic activity (Hall & Higman 2005). HeliCat Canada's Social and Economic Impact report (2016;14) agreed, stating ski areas bring tourists to "small and often isolated communities that may not otherwise see much traffic, particularly in winter", and diversify local economies through increased expenditures in "community-based suppliers of goods and services". This influx of tourists and tourist dollars brings jobs. A study by Colorado Ski Country USA and Vail Resorts Inc. (2015) found skiing directly supports 46,000 full-time jobs in Colorado alone. While a smaller market, HeliCat operators in BC directly create over 728 full-time equivalent jobs, many of which are highly skilled positions, attracting diverse, educated people to rural areas (Norrie & Murphy 2016).

The combination of increased expenditures, stable service industry jobs and diversified population growth gives mountain communities power to inform development and policy decisions that better reflect themselves, and their natural capital and recreation resources. The high tax revenues are reinvested in infrastructure, development and quality of life amenities that meet affluent guest and second-homeowner expectations, and benefit permanent residents and staff. This includes attractive recreation and cultural facilities, scenic and healthy natural environments, efficient transportation and communication systems, and vital community support services (Moss 2006; Nepal & Chipeniuk 2005). In December 2016, the US senate gave the ski industry a louder voice when they unanimously passed the Outdoor Recreation Jobs and Economic Impact Act meaning the outdoor recreation economy is now reported as part of the US national GDP (US Senate 2015).

Image 4: *Telluride (Left) and Crested Butte (Right) former silver and coal mining towns in isolated areas in Colorado's Rocky Mountains were rejuvenated by ski tourism in the 1960s and 70s and are now considered some of the last great independent ski towns. (Photos: Knowles 2017)*

The drive to grow economically in a stagnant market started a consolidation movement as early as the 1990's when Vail Resorts, Intrawest and American Ski Co. began picking up smaller, struggling or bankrupt ski areas to alleviate operating costs and diversify geographically against weather-related risk (Clifford 2002; Tang & Jang 2007). Consolidation promises growth but often leads to community homogenization or 'resortification' – a form of gentrification where an explosion of 'luxury experience' development for quarterly growth (Gill 2012) can come at a high price to local residents and staff who, in a single commodity economy, are at the mercy of the now remote owners (Clifford 2002). To compete, independent ski areas follow these trends and as a result the industry is reaching social limits that negatively affect tourism (Gill 2012).

High costs of living in ski towns pushes out residents and impacts the ability to acquire and retain skilled employees. In Mammoth CA 52% of houses are empty most of the year yet the two-year-long waitlists for employee or low-income rentals are full (Michelson 2017). In Whistler BC, a growing group of young seasonal workers have taken to living in cars and vans after struggling to find rooms while others commute long distances. A 2015 housing study in the Tahoe CA area found 59% of local workers commute from elsewhere. Similarly, in Colorado, Lipsher (2000) has projected that by 2020 nearly 59,000 workers will commute into ski towns in Eagle, Summit, Pitkin, Grand and Jackson counties. Lipsher (2000) goes on to predict that over 8000 ski industry jobs in Colorado will go unfilled as a result of high prices and horrible commutes.

Increased commuters affect air quality, the loss of workers directly hinders ski area operations and the permanent resident population decline itself can be detrimental to local businesses and overall community vibrancy, particularly in the shoulder seasons. Empty communities reduce neighbourhood appeal, sense of place and quality of life (Bush 2006; Thompson 2006), the same characteristics valued by second-home buyers in the first place (Gill 2000). Clifford, author of Downhill Slide (2002;85), sums this up stating "community sustainability and quality of life do not mesh with relentless quarter over quarter growth".

CLIMATE:

Ski tourism growth is directly and immediately vulnerable to climate change (Rutty et al. 2015). While ski areas cannot necessarily manage immediate weather, they have potential to

lead climate change mitigation and adaptation for future generations of skiers on a multitude of scales in their pursuit of long-term profit.

Gale (1972;285) found "strong personal attachment to an outdoor recreation activity can lead to an equally strong commitment to protect those features of the environment which contribute directly to enjoyment of the activity". With snow providing skiing's essential element, the skiing constituency has a vested interest in mitigating climate change. Because of this, NGO Protect Our Winters (POW) and their global network of over 130,000 skiers, are starting a climate action social movement. With a global network of over 130,000 supporters, POW says, "we share a passion [winter sports] that crosses party lines, a unique perspective that de-politicizes any climate discussion, and an industry with an economic impact that can't be ignored" (POW 2017), indicating an area the ski industry must address to engage the entire skiing community. Ski areas have the local, regional and in some cases national or international platform to advocate, educate and engage their staff and guests on climate change and reducing carbon emission.

Scott (2011;17) says that "how tourism responds to climate change is absolutely critical to the sustainability of tourism and should the sector retreat from engagement in climate change it would be to its substantial detriment". The UN Environmental Programme's Green Economy Report (2011) states a third of travellers favour environmentally friendly tourism. As tourists demand greener destinations, sustainable tourism has significant potential to drive growth in the world economy (UNEP 2011) and in individual enterprises. With mountains being one of the most visited areas and snow being an early indicator of climate change, both the potential to lead change and the risks of not acting are massive. "While notable progress has been made in the last decade", Scott et al. (2012;213) feel there are indications "that the tourism sector is not currently well prepared for the challenges of climate change".

Yearly competition to be the first area to offer skiing in the fall, the last to remain open in the spring and the need for consistent snow conditions in between, have over 90% of North American ski resorts dependent on snowmaking (NSAA 2016a). Ski resorts are spending between $500,000 and $3.5 million annually on snowmaking infrastructure, energy and labour (Duglio & Beltramo 2016). With rising temperatures and energy costs, snowmaking doesn't currently match the level of climate threat (Duglio & Beltramo 2016) and is increasingly unviable in costliness and effectiveness (Clement et al. 2015). Furthermore, this core business maladaptation has adverse effects on other primary stakeholders. Artificial

snow melts slower, potentially causing conflict with biodiversity temporal characteristics. For example alpine flower blooming misaligns with pollinator species or late snowmelt freezes fish eggs (Hudson 2000). Diverting streams and holding water reservoirs for snowmaking has the potential to introduce or transfer foreign elements and pollutants into fragile alpine environments and drinking water sources (Spector et al. 2012). This has cascading effects on communities, species and ecosystems throughout entire watersheds particularly in futures with less water.

English skier and mountaineer Sir Arnold Lunn felt "The effects of climate change on Alpine skiing and the increasing technological manipulation of the environment have led many to speak of the alienation of humans from nature" (Denning 2015b;3). Ski areas are carbon heavy with snowmaking, helicopters and snow-cats consuming large amounts of energy. Being rural and remote, ski areas are often dependent on local energy providers using high carbon energy sources such as coal (Clifford 2002). Porter Fox's (2016) report *Campaign Donations Link Ski Industry Leaders to Climate Change Deniers* in November 2016, found a number of US ski area owners, presidents and executives sending money to support and elect various congressional candidates running on climate denial and pro-fossil-fuel campaigns.

Political incongruity, and carbon reliance, plus industry confidence in snowmaking contradict ideas of sustainable tourism and the general consensus on the need to mitigate climate change (Duglio & Beltramo 2016). This decouples skiing from natural snowfall and reduces tourists' climate change risk perception (Rutty et al. 2015), undoing the potential to engage the skier constituency in a social movement necessary to manage climate in the long-term.

Choosing the Right Line

Aspen's Schendler, suggests in his 2002 article that "corporate sustainability won't occur without a company mandate that springs from ethics not economics". Thus far, voluntary environmental initiatives and programs in this industry, most visibly the National Ski Areas Association's '*Sustainable Slopes'* program – an environmental charter with 21 principles, have followed stakeholder theory's neo-institutional ideas that responsibility is separate from profit (Freeman 1984; Suchman 1995; DiMaggio & Powell 1991; Meyer & Rowan 1977). "The number one reason for supporting Sustainable Slopes, expressed either directly or indirectly by all Partnering Organizations, is that it leads to improved environmental

performance" (NSAA 2005;3-1) but Rivera & De Leon's (2004) and (2006) analysis found that participating ski areas performed no better than non-participating areas. Steelman and Rivera (2006) blame the program's voluntary nature. Instead I, like Jenson (2001), argue a lack of ability (or interest) to set tangible goals, prioritize decisions, and assess and communicate performance make voluntary environmental programs, corporate social responsibility and stakeholder theory "a recipe for destroying firm value and reducing social welfare" (Jensen 2001).

Avid skier[5] and controversial free-market economist Milton Freidman's provocative essay *The Social Responsibility of Business is to Increase its Profits* resonates in this contemporary context. "The great virtue of private competitive enterprise is that they can do good – but only at their own expense", Freidman (1970;3) writes. In the realm of public companies Friedman (1970;4) finds 'social responsibility' over profit maximization to be a 'fundamentally subversive doctrine'. By deciding responsible management practices, for example which of the *Sustainable Slope*'s 21 principles to pursue, individual managers inadvertently take on the role of natural environment stakeholder representative whereby managers' personal objectives and morals consciously or unconsciously influence nature or climate stakeholders' 'best interest' (Friedman 1970; Stone 1972). Jensen (2001;9) agrees stating "without the clarity of mission provided by a single-valued objective function, companies embracing stakeholder theory will experience managerial confusion, conflict, inefficiency, and perhaps even competitive failure" because it "leaves its managers empowered to exercise their own preferences in spending firm's resources".

"It is logically impossible to maximize in more than one dimension at the same time" Jensen (2001;10) continues, "200 years' worth of work in economics and finance indicate that social welfare is maximized when all firms in an economy attempt to maximize their own total firm value". If Freidman's (1970) notion of 'increasing profits' is considered an indefinite objective, his argument aligns with both Schendler's (2009) concept of a sustainable corporation and Jensen's (2001) Enlightened Stakeholder Theory – only when the natural environment is considered a stakeholder. With the goal of staying in business forever, seeking total firm value is the objective function that will guide managers in making optimal

[5] Learning to ski at age 30, Milton Friedman took an annual ski trip to Alta Ski Area in Utah with conservative author William F Buckley Jr. In a eulogy to Friedman, Buckley read a letter written by Friedman stating "Those many years we spent three days together at Alta are among my happiest memories." (W. F. J. Buckley 2012; Buckley 2006)

trade-offs between stakeholders, bearing in mind short-term profit maximization at the expense of long-term value maximization destroys total firm value.

Just as the distinct stakeholders nature, climate and community, intertwine into an intangible mountain experience asset, (Murphy 2008; Haigh & Griffiths 2009; Perdue 2002) "triple-bottom-line (or quadruple-bottom-line (UNWTO 2004)) is not about compartmentalizing activities and projects into the three bottom lines, but rather is about integrating core principles that reflect a commitment to a sustainable organization and society" (Dwyer 2005;91). A single focus on long-term success allows companies to set goals, prioritize decisions, and assess and communicate the results. "It tells firms to spend an additional dollar of resources to satisfy the desires of each constituency (stakeholder) as long as that constituency values the result at more than a dollar" where "firm value is simply the long-term market value of this expected stream of benefits" (Jensen 2001;12,11).

To secure this stream of benefits, the ski industry must identify which stakeholders to spend additional resources on and what activities to engage in to cultivate a quality mountain experience that future guests value, within what society and the environment will allow (Murphy 2008; Ryan 1991). By forecasting potential industry scenarios, the following research identifies how ski areas should set goals, prioritize decisions and communicate the results to provide a valued future mountain experience and reach sustainable tourism status.

Methods

I used a multi-methods approach (Gray 2014), featuring a literature review, document analysis and a qualitative Delphi survey modified with key informant interviews, to answer the complex research question, and forecast and conceptualize long-term ski industry success and socio-ecological climate resilience.

Study Area

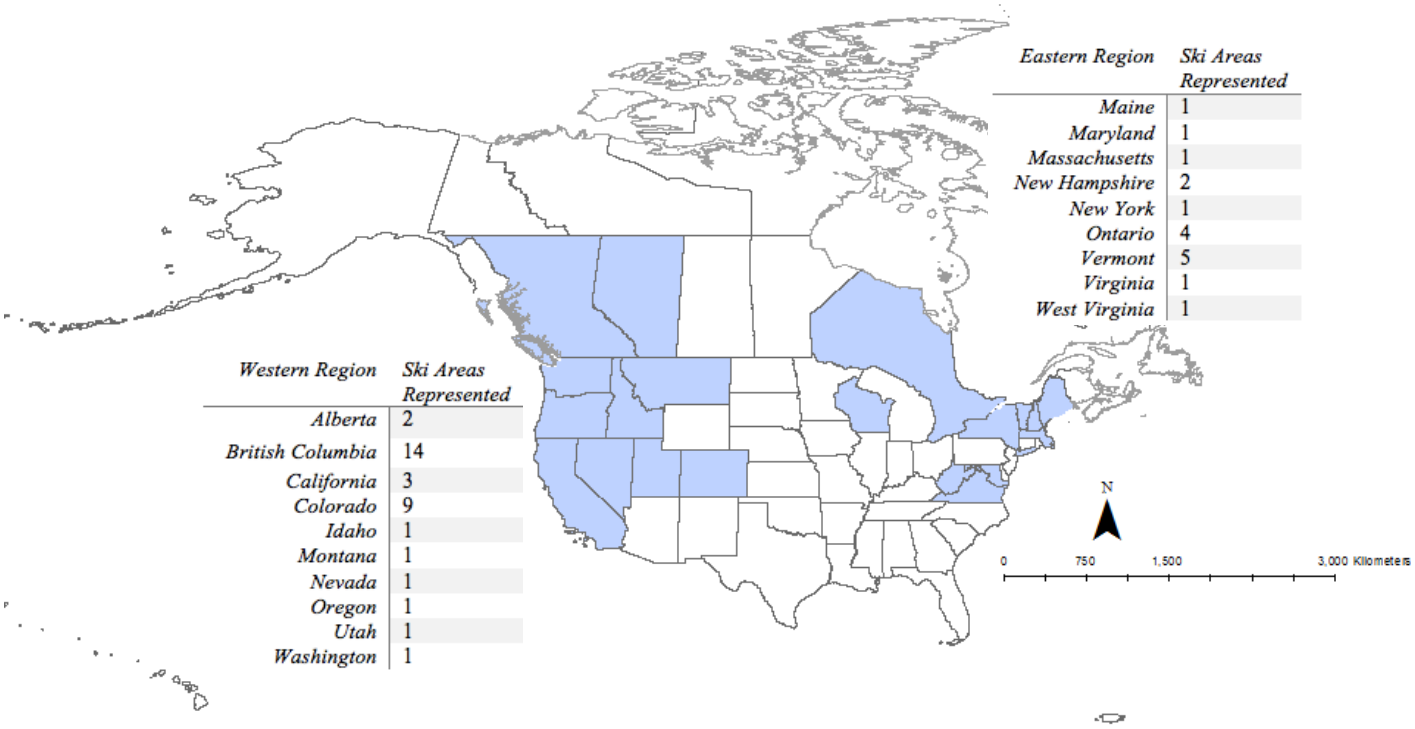


Figure 3: *Geographic range of ski areas represented by experts in this study by region (State or Province). (Map: Candidate 1011918)*

This research looks at the North American ski industry with experts representing ski areas covering the Coastal Mountain, Sierra Nevada and Rocky Mountain Ranges in the west and the Appalachian Mountain Range and Niagara Escarpment in the east (notably missing from this study are experts representing Quebec and Alaska) (see Figure 3). North American ski areas are unique from Europe and other regions in that a single organization generally owns and operates the lodges, resorts, lifts, transportation system and even in many cases land, real estate and restaurants (Hudson 2000) meaning the management of a ski area has profound impacts on its surrounding mountain socio-ecological system.

Literature Review and Document Analysis:

Literature review and document analysis is essential in establishing the status quo of ski industry environmental values, impact and management. Being a relatively niche industry, there was limited existing academic literature on ski areas specifically. To supplement this, I incorporated and extrapolated the plentiful literature on outdoor recreation, tourism, stakeholder theory, legitimacy, and corporate responsibility alongside industry association and NGO reports to reflect the ski industry reality. This informed the Delphi Survey's first-round questions and subsequently verified the first-round's demographic and industry trends that guided the second-round questions.

As industry trade associations these documents (see Figure 4), which illustrate the trends in industry spending, revenue stream, consumer demographic, sustainable practice and impact, and socio-economic influence, can be considered valid sources (Atkinson & Coffey 2004).

Organization	*Documents Analysed*
HeliCat Canada	• 2003 Best Practices of Sustainability • 2016 Socio Economic Impact of Helicopter and Snowcat Skiing in Canada • 2016 Annual Report • Raw Data Social and Community Survey
National Ski Area Association (US)	• 2013-2016 Economic Analysis of United States Ski Area • 2016 National Demographic Survey • 2016 Kottke National End of Season Survey
Protect Our Winters (NGO)	• Protect Our Winters Resort Alliance • Industry Information • Climate Impacts on the Winter Tourism Economy in the United States
Canada Ski Association	• 2014/2015 Economic and Demographic Report

Figure 4: *Analysed documents from official industry association and NGO reports either provided by the organization or found online furthered the literature review.*

Delphi Survey:

The main source of data and point of analysis in this research, is the Delphi survey method, a qualitative forecasting technique used to establish a consensus of opinion by groups of experts using a series of questionnaires and feedbacks (Kurian 2013; Okoli & Pawlowski 2004).

The Delphi method is appropriate to answer the research question because it acts as a brainstorming tool, aiding in the gradual formation of considered opinions in situations where judgmental information is critical yet participants would otherwise not collaborate (Okoli & Pawlowski 2004). Close dialogue has been deemed by Clark (1998) to be a valuable way to promote conceptual and theoretical innovation but disclosing environmental management or strategic planning is often a sensitive issue, risking corporate reputation and competitive advantage. Direct confrontation could lead to either "a hasty formulation of preconceived notions [and] an inclination to close one's mind to novel ideas or alternatively a predisposition to be swayed by persuasively stated opinions of others" (Okoli & Pawlowski 2004;2). By collaborating the distinctive knowledge, experiences and local contexts of experts in a non-competitive environment, this method acts as a close dialogue tool to forecast industry wide trends on long and short timelines, identify best practice and prepare the scene for innovation and progressive ideas (Clark 1998; Kurian 2013).

The Delphi survey method is flexible to suit the context of the research, a quality Harvey (2010) deems necessary when researching elite members of society, in this case people in senior management positions. The lack of rigidity in procedure has resulted in some (Smith 1995) questioning Delphi survey validity but Costa (2005;119) considers the technique to be "proven useful when endeavouring to ascertain experts' views on the current status and future direction of a field", which is precisely this study's aim within the ski industry. Weick (1993;352) considers Delphi methods to excel at improvisation or opportunism, using the French term 'Bricolage'; "to use whatever resources and repertoire one has to perform whatever task one faces", a useful quality for short-term masters-level research.

IDENTIFYING AND ACCESSING AN EXPERT PANEL:

In this study experts are defined as senior management decision-makers in North American ski industry or area management, operations, development, sustainability and environmental management or corporate social responsibility (see Figure 5).

McDowell (1998) places the success of gaining access to elite subjects on 'serendipity' and social networks. I identified experts through a collaboration with HeliCat Canada, industry trade association sustainability contact lists, personal contacts and online research. I contacted approximately 150 experts to participate via email. 48 ski area experts working in

53 ski areas participated in the Delphi Survey[6]. An additional 4 ski association experts participated in key informant interviews for a total of 52 experts. 7 declined and the remainder failed to respond.

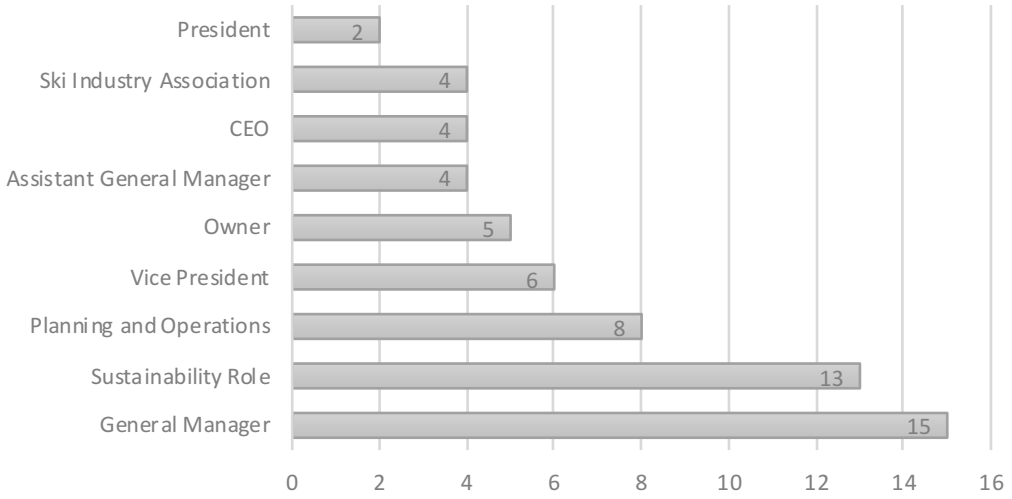


***Figure 5**: Expert Panel Demographics. *Note some experts may be classified under two headings e.g. Owner and General Manager*

DATA COLLECTION:

In this study I followed a qualitative Delphi framework outlined by Nielsen & Thangadurai (2007) consisting of three steps:

1. Identify the theses, problems or issues
2. Sharing of perspectives based on experience and knowledge
3. Synthesis or a summary of the degrees of consensus and divergence.

1. <u>Identify the issues</u>

Following Central University Research Ethics Committee (CUREC) ethical approval, I sent the panel of 45 experts an email survey consisting of five broad open-ended questions (See Appendix A) based on literature review and document analysis information. The questions covered: natural capital assets, current sustainability focus, strategic timelines, challenges facing the ski areas and future outlooks on the industry. Open-ended questions allow the experts' responses to identify the issues and guide the direction of the study (Hasson et al. 2000). I manually coded the qualitative responses and analysed the data, following Newing's (2010) process of letting themes emerge through inductive reasoning (Gray 2014).

[6] Some ski area experts represent more than one ski area while some ski areas had more than one expert participate.

2. Sharing of perspectives

I presented an anonymized summary of the trends back to the expert panel (See Appendix B) in an email alongside a second-round of questions (See Appendix C). In the second-round I asked if experts would reconsider their answers after seeing the group trends and asked new questions, based on these same trends (Hasson et al. 2000). The additional questions focused on three prominent trends identified from the first-round responses; the current lack of an industry-wide strategy or timelines, the scale of action needed for change and their envisioning of the future ski area.

In total 23 experts participated in round two. 16 experts from the first-round survey responded to the second-round questions. An additional 3 ski area experts and 4 ski association experts participated in the second round, answering the same questions and discussing their thoughts on the first-round industry survey trends. 5 experts responded via email. Based on availability, I performed 18 key informant interviews, 7 in person and 11 over the phone.

Key Informant Interviews

The key informant interviews began with three structured questions that aligned with the second-round questions asked to the email respondents. I followed this with semi-structured questions flowing from the general first-round survey trends, but also recognizing where individuals diverged from the group consensus, to gain further insight into alternate positions (Hsu & Sandford 2007). The key informant interviews with ski association experts gave a wider perspective while ski area expert interviews provided opportunities to delve into issues unique to specific regions, corporate structure or ski area type, making this method both a 'broad and rich' investigation into the research question (Okoli & Pawlowski 2004).

3. Synthesis and Summary

The second-round responses tested the validity of the first-round trends, refined broad themes and expanded insight into new topics. While the Delphi method often focuses on consensus, it also emphasizes identifying differences of opinion to cultivate alternative sets of future scenarios (Okoli & Pawlowski 2004) which is useful for innovative conceptualization. These second-round expert responses were coded manually and analysed based on priori codes established from the first-round trends to inductively forecast future ski industry scenarios (Newing 2010; Gray 2014).

Positionality and Power

Clark (1998;73) states "close dialogue relies upon the intimacy or closeness of researchers to industry respondents, a level of personal commitment quite at odds with the conventional notions of scientific dissociation and objectivity". As a former elite ski racer and member of the North American skiing 'social network', I could access many gatekeepers through personal relationships and credibility within the industry with one expert replying "*If you had not been a former racer, I probably would not have completed the survey… I assume that your racing background means that you love the sport and want it to continue*". This intimacy with the industry while opening doors to access industry elites and providing useful close dialogue results, also meant I had to be very careful with bias, power and positionality when conducting my survey and interview (Harvey 2010).

Positionality is not static (Harvey 2010) and perception of the researcher's intentions can affect how experts respond (Butler 1990). By exposing my environmental management and sustainability research topic in my initial email I likely influenced not only the responses but the expert panel itself to lean towards pro-environmental values. I recognize my position as a female researcher, my underlying environmental interests and my relationship with the expert panel as a skier will undoubtedly create subjectivity to some extent (Kitchin & Tate 2013). With an often-contradictory skier/environmentalist predisposition and 88% male participants, bias and power likely influence responses. Attempting to remain neutral, I kept my survey questions open-ended and tried to maintain a reflexive stance but during this process I sometimes found myself leaning slightly towards either skier or environmentalist perspectives depending on the power relationship with the expert I was conversing with. To remedy this I was transparent about my research stance, that profitability and sustainability are not exclusive, and adapted to the variable time, commitment and involvement each expert offered as recommended by Harvey (2010) and McDowell (1998).

Feminist Haraway (1991) suggests 'feminist versions of objectivity' whereby making visible our own critical positioning within the structures of power can open up situated knowledge. Scientific methods generally demand objectivity, stylized facts and non-involvement with the people studied but the embodied nature of knowledge, complexity of life, and value of information exchange and interpretation mean subjective and situated knowledge can be useful in understanding decision-making and innovation (Clark 1998; McDowell 1998).

Results and Discussion

The literature review established that long-term value maximization requires evolving the 'intangible experience' to suit what future consumers want and how primary stakeholders; nature, climate and community, will exert their power (Murphy 2008; Haigh & Griffiths 2009). Assuming this, how ski areas react, manage and adjust usuncertain futures will determine the sustainability of the industry and socio-ecological system. Using expert responses, I forecast what a future ski industry will look like in two sections;

1. Envisioning the 'new mountain experience'
2. Developing a strategy for sustainable tourism

Expert responses have been coded and analysed in themes based on both consensus and divergence (Newing 2010). This discussion aims to reflect industry-wide trends, concerns, predictions and solutions but understands the unique qualities of the 53 ski areas (see Figure 5). Diversity within the industry means the results discussed here may not always represent the reality of each individual ski area or expert.

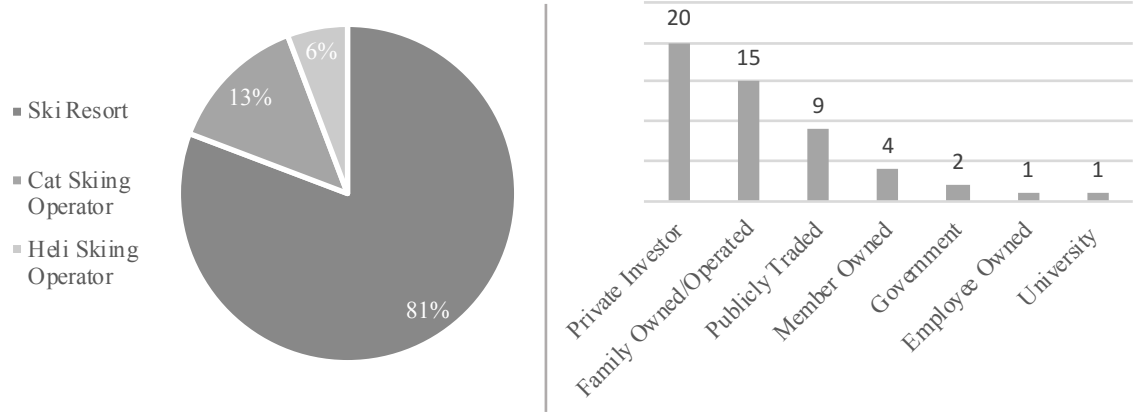


***Figure 6**: Ski Area Demographics; 53 ski areas represented in this study by experts are diverse in service and operation type (Left) and ownership structure (Right).*

Exploring New Terrain: Envisioning the 'New Mountain Experience'

Success for a ski area, means; "attracting, holding and satisfying guests so they become visitors or good will ambassadors. To achieve these objectives requires a management strategy that can operate at a variety of scales and with a selection of target markets but its constant must be the creation of a valued experience" (Murphy 2008;9). Findings confirm that ski areas seek to attract visitors and build value by producing and selling what one expert

deemed "*meaningful experiences*". "*Experience quality will continue to have the biggest impact on our success as a resort"* said another expert.

Experts further ratify the current intangible experience in this industry is built on ski area's nature, climate, community and setting assets. "Setting", which included aspects of a ski area such as "*close proximity to large city population*", "*remoteness*" and "*steepness of terrain*" is the only aspect of the meaningful experience that cannot be cultivated or degraded by ski area practices. **Nature**; "*The amazing natural setting that we operate in"* and *"Views and vistas looking out over millions of acres of public lands*", **community**, "*an authentic town*" and "*local vibe*", and **climate**, "*clean air*" and "*the greatest snow on earth*", are all intuitively considered assets for success but are also stakeholders affecting and being affected by ski industry behaviour (Freeman 1984; Haigh & Griffiths 2009).

Within the unpredictability of skier demographics, policy and markets, and uncertainty in how stakeholders will exert their power, expert panel responses act as a brainstorm forecasting how new activities, consumers, and contexts will combine to create a new valued mountain experience.

NATURE:

"*As long as the weather continues to get warmer, we are in trouble and are having to think up alternatives to relying on snow*" said an expert. Another asks, "*How to convince the market that they should come to our resort regardless of weather?"*. With climate and weather threatening winter recreation revenue, the current move for ski areas is developing and marketing four season activities. Large investment into ski area infrastructure and development, means using these assets year-round makes financial sense.

> "*For us financial sustainability is critical, for this we require all season access to our mountain, utilization of our assets in all seasons, i.e. lifts for access to new summer attractions. Our remote mountain environment is our largest draw for visitors. Expanding our offering to bring more visitors winter and summer is required*."

The top activities listed by experts unsurprisingly use pre-existing infrastructure to diversify, including hiking and biking on trails, summer gondola or helicopter rides, guided sight-seeing and wildlife tours, and mountain top lodge or chalet events. Others suggested developing golf courses, spas, dirt bike tracks, ropes courses and other new infrastructure to attract summer consumers. Richins and Hull (2016) explain in a case study that the BC government

developed an all-season resort policy in 2005 allowing summer activities to help recuperate the heavy capital and operating costs of winter recreation. A similar law was developed in the US in 2015 (US Senate 2015).

One expert warns that "*when the snow is gone, the experiences are much different and nature comes along. If development was not done carefully it can be a real turn off… it's not attractive. We must design ski areas and activities into forms of nature-based experiences*". With nearly all experts discussing some variation of "*the pristine nature of our natural environment continues to be the draw*", four season activity diversification strategies involving infrastructure development or land-use change could harm local ecology and decrease the desirability of the surroundings (Hammitt et al. 2015).

Image 5*: Summer versus winter in Vail Colorado: both beautiful but the different activities mean different ecological impacts and requisite management strategies (Pictures: Candidate 1011918).*

With four-season activities, nature gains greater proximity and legitimacy as a primary stakeholder contributing to the 'new mountain experience' asset (Haigh & Griffiths 2009). Experts contend that there will be a shift from recreation resource assets to more of what HaySmith and Hunt (1995;203) call nature-based tourism; "domestic or foreign travel activities that are associated with viewing or enjoying natural ecosystems and wildlife for educational or recreational purposes",

> "*In the future visitors will be drawn to our area by the authentic community we will have developed, that gets them out of their cars and into meaningful relationship with nature, each other and themselves,"* says one expert while another professes *"Folks want to go to 'mountain towns' for fresh air and natural settings that they can interact with. Our job is to figure out how."*

General understanding of outdoor recreation's environmental impact is deficient (Sato et al. 2013; Buckley 2005) and increased reliance on nature stakeholders to provide mountain

experience assets means a greater urgency for recreation ecology research to improve nature management. (Haigh & Griffiths 2009).

Only a few experts noted increasing urgency – one expert states "*Wildlife is more of an issue in the summer".* Hudson (2000) confirms that recreation disrupting alpine flora and fauna's short summer recuperation periods is problematic. Another ski resort expert notes a need to update current management best practice, *"We are trying to work on understanding and awareness as weather and climate change affect the forest health side, there may be some changes needed there*". Some HeliCat operators have taken further initiative to operate with greater ecological understanding by supporting wildlife impact and best practice studies for example caribou, mountain goat and most recently, wolverine monitoring. The majority of ski resorts profess government or other external organizations provide sufficient ecological data to act appropriately.

Still Sato et al. (2013) find ecological research is not sufficient nor keeping pace with ski industry development. Climate change affects alpine species ranges, distribution, behaviour, phenotype and growth (Theurillat & Guisan 2001; Chapin & Korner 2013) meaning not only are the new activity impacts unknown, but the ecological context is increasingly unfamiliar. Introducing new activities, in different seasons and changing climates without managing nature as a primary stakeholder by researching 'all injury to it', and remedying impact by 'making it whole again' (Stone 1972;458) may prevent nature from providing the assets new summer and nature-based activities require.

COMMUNITY:

Experts are trying to entice a new generation of skiers into the mountains. As North America becomes more diverse, Canadian Ski Council, CWSAA and their member ski areas are proactively working to attract and welcome this new wider constituency into the mountains. Others focus on attracting "*a young, vibrant, and expanding middle class*." As community demographics shift, expectations of ski area services and perceptions of corporate legitimacy will likely change as well.

"*Expanding the social component to the sport*" and "*working on spring, summer and fall programing*" will hopefully create a "*vibrant base area community and economy of full time residents, part time residents, short-stay visitors and businesses, on a year-round basis*".

Divergent expert responses signal a need to balance "*technology and connectivity*" with rural culture and "*the escape notion*". "*People are aspiring for a sense of community*" so ski areas are focused on creating "*places where people live and want to live*". By introducing cultural diversification and using mountains as social event venues such as weddings, concerts, festivals, and conferences, experts expect future community assets will come from creating what Kotler et al. (1993) calls 'place bound products' focused around local people and resources. Arapahoe Basin in Colorado for example is introducing a local brewery festival, a mountain yoga retreat and local music jam day among other new events. "It is exciting", said Tom Tidwell, Chief of the US Forest Service (Peters 2014), "that our ski areas will now be able to offer more recreational opportunities and economic benefits". De Grave (2014) concurs that the shift to diverse year-round mountain tourism, positively benefits the community socially and economically.

"*We think ski areas will try to bring along local towns to unite in a more strategic approach to sustainability, realizing that the ski area is not an island and must integrate the community in order to act more effectively and address risk*" said an expert at a family-owned ski area. Community stakeholders' sense-of-place values coupled with coercive power over social-license-to-operate has many ski areas concerned about gaining support from their new constituency. "*We are the largest employer in a small and relatively isolated community*", says one expert, "*we need to have buy in from our surrounding community in anything we do*". Internal and external community stakeholders' buy in comes from responsible behaviour which is tightly linked to the same sense-of-place values experts feel new consumers desire. An expert running a longstanding corporate social and environmental responsibility program at a leading resort said,

> "*As we engaged in that journey we started to see meaningful benefits from million-dollar savings, recruitment retention, credibility, social license, local government and active community engagement. Why do people come here? To recreate in nature, to work here and live here. 75% percent of the workforce is living in the resort. There is a strong connection to place and to the natural resources*."

Interestingly few experts addressed the affect consolidation is having on the industry even as Aspen Ski Co and KSL Capital Partner (owner of Squaw Valley Ski Resort) joined forces this summer to purchase Intrawest's six ski resorts and a 12 lodge Heli ski operation for $1.7 billion USD (Blevins 2017a). An expert from a newly consolidated ski area found conglomerates offer increased resources for stakeholder management. Alternatively, a ski area expert previously part of a ski area conglomerate felt aloof corporate bureaucracy meant

less time and attention available to address local issues. Gaining approval and building sense-of-place values among the many constituencies, investors, employees, residents and guests that make up a ski area's community is extremely difficult, particularly with remote owners or managers.

Image 6: *Crested Butte Mountain Resort offers kids camps, mountain biking, ropes courses, climbing, guided tours, chairlift rides, archery, disk golf, fishing, horseback riding, four wheeling, concerts, events and more, meaning the town is bustling in the summer (skicb.com 2017) (Image: Candidate 1011918).*

An expert at an up and coming ski area suggests "*sharing up front the company's key values around stewardship, sustainability and community development should minimize some of the hurdles*" of maintaining all community members' support. A large number of experts find "*communication and visibility is very hard*" especially with respect to corporate social and environmental responsibility. Spector et al. (2012) confirm ski areas have difficulty communicating information but attests that benefiting from community stakeholders' license to operate, as well as building assets off sense-of-place values, means ski areas must not only act responsibly but communicate and market their values and behaviour accurately and transparently.

CLIMATE:

A near consensus of experts understand the *"direct relationship between weather and revenue in this industry*", particularly the link between climate change, energy usage and operating costs. Further investigation via key informant interviews, particularly with industry association experts, highlight that declining skiers industry-wide, exacerbated by lack of natural snow, and high energy and operating costs creates the intense downward cycle the industry is trying to reverse. An industry expert gave an interesting example of how this issue has lengthy consequences. In California many teenagers, having not skied in multiple years

because of the recent drought affecting snow, will pursue other activities and are then less likely to ski later in life. Ski area experts also convey this issue clearly.

> "*The weather, is not predictable. We have had four very challenging seasons with a lack of natural snow, increased costs in energy, a shrinking market of skiers across the industry in North America*".

Echoing a large body of research showing even the threat or perception of bad weather reduces tourism demand, (Murphy 2008; Pickering et al. 2009; Pickering 2011; Hopkins 2014) another expert continues,

> "*This variability in weather has a huge impact on the markets' confidence in our product - leaves uncertainty in the minds of our guests, is there snow, is the resort open, does the resort have quality snow conditions, will it rain while I am at the resort etc*."

Still, opinions regarding climate's future power over the intangible experience ranged drastically. At one end experts had rather dire responses.

> "*Not to beat a dead horse here, but we don't think most ski resorts will be around in 25 years, and so what we do today ought to be focused on changing that story. The truth is, though, that we can't change that story – we're going to see a level of warming that takes this industry down*… [Ski area] *is going to become a place that is a refuge from heat*". Another expert agrees "*people want to escape the heat and poor air quality".*

At the other end of the spectrum experts remain highly optimistic, "*Mother Nature will continue to bless us with excellent snow conditions*" said one, while another said, "*this region is predicted to have more snow as the climate warms*". While it is true microclimates may experience localized short to medium-term snow increases (Tang 2011), those ski areas may face other issues. *"We may be getting more snow, but our greatest concern is heat in the summer melting glaciers and greater wildfires"* confirmed an expert.

The majority of experts currently feel comfortable that technology advances will absorb climate issues, particularly within the resort sector where many feel artificial snowmaking will continue to be an adequate solution.

> "*Snowmaking improvements in efficient production, snow management and slope coverage will become imperative to continued successful operation and sustainability*"

The core climate adaptations suggested by experts including "*more snowmaking, higher elevation lifts*", geographic diversification and consolidation will likely reach a threshold, becoming unviable in terms of cost and effectiveness in business as usual contexts (Clement et al. 2015). As Paul Polman of Unilever said in a 2014 speech "Most CEOs, I'm convinced

of now, know that their companies cannot prosper in a world with runaway climate change. This is increasingly evident. They understand the need to work together with political leaders to address these challenges."

"*It is our duty as a ski industry to keep the focus on climate change*", says an expert part of a select group that feel "*the industry is behind on advocacy*". This group mentions lobbying for carbon taxes and pursuing the Paris Agreement while the other end of the spectrum "*still has challenges educating our staff and guests*". Beyond physically allowing the core skiing business to persist, like-minded experts explain sustainable action can entice new 'conscious consumers' (Cohen & Munoz 2017).

> "*Sustainability can also lead to new skiers. People think it's purely about the environment but its more complex than just snow and potentially more valuable. New demographic of skiers may be demanding this sort of values. Overall trips to interact with ski areas will be based on considerations of experience. One of those considerations will be do I feel good about their commitment to the environment*."

The consumers' perceived value of a tourism experience includes the functional value or utility of the product or service but also the "emotional value: the capacity to arouse personal feelings in relation to the product experience, such as excitement and fulfilment, and social value: the enhancement of social self-esteem because the product has social status" (Murphy 2008;34).

> "*By promoting excellence in sustainability people will want to come up more because people like to surround themselves with what is trendy and the right cause. Today and moving forward, people are taking steps towards sustainability."*

These predictions align with North America's rapid growth of a 'conscious consumer market' concerned with corporate values and impact (Cohen & Munoz 2017) and the responsibility and transparency demanded by community members.

An industry expert says "*fear of the political spectrum of skiers and distress of marketing*" means "*a lot of ski areas don't want to talk about climate change publicly*" but with Wobus et al.'s (2017) climate projections suggesting lowered levels of future greenhouse gas emission reducing physical and economic impact to the ski industry, and expert and academic projections of a growing conscious-minded consumer base, advocacy to minimize greenhouse gas emissions will directly and indirectly enhance the value of the new mountain experience.

The new mountain experience will exist "against a background of increasing environmental awareness and constraints on the freedom of choice because of concern for the repercussions on nature and society" say Pigram and Jenkins (2006;112). Expert responses recognize nature, community and climate stakeholders' power and suggest responsible behaviour through natural environmental research and action, and transparent communication to community members as valuable for growing future mountain experience, however opinions diverge on how exactly to transform.

"*We strongly feel environmental management should be a priority throughout the ski industry. However, many areas do not have the blue print to make major changes".* Expert responses to setting environmental management objectives focus primarily on climate but solutions range from recycling programs to carbon taxes while nature goes unmentioned by nearly half the panel. Timelines to achieve sustainability management objectives vary from "*not applicable*" out to 2030. Some suggest educating consumers and employees should be a priority while others believe addressing community issues, creating regional partnerships, lobbying federal governments or influencing international agreements will create desirable futures.

Many experts brought up the phrase "*meaningful action*" or "*meaningful change*", which ultimately describes managing stakeholders to a level that allows optimal ski industry operations to continue indefinitely. Inconsistency in environmental objectives, scale of action, and timeframe suggest there is no industry consensus on what meaningful action entails.

Planning the Ascent; Developing a Strategy for Sustainable Tourism

"*We need to adopt holistic solutions and not piecemeal different solutions together*", says one expert. Together nature and place values, responsibility and transparency ethos, climate change mitigation and corporate financial goals suggest what the UN World Tourism Organization (2004) terms as sustainable tourism's "quadruple bottom line"; environmental, social, economic and climate responsiveness. Although criticised by McCool and Moisey (2001) and Pigram (1990;3) as a 'guided fiction' lacking the ability to 'translate idea to

action', the World Tourism Organization's (2004; 2017) sustainable tourism definition clearly lays out objectives for meaningful action:

- Continually Improving Stakeholder Management

> "Sustainable tourism development requires the **informed participation of all relevant stakeholders** as well as strong political leadership to ensure **wide participation and consensus building**. Achieving sustainable tourism is a continuous process and it requires **constant monitoring of impacts**, introducing the **necessary preventive and or corrective measures** whenever necessary"

- Engaging Consumers in the Experience, Issues and Solutions

> "Sustainable tourism should also maintain a high level of tourist satisfaction and ensure a **meaningful experience** to the tourists, **raising their awareness** about sustainability issues and **promoting sustainable tourism** practices amongst them"

This combination decreases stakeholder induced risks, increases corporate legitimacy and heightens conscious tourism consumers to drive sustainable tourism and enlarge the climate advocacy constituency, leaving the ski industry fiscally and socio-ecologically more resilient.

Ski association experts recognise ski industry sustainability as a collective action challenge. Losing smaller ski areas that do not or cannot adjust to suit future consumer and stakeholder demands, "*damages the supply chain and the ability to cater to all demographics of skiers and has ramifications for the industry as a whole"* says an industry expert. While ski area experts are competitive about attracting skiers, industry experts fear the loss of grassroots skiing hinders long-term industry growth and leads back to the negative short-term profit seeking cycle. More obvious is how climate is affected by more than a singular niche tourism sector let alone individual ski areas. "*We can't do this on our own*" said another leading expert, "*it's all about building critical mass*".

"*Ski areas have to be realistic. We've got to say we're going to stick around and this is how we're going to do it*", an expert explained. A ski industry sustainability leader said this;

> "*We collaborate with [external organizations and businesses], leaders in the sustainability world because the ski industry is behind on advocacy. Leadership in the industry, it's growing but [ski area] feels like we don't have anything we can learn from other ski areas."*

While sustainability efforts are slowly emerging in the ski industry, the unwillingness to work within the industry to build critical mass hinders the ability to work successfully beyond the North American ski industry.

Other industries (including skiing's nemeses coal, oil and gas unfortunately) understand the benefits of working collaboratively for a prosperous industry by **presenting a united front, improving efficiency,** and **coordinating technology innovations** (OGUK 2016; Ashraf & Rabley 2017).

> "If we want to move forward, see Apple healthy and prospering again, we have to let go of a few things here. We have to let go of this notion that for Apple to win, Microsoft has to lose. We have to embrace the notion that for Apple to win, Apple has to do a really good job. And if others are going to help us that's great… And if we screw up and don't do a good job, it's not someone else's fault – it's our fault… So the era of setting this up as a competition between Apple and Microsoft is over as far as I'm concerned… This is about Apple being able to make incredibly great contributions to the industry, to get healthy and prosper again". – Steve Jobs (1997)

ADDING THE TEAM EVENT; Presenting a United Front

Through the survey and key informant interviews, expert opinions produced a scale of five levels of action (see Figure 5) that ski areas can work at to meet sustainable futures. Perspectives on what type of action and which levels would most effectively create change are fragmented.

One group, whom Weaver (2011) identifies as 'Adaptionists', understand climate change threats and are committed to adapting within the parameters of a warming climate and traditional corporate roles by addressing destination-level impacts (Hoyer 2000). An example of this perspective follows:

> "*I personally do not see ski areas leading a major sustainability movement. At the end the day, ski areas are in the business of providing quality skiing and service to guests. That being said, areas like [ski area] have a set of standards and values regarding sustainable practices and conduct operations accordingly. I feel that ski areas are abiders of other environmental organizations. I believe it is up to non-profits, environmental organizations, and government entities to set standards and create a movement from which ski areas across the world can buy into and rally around*."

The other group deemed 'Mitigationists' (Weaver 2011), have a 'volume-perspective' (Hoyer 2000) that looks at changing the parameters of a warming climate and the role of the corporation, by actively addressing political environmental stewardship to mitigate global climate change. One expert articulates this well.

> "*We don't believe that operational sustainability, meaning greening your resort, is meaningful anymore. First, it's just good business. If you're not doing efficiency, green building, retrofits, etc. you're just missing the boat and will likely get out competed…we think the focus on operational greening has been a drag on getting*

> *resorts to take meaningful action on climate. We think it provides a dodge whereby resorts can tout their green actions without actually doing the difficult, controversial, and even risky work of taking a stand and wielding power on climate, pushing for policy solutions, helping create a social movement in support of action*."

The above quotes show contention between adaptationist and mitigationist perspectives, which Weaver (2011) frames as a conflict between adaptation, growth at the expense of socio-ecological systems and mitigation, incompatible with pro-growth free-market ideologies. Scott (2011) responds directly to Weaver citing evidence that adaptation and mitigation can be complementary but experts in this industry still feel the two viewpoints are contradictory.

Mitigationists believe threats to the ski industry require *"scale action*", "*leveraging our voice*", "*taking a stance*", and "*influencing the permitting authorities to take bold steps*". One goes so far as to say he is "*skeptical of exploring sustainable practices that don't take on climate change at scale*". They want a social movement to drive the sustainable tourism ideology and political action on climate change. But a social movement or action '*at scale'* is, in reality, action at the level of the individual; convincing individuals to vote climate friendly officials into office, and endorse sustainable tourism. Reddy and Wilkes (2013) feel the next step to attaining sustainable tourism is improving public awareness, interest and involvement in the solutions to tourism threats. Mitigationists focused solely on the complex, long-term climate picture risk diverting attention from other stakeholders' immediate needs or disengaging their audience with intangible solutions (Nisbet 2013; Weaver 2011; Scott 2011). Adaptionist strategies that pursue the new mountain experience are just as, if not more, likely to engage individuals.

Adapting to climate change will, as the 'new mountain experience' suggests, require increasing tourist exposure to environmental issues through nature-based recreation development and corporate transparency requirements. Adding mountain recreation experiences beyond expensive, dangerous, difficult-to-learn sports like skiing (Mintel 1996) means potentially increasing pro-environmental values in a wider constituency (Dunlap & Heffernan 1975). Corner et al. (2014), find that the values we hold influence how we interpret climate information and lead us to either accept or reject the need for greater engagement. With ski area experts forecasting increased desire for connections with nature and heightened sense-of-place values, addressing direct, imminent or tangible climate threats such as air pollution and operational or community level solutions like habitat restoration can create a

local sustainability culture that is the essence of a large-scale social movement mitigationists want (Nisbet 2013; Williams et al. 2016; Weaver 2011).

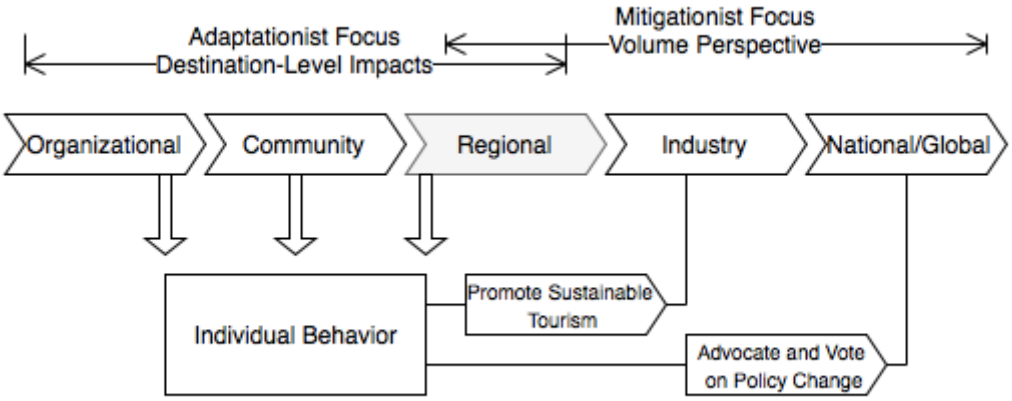


***Figure 7**: Conceptual map (Knowles 2017) identifying ideal scale of action to reach sustainability goals based on expert opinions, based off Weaver (2011) and Hoyer (2000).*

By framing adaptationist and mitigationist positions as contradictory, experts lose sight of how their underlying interests in a prosperous ski industry align. Despite a perceived incongruity, Dubois and Ceron's (2009;411) alternate claim that "climate change adaptation and mitigation are two sides of the same coin" resonates loudly for the ski tourism sector.

> "*At the end of the day we are a company that must remain profitable in order to survive. This means that we must remain in a balance of holding true best management practices while ensuring the strategic decisions we make bring economic benefits as well*".

"*To get scale up action we need to change mind-sets. We need CEOs talking to CEOs*" to ebb conflicting rhetoric, focus on shared interests, and "*make sure it doesn't become so cumbersome that small resorts can't follow*".

PICKING UP SPEED; Improving Efficiencies

The most promising place where mitigationist approaches of "*leveraging our voices*" for "*meaningful change*" overlap with adaptationists' destination-level impact concerns is at the regional level. Regional approaches work because they yield practical, tangible volume-scale benefits and simultaneously address localized-intensity perspective issues (Weaver 2011) that engage widespread place-bound advocacy from community stakeholders including local businesses, governments, NGOs, and individuals (Williams et al. 2016). Operating in small

rural economies means ski areas are highly influential at this level, particularly when working together (Norrie & Murphy 2016).

"*Power company contracts are a hindrance to contributing renewable energy into the grid. [The ski industry] need[s] to get involved and put pressure on utility coops*" says an expert but others gave successful examples of existing regional partnerships fighting this. Four ski areas in Colorado's Summit County partner with Xcel Energy to reduce energy usage. Similarly, Quebec ski areas have signed onto a collaborative hydro incentive with the provincial government. An industry expert suggests there are opportunities for cooperative ski areas to invest in mutual loans for renewable energy or other communally beneficial environmental, social and economic initiatives. Ski areas in Utah's Little Cottonwood Canyon and the Salt Lake City public transportation share a green transit scheme to reduce air pollution. Three separate ski areas in Alberta, contribute to a joint 'Resorts of the Rockies' international marketing scheme aimed at bringing tourism to the Banff area. Protect Our Winters is currently aligning Utah ski areas to advocate against Rocky Mountain Energy increasing costs of solar energy as well as mobilizing Colorado skiers against the expansion of the West Elk Coal Mine in Colorado's Gunnison National Forest.

A leading expert feels "*we need to be passing best practice on a daily basis, working with other resorts with an open approach".* Ski areas collaborating on best practice at the organizational and community level build industry "*street cred"* efficiently. For example, an expert highly committed to improving the impact of their ski area is currently putting a lot of effort and resources into the very basic steps of planning and piloting a recycling program next year. While other ski areas are far beyond this type of operational initiative, helping ski areas efficiently achieve simple change like a recycling program means widening the sustainable tourism movement, allowing that expert to pursue more impactful initiatives, increasing regional collaboration opportunities and influencing more individuals.

Industry organizations including HeliCat Canada and NSAA, have built a platform for industry communication by publishing work on best practices (BCHSSOA 2003; National Ski Areas Association NSAA 2005a), but most experts feel collaborative communication has to come from experts and ski areas with tangible experiences. One expert believes "*showcasing successful models, especially fiscally successful models*" would be helpful in identifying stakeholder trade-offs, something that aligns with Jensen's value maximization ideas (2001). In his book, Schendler (2009;15) expands this by stating "we need something

that talks about failure and the difficulties associated with on-the-ground implementation…to complement our roadmap to sustainability, we need a book of wrong turns. You don't learn to hit a curveball by hitting it - you learn by missing it".

Image 7: *Aspen's closing weekend celebrations in April 2017 bring hundreds of people into the mountains. Aspen Ski Co is considered to be a leader in sustainability, but Hudson (2000) and Spector et al. (2012) fear environmental communications fail to reach these audiences (Photo: Knowles 2017).*

Sharing successes and failures requires having principled ways to evaluate whether or not managers are achieving meaningful change (Jensen 2001; Friedman 1970). Many ski areas voluntarily report social and environmental targets or performance. Vail Resorts for example, a ski resort conglomerate of 13 ski areas, announced this summer a commitment to become zero net emissions, zero waste to landfill, and zero net operating impact on forests and habitats by 2030 (Ladyga & Biebl 2016). Some experts report adhering to environmental management systems for instance Stowe Mountain Resorts advertises on its website being the "first mountain community to receive Audubon Sustainable Community Certificate". These individual ski areas are endeavouring to meet sustainable tourism's objectives of "constant monitoring of [stakeholder] impacts" and "rais[ing tourist] awareness about sustainability issues" (UNWTO 2004;2). Unfortunately inaccessibility, inconsistency and incongruity in communication platforms make it difficult for anyone to shrewdly assess or endorse meaningful action (Spector et al. 2012).

Experts and academics propose many tools to remedy the problem of measuring and achieving meaningful change. Managerial proposals include a "*standard that is owned by the ski industry*" so "*consumers can see and understand*" management practices, a standardized structure for online environmental communications (Spector et al. 2012), "*simple industry targets that resorts can compete with each other*" to "*drive competitive innovation*", or a framework for a standardized industry Environmental Management System (Todd and Williams 1996). Experts see technical innovation as purely pragmatic operation changes mostly focused in carbon footprint or energy efficiency, such as "*electric vehicle technologies and infrastructure*", or "*research and development into using alternative fuels in cold and harsh environments".*

These ideas increase efficiency and comparison, but don't contend with the ultimate issue hindering existing voluntary environmental programs, corporate responsibility, and stakeholder theory; giving the natural environment rights by identifying all impacts to stakeholders, assessing trade-offs and remedying wrongs. Additional angles point out "*with no one to check up on it, it must be self-evaluated".* Schendler (2009) is concerned technology is not moving fast enough and that research and development slows down deployment of existing technologies. Other experts, particularly those representing smaller ski areas worry about *"the high cost to implement sustainable technologies and practices"* suggest tools be *"designed in a manner where they can be achieved at varying levels by all ski areas*". Duglio and Beltramo (2016;860) conclude "there is not a tool able to deal completely with the concept of sustainability" but that risk-based systems may stimulate managerial and technical innovation.

Based on expert and academic ideas and concerns, the ski industry could creatively harness existing, new and bespoke information and communication technology to improve climate risk-based managerial decision-making while educating and engaging tourists and enhancing the new mountain experience. The explosion of big data means innovative technologies can integrate information on the natural environment with human impacts cheaper, faster and better and transparently communicate the data to community stakeholders on impartial yet engaging platforms (Arts et al. 2015). Tools that constantly monitor information on the natural environment give nature and climate stakeholders an impartial representative voice

which allows accurate, objective decisions-making to efficiently maximize value and accurately remedy impacts (Arts et al. 2015; Stone 1972; Jensen 2001).

For climate, the 'internet of things' and smart technologies can monitor value chains, product lifecycles, energy use and carbon data to fully understand impact versus efficiency at the operational level (Miorandi et al. 2012). Communicative tools could work to visualize, market or incentivize sustainable tourism conduct among consumers and/or 'maintain or win public and political support' (Arts et al. 2015) by bringing people into the climate action social movement. At a larger-scale adaptive agent-based modelling can solve complex decision-making problems by simulating emergent economic, social and environmental outcomes and optimizing macro-scale behaviour such as carbon reduction through regional or industry partnerships (Miorandi et al. 2012; Dohert et al. 2014; Arts et al. 2015). Future uncertainty is difficult to communicate but these models add tangibility and open doors for two-way conversations between the industry, and various community stakeholders.

For nature, the Local Ecological Footprint Tool (LEFT) is an example which can, in a few minutes via the internet, identify and aggregate land cover, threatened species, species beta-diversity, habitat fragmentation and vegetation resilience into a single map of standard ecological value (Willis et al. 2012; Willis et al. 2014). Existing general recreation apps such as *Strava, mapmyrun,* or *slopetracker* can be mobilized to identify the currently uncertain recreation impacts on vulnerable ecosystems LEFT identifies. Ski areas with existing apps, for example Vail's *EpicMix*, used to monitor and manage human activity remotely and enhance skier experiences can be used to identify environmental impact. Additionally, integrating interactive components such as Warblr, a bird call identifying app, can enhance nature-based activities and build on sense-of-place values by educating participants on the surrounding ecosystem or even create new digitally-facilitated mountain activities (Arts 2015). Citizen science examples such as the Global Biodiversity Index Forum (GBIF) can further enhance the connection with nature and scientific understanding of mountain biodiversity by allowing individuals to contribute species sightings.

RESETTING THE COURSE OF THE INDUSTRY

Innovative tools and techniques in technology, communication and management can proactively transform the ski tourism sector into more desirable configurations, setting the

industry ahead of the impending climate change avalanche (Ninan and Inoue 2017). "*Long-term I would like to see the industry, government, and society address the environmental impacts of travel, namely auto and air travel*" says one expert. This paper for example doesn't even begin to address the extended responsibility or impact of travel itself. Staying ahead of the avalanche means ski area owners and operators constantly need to work at implementing, experimenting and enhancing their technological, communicative and managerial skills and equipment to suit challenges as they approach so future generations can partake in the intangible skiing experience.

> "Finally, there was the great glacier run, smooth and straight, forever straight if your legs could hold it, your ankles locked, you running so low, leaning into the speed, dropping forever and forever in the silent hiss of the crisp powder. It was better than any flying or anything else, and you build the ability to do it and to have it with the long climbs, carrying the heavy rucksacks. You could not buy it nor take a ticket to the top. It was the end we worked all winter for, and all the winter built to make it possible" – Ernest Hemingway (1964;207)

Conclusion

> "It is not necessary that we be able to maximize [value], only that we can tell when we are getting better—that is, moving in the right direction" – Jenson (2001;11).

Maximizing long-term value means moving in the direction of accurately and objectively identifying how a corporation affects and is affected by its stakeholders while generating its products and services. In the ski industry's case, nature, community and climate are each primary stakeholder, that together create the 'intangible mountain experience' asset ski areas sell. This highlights how stakeholder stewardship and long-term value maximization are inherently intertwined, but nature and climate stakeholders lack rights and representation (Stone 1972; Jensen 2001). Without an unbiased representative to voice natural environment stakeholders' status, vulnerabilities, and impacts on it, the ski industry cannot accurately strategize management toward maximum long-term value and when faced with a decline, maladapts towards short-term profit maximizing behaviour. This not only puts ski industry assets and economic success at risk, but the natural environment, community members and future generations as well.

Within a future of more fragile environments, diverse societies and inconsistent weather, long-term value maximization in the ski industry will come from balancing the experience future consumers want with what nature, community and climate stakeholders will continue to provide. Forecasts show consumers will desire activities connected to nature, a sense of place in the community and transparency in corporate responsibility culminating in a 'new mountain experience' aligned with the sustainable tourism ethos.

The new mountain experience cannot be achieved in the long-term with business as usual practices and the ski industry is currently divided on if or how to adapt, transform and evolve into a sustainable tourism sector. I suggest the path to a sustainable ski industry requires collective action. Ski areas must align their interests in maintaining a prosperous industry to present a united front on sustainable tourism and relevant policy. To do this, ski areas must efficiently widen industry legitimacy and credibility by communicating and collaborating on organizational level best practice. Technological innovation has the potential to identify, evaluate and innovate best practice by accurately and objectively assessing managerial decision-making impacts on stakeholders.

This study gives a broad overview of the North American ski industry's perspective on the threats and responses to climate change. It does not dissect regional or individual ski area disparities nor does it provide nature, community or climate stakeholder perceptions. Further research should add to these perspectives to enhance decision-making by studying community interests in a future mountain experience as well as evaluating specific opportunities for implementing technological innovation as objective representatives for natural environment stakeholders.

The North American ski tourism sector is imminently vulnerable to climate change (Wobus et al. 2017). As such, how ski areas fail or succeed at managing climate change to their advantage will have profound impacts on the concepts and applicability of sustainable tourism. This research could be useful for and expanded upon to include emerging ski tourism markets that lack research into environmental impacts, particularly ski areas in South America and the rapidly rising Asian ski industry (Scott & McBoyle 2007) as well as to collaborate and connect international ski tourism destinations. Additionally, further research into sharing best practice and bespoke technologies between various sectors in the global tourism industry using the same strategies of communication and collaboration suggested in this research could foster a global sustainable tourism movement.

Finally, as all private sector organizations increasingly face similar issues adapting, transforming and evolving towards climate resiliency, envisioning the natural environment as a primary stakeholder will become more relevant. It would be interesting to investigate theories of natural environment stakeholders and enlightened stakeholder theory in industries or corporations whose products and services are less directly and visibly impacted by the natural environment. The North American ski industry is at an important moment in time, where its response to the existential climate change crisis will determine its own future, and it has a unique opportunity to be a leading example of treating the natural environment as a valued stakeholder for the long-term health of its socio-ecological systems.

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Appendices

***Appendix A**: Round 1 Delphi Survey Question Set*

The questions in round 1 are very broad and open ended to allow you to shape the direction of focus for round 2. Don't feel as if you need to answer each question directly, you are welcome to read the question/questions and answer what comes to mind, what you feel is most important, most relevant to you or your ski area, or even critique the question itself. Write as much or as little as you wish.

Thank you so much for taking the time to answer this survey and I look forward to reading your thoughts and sharing the results with you.

1. Your name, ski area(s), and your position/role within your area (for administrative use only, your responses will be anonymized)

2. What natural assets or qualities would you say draw people to your ski area/ski operation/lodge/resort?

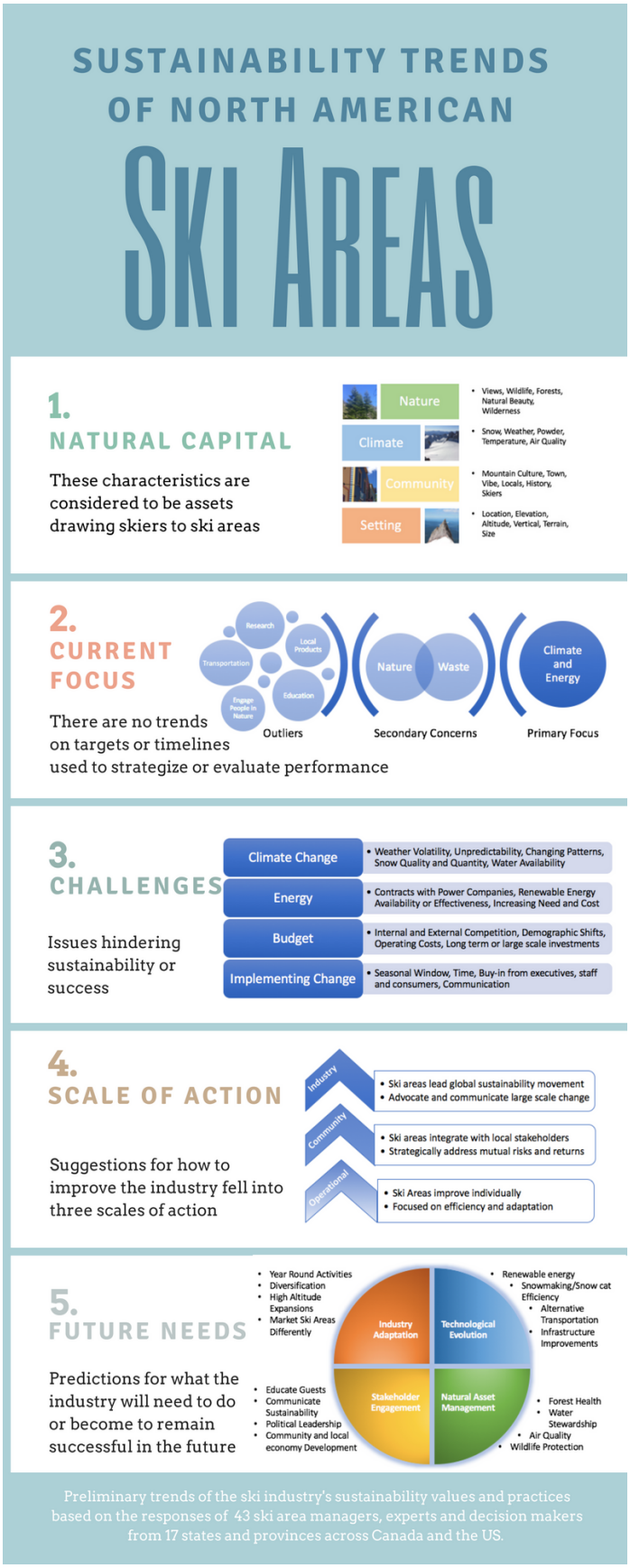
3. What are the main environmental management/sustainability focuses in your ski area and how are these determined? Do you set performance related targets, in which case what are the key targets? What aspects of environmental management are outsourced and to whom? Do you think environmental management/sustainability is getting the priority it deserves in the industry?

4. On what sort of timelines do you plan, strategize or set environmental performance based targets (e.g. annual targets, reach x by 2025, etc.)? How often are they reviewed or updated?

5. What do you think the biggest changes affecting sustainability in the ski industry will be in the future? What do you think are the biggest hurdles hindering your ability to reach sustainable targets or implement new sustainable initiatives? Do you have suggestions to remedy this?

6. What do you think sustainability at your ski area will be focused on in 5 years? In 10 years? In 25 years? What do you think it should be focused on? What natural assets or qualities do you think will draw visitors to your resort in the future?

***Appendix B**: Summary of trends from Survey Round 1 distributed to participants*



***Appendix C**: Round 2 Delphi Survey Question Set*

Thanks again for your involvement in my project, I wanted to share with you some of the trends I've found in my research so far (Appendix 2) and hopefully hear your thoughts on them.

I would love comments, critiques and opinions on any of the trends below. I'm particularly interested in what you think about three sections:

2. Current Focus – Do any outliers (listed here or not) deserve more focus? Why you think there are no similarities in targets or timelines set? Should there be? If so what they should be? Do you or would you work with other resorts to set industry wide targets or timelines or achieve sustainability goals?

4. Scales of Action – Which one is best, most realistic or most effective? What should action at these different scales look like? Who should be acting at each level? Should other organizational levels should be considered, added, removed or replace these ones?

5. Future Needs – Do you feel the four themes are relevant or not? How they should be prioritized or implemented? What do you feel within or outside those themes will be effective, useful or harmful to ski area or ski industry success? Does ski area and ski industry success differ?

*Those completing survey 2 via interview in person or on the phone were asked these questions to begin the interview and then further questions were asked based on their personal responses to survey 1, their ski area's characteristics and anything else they or I found relevant.