

Reducing vulnerability to climate change in the Swiss Alps: a study of adaptive planning

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The Swiss Alps will experience pronounced effects of climate change due to the combination of their latitudinal positioning, altitude and unique ecosystems, placing socio-economic stresses on alpine communities, many of which rely on seasonal tourism. Studies into tourism adaptation within the Swiss Alps have so far focused on the technical adaptation options of alpine stakeholders, rather than perceptions of adaptation to climate change at the operational and community level. This article investigates attitudes to adaptation in two alpine regions within Switzerland's well-established decentralized political framework, through semi-structured qualitative interviews. Stakeholders focused almost entirely on maintaining the *status quo* of winter tourism, through technical or marketing measures, with mixed attitudes towards climatic impacts. A matrix based on the relative internal strengths and weaknesses, external opportunities and threats of adaptation measures (a SWOT framework) was used to assess the measures and suggest how stakeholders could capitalize on the new opportunities thrown up by climate change to create a competitive advantage. A comprehensive and collaborative planning approach is vital to enable policy makers and stakeholders to maximize opportunities, minimize the adverse effects of climate change on the local economy, and develop inclusive adaptation measures that benefit the entire region in order to create more sustainable social, economic and environmental structures.

Keywords: adaptive capacity; adaptation strategies; climate change; economic diversification; socio-economic impacts; Switzerland; tourism; vulnerability

Les Alpes suisses vont subir de manière prononcée les effets du changement climatique, dû au concours de leur position latitudinale, leur altitude et leur écosystème unique, plaçant ainsi des pressions socio-économiques sur les communautés alpines, beaucoup d'entre elles dépendant du tourisme saisonnier. Les études sur l'adaptation du tourisme dans les Alpes suisses ont jusqu'ici porté sur les options techniques d'adaptation disponibles aux parties prenantes alpines, plutôt que sur les perceptions concernant l'adaptation au changement climatique au niveau opérationnel et communautaire. Cet article examine les attitudes concernant l'adaptation dans deux régions alpines, dans le cadre de politique décentralisée bien établi en Suisse, par une étude qualitative basée sur des interviews semi-structurées. Les parties prenantes se sont concentrées principalement sur le maintien du statu quo concernant le tourisme d'hiver, par l'intermédiaire de mesures techniques ou de marketing, les attitudes étant mitigées concernant les impacts climatiques. Une matrice portant sur les forces et faiblesses internes relatives, et les opportunités et menaces externes des mesures d'adaptations (démarche SWOT) est employée pour évaluer et suggérer la manière dont les parties prenantes pourraient tirer un avantage compétitif de la menace climatique. Une démarche de planification approfondie et collaborative est essentielle pour que les décideurs en économie locale et les parties prenantes puissent maximiser les opportunités, minimiser les menaces du changement climatique pour l'économie locale, et développer des mesures d'adaptation inclusives bénéfiques à une région entière pour la création de structures sociales, économiques et environnementales plus durables.

Mots clés: capacité adaptative; changement climatique; diversification économique; impacts socio-économiques; stratégies adaptatives; Suisse; tourisme; vulnérabilité

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1. Introduction

The vulnerability of mountain habitats to climate change is globally recognized by the United Nations Framework Convention on Climate Change (UNFCCC, 2007). The Intergovernmental Panel on Climate Change (IPCC) (Lemke et al., 2007) identifies mountain ecosystems as being among the most threatened in Europe, heightening the need for adaptive responses to the ensuing issues (Schröter et al., 2005). In the last 50 years, Swiss rural alpine communities, which have been traditionally dominated by agriculture, have become increasingly dependent on tourism, especially winter tourism (Wiesmann, 1999). As a result, these communities now face increased vulnerability to the impacts of climate change.

Mountain areas have experienced warming greater than the global average (Beniston, 2005), affecting some of the most fragile, most diverse, and most valuable ecosystems to the planet. Resource damage (Wiesmann, 1999; Batterbee, 2007) and marginalization threats (Michaelsen, 2000) have been compounded by an increase in natural hazards and a decrease in awareness of the environmental limits or natural dangers within the mountains (Hill, 2007; Ross, 2007). The foundations for action have been laid by means of a significant body of work on adaptation paths for the mountain tourism sector in Switzerland (Abegg et al., 1998; Elsasser and Messerli, 2001; Bürki et al., 2005). However, in many areas, very few non-technical adaptive actions have been taken. This generally reflects the adaptation discourse, where it has been recognized that, despite an increased understanding of the impacts and causes of climate change, ‘the ability to design and implement policy responses that engender effective action has remained insufficient’ (Burch and Robinson, 2007).

This may partly be explained by the scientific focus of research aimed at creating scenario models (Abegg et al., 1998; Beniston, 2005; OECD, 2007) and capturing the technical mitigation and adaptation solutions to decreased snow cover and melting permafrost or glaciers (Abegg et al., 1998; Nöthiger et al., 2002; Bürki et al., 2005; Scott et al., 2005; Müller and Weber, 2007), whereas the focus of the groups actually implementing actions may require a more prescriptive policy approach. Although this is a vital foundation for action, a clearer linkage now needs to be made in order to embody these findings into policy and action, and into mainstream adaptation.

Adaptation is recognized as being ‘necessary to address impacts resulting from the warming which is already unavoidable due to past emissions’ (IPCC, 2007, p.19). Our study builds on the literature and dialogue concerning the issues that alpine tourism faces due to climate change, exploring stakeholder responses at four different administrative levels in two different regional areas. The results presented in this article form part of a larger study (Hill, 2007), which evaluates the adaptive responses of private and public sector stakeholders with a stake in alpine tourism to the impacts of climate change on tourism in the Swiss Alps. The article sets out to explore and establish:

- the implementation plans for the case-study areas, across the different sectors and governmental levels
- the different ways in which the private and public sectors respond to impacts from climate change
- the contingencies or alternatives which are already implemented
- a set of policy recommendations to reduce vulnerability to climate impacts, which can be implemented at both private and public – as well as local, regional and national – levels.

This article considers how our previous research and findings has enabled a SWOT (Strengths, Weaknesses, Opportunities and Threats) analysis to be conducted, and the subsequent creation of policy recommendations. The object of the exercise was to reduce vulnerability to climate change by reducing threats and weaknesses and maximizing strengths and opportunities.

2. Background

2.1. Adaptation to climate change: reducing vulnerability

With the reality of climate change now being almost universally accepted, focus is spreading to the policy realm in addition to the scientific realm, as well as from mitigation to adaptation (Dovers, 2009). Adaptation to the impacts of climate change has already been observed across a number of sectors and geographies (IPCC, 2007). The IPCC's Fourth Assessment Report retained a focus on the role of adaptation ability in the consequences of climate change on livelihoods (IPCC, 2001, 2007). The IPCC defines 'vulnerability' as

the degree to which a system is susceptible to, or unable to cope with, adverse effects of climate change, including climate variability and extremes. Vulnerability is a function of the character, magnitude and rate of climate change and variation to which a system is exposed, its sensitivity, and its adaptive capacity.

'Adaptive capacity' is defined as

the ability of a system to adjust to climate change (including climate variability and extremes) to moderate potential damages, to take advantage of opportunities, or to cope with the consequences (IPCC, 2001, Box SPM-1).

Adaptive capacity varies significantly from system to system, sector to sector, and region to region (IPCC, 2007). Therefore the determinants of adaptive capacity include the existence of sufficient economic resources, technology, information and skills (including human capital), infrastructure, equity and developed institutions such as government bodies.

Adaptation may take the form of adaptive capacity building in order to empower individuals, groups or organizations to adapt to change, or implementing adaptive decisions; the process of transforming capacity into action (Adger et al., 2005). Klein et al. (2005) suggest that the objective of climate policy should be to 'facilitate such development and implementation as part of sectoral policies'. While adaptation to change and vulnerability over short time periods falls within a 'coping range', there are limits to resilience even for the most robust of systems (Yohe and Tol, 2002). In that case, judging adaptive capacity depends on being able to define the coping range and understanding how a 'coping strategy may be expanded by adopting new or modified adaptations' (Yohe and Tol, 2002, p.27).

Within this framework, a highly vulnerable system would be a system that is very sensitive to modest changes in climate, where the sensitivity includes the potential for substantial harmful effects, and for which the ability to adapt is severely constrained (IPCC, 2001). Therefore, within the alpine communities studied, their vulnerability can be determined by how much the expected changes in snowfall, hazards etc would affect their local livelihoods, and where their ability to adapt is constrained for economic or social reasons. Traditionally, political and social change has been slow in Switzerland and its alpine communities, which is an impediment to increasing adaptive capacity.

2.2. The Swiss Alps

The biophysical features of the alpine regions (environmental) and the range and nature of livelihood options (socio-economic) expose mountain communities to environmental and social vulnerability (Jodha, 2001). The natural vulnerabilities of mountain areas (high degree of fragility, marginality, inaccessibility) are now being compounded by increasing stress from climate change (Figure 1), migration, and environmental degradation (Schneider et al., 2007). Although mountain

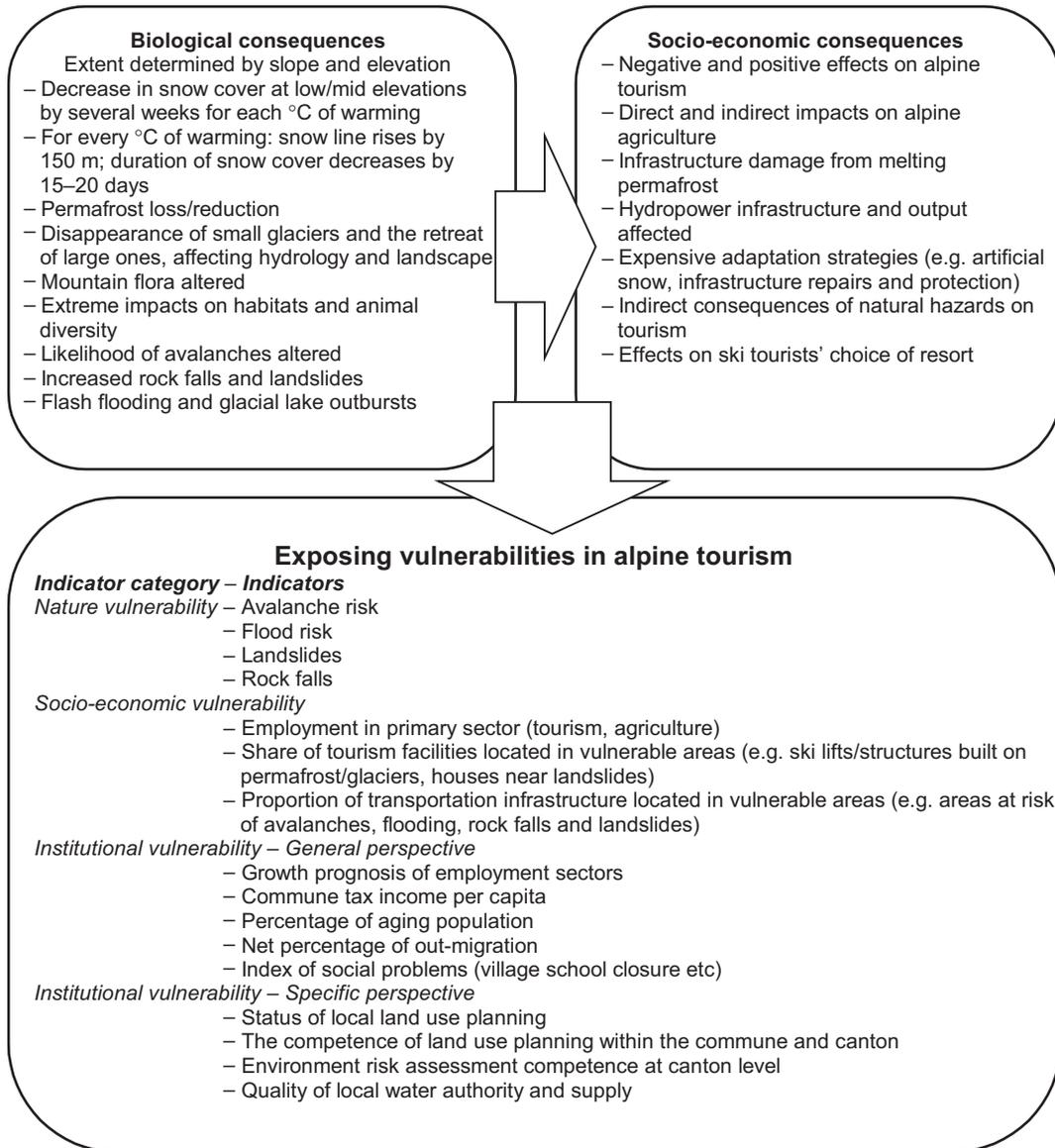


FIGURE 1 Biological and socio-economic impacts of climate change in the Swiss Alps leading to vulnerabilities in alpine tourism (see Abegg et al., 1998; Häberli and Beniston, 1998; Bürki and Elsasser, 2000; Nöthiger et al., 2002; Beniston, 2005; Martin and Etchevers, 2005; Jianchu et al., 2007; Lemke et al., 2007; OcCC, 2007; OECD, 2007; Prudent, 2007): based on the framework by Aall and Høyer (2003) of 'local vulnerability indicators', adapted to show how climate change impacts lead to or heighten vulnerabilities at the local and institutional level within alpine areas

communities have long coped with uncertainties through flexible livelihood strategies, the speed and novel nature of climate change (Pachauri, 2007) is exposing such societies to additional environmental stresses and hazards (Figure 1) at a rate beyond the human ability to evolve and implement adaptive strategies (Mountain Agenda, 1997; Jianchu et al., 2007).

The environmental vulnerability of the Alps will place socio-economic stress on alpine communities, particularly those that rely on seasonal tourism. The IPCC (Schneider et al., 2007) categorizes significant barriers to adaptation in the following four groups: market, social, psychological and institutional. The current lack of economic diversification in alpine communities is a factor that reduces the coping range for communities that depend on snow-related tourism.

Climate change has already started to affect tourism in the Swiss Alps, with higher-altitude ski regions profiting from the above-average winter temperatures that adversely affect the lower-altitude villages (Teich et al., 2007). Almost one-twelfth of Switzerland's workforce is employed directly or indirectly in tourism; this proportion is much higher in mountain regions (Price et al., 1999).

While Switzerland will be the least affected area within the Alps (OECD, 2007), the consequences for local livelihoods at lower alpine resorts are potentially severe (OcCC, 2007). For local alpine communities, the current lack of economic diversification is a major impediment to their ability to accommodate changes in climate that would impact tourism. Additionally, the exposure of alpine systems to variability and to extreme events is an important source of vulnerability (Figure 1), since systems 'typically respond to variability and extreme events before they respond to gradual changes in the mean' (Yohe and Tol, 2002, p.26).

3. Study site and methodology

Within Switzerland a 'highly developed federalism (decentralization) leaves many tasks and responsibilities to the local communities and cantons' (Brugger et al., 1984, p.11), in contrast to more centralized regimes. Two case-study locations were chosen from within the associated communes of the Swiss Alps Jungfrau-Aletsch World Heritage Site. Recent case studies by UNESCO (2007) on climate change and World Heritage Sites have shown the strong influence of climate change on the Heritage Site in terms of glacial retreat and plant species migrating to higher elevations. The locations of Mürren (canton of Bern) and Bettmeralp (canton of Valais) were selected to represent each of the two cantons in the UNESCO area (see Figure 2), as well as typifying one area from the northern alpine side, and one from the inner alpine area. The two areas are similar in population, altitude and size, yet are differentiated by their situation on opposite sides of the Heritage Site in different cantons.

Semi-structured qualitative interviews (Creswell, 2003) were conducted, based on the principle of 'greatest possible openness and flexibility' (Hunziker, 1995, p.402), which is appropriate for ascertaining why opinions are held and how they may be influenced (Lorenzoni et al., 2007). Interviewees were led through a structured set of questions, allowing them the scope to talk more about their own areas of expert knowledge, resulting in more detailed information being obtained.

The qualitative approach did not seek to obtain a universally representative sample. Instead, a sample of stakeholders from varying sectors and with widely differing opinions (Wallner et al., 2007) were used to elicit their thoughts on key concepts of adaptation proposed in the current literature and ideas for adaptation strategies within the two case-study locations. After the open discussions, interviewees were presented with an adaptation measure priority scoresheet, to provide a quantitative ranking of adaptation measures. Interviewees were asked to rank a list of adaptation measures, as defined from a literature review, using a priority score from 1 to 5 (with 5 being the most important). Since 'external socio-economic and political factors ... may lead to a narrower coping range' (Smit and Wandel, 2006, p.287) and adaptation is recognized as being more than just a local activity (Eriksen and O'Brien, 2007), it was important to take into account the role that regional and national players have in reducing local vulnerability to climate change (Table 1). In Switzerland there are three official administrative levels: Federal, Canton and Local. In the

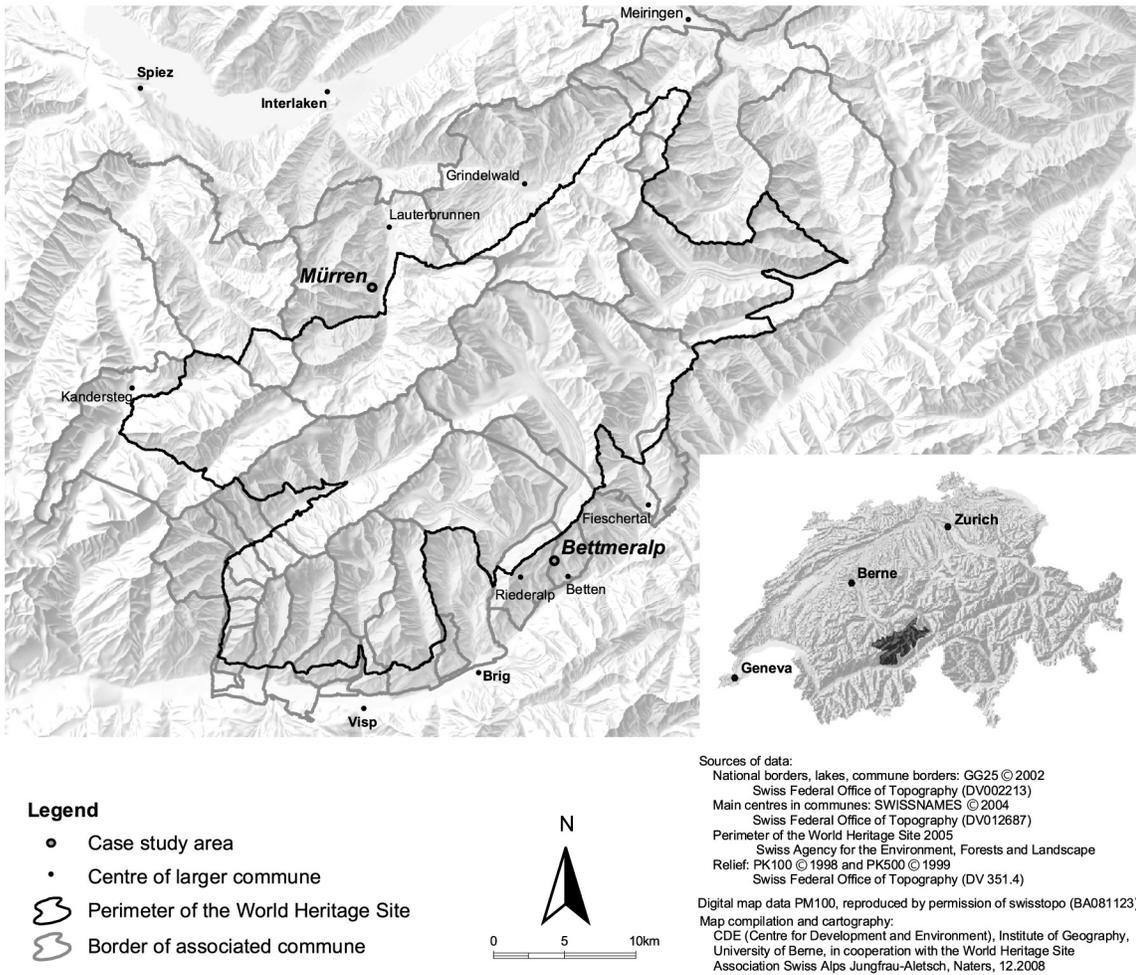


FIGURE 2 Map of the UNESCO Swiss Alps Jungfrau-Aletsch World Heritage Site

case of tourism, however, one must take into account the destination level. Therefore stakeholders selected for interview represented public administrative bodies from each of the different levels. At the local level, tourism associations and private enterprises were also taken into account as being significant to the study.

4. The adaptive response: implementation trends

Elements of the results from interviews (Hill, 2007) are presented in this section. However, the focus here is on how these results were used to conduct a SWOT analysis to guide collaborative and cross-sector planning for vulnerability reduction.

Stakeholders were seen to be aware of the consequences of climate change, but remained heavily focused on technical measures. The majority of stakeholders felt that it was highly important to implement some form of adaptation measure to the negative effects of climate change on tourism

TABLE 1 Overview of interviewees at the different levels and sectors: 29 stakeholders were interviewed, numbers in each category are given in brackets

	Federal	Canton	Destination	Local
Public	Federal Office for the Environment (Division on Climate, Economics, Environmental Observation) (1)	Canton Bern Office for Economic Development, Tourism Leader (BECO) (1) Canton Valais Office for Environmental Protection (1) Canton Valais Office for Economic Development (1)		President of the Local Commune Council (2) Local Tourism Director (2) Tourism Association Members (1)
Private	Swiss Mountain Guide Association (1) Swiss Cable Car Association (1)		Jungfrau Destination (2) Wengen-Mürren-Lauterbrunnental Tourism (2) Pro-Natura, Aletsch Area (1)	Mountain Cable Car Companies (3) Hotel Owners, Associations (5) Sports Shops (4) Ski School Directors (1)

Source: Hill (2007).

within their alpine area, even though some expressed mixed sentiments about the causes and continued effects of climate change. Local stakeholders also ranked 'climate change adaptation' as an important issue, but rated other issues that affected their business, village or family as being a competing – if not greater – threat to their livelihoods. The competing everyday issues tended to usurp the longer-term threat of climate change; a barrier that is seen to be prevalent throughout the climate change discourse (Lorenzoni et al., 2007).

Most stakeholders expressed the need to diversify their winter offerings and to boost the percentage share of summer tourism to compensate. A proportion expressed scepticism about diversification, and focus remained heavily on technical measures such as artificial snowmaking (Figure 3). None of the interviewees spoke about diversification outside of the tourism economy. The results present similar findings to other studies (OECD, 2007; Teich et al., 2007), where stakeholders acknowledged the importance of boosting 'regional strength' and increasing the focus on summer activities as well as winter ones.

Protective measures against natural hazards (avalanche, flood control etc) are implemented by the canton. An exception to this is the work carried out by local or regional cable-car companies and the mountain guides. The cable-car companies have so far been the most active in adapting to the environmental changes experienced over the past few decades. For a

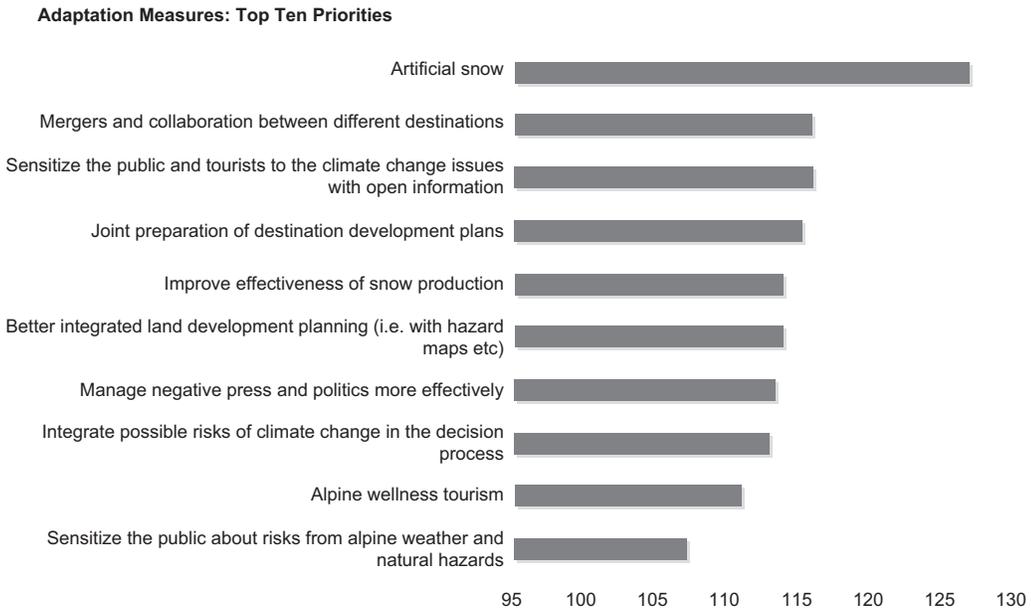


FIGURE 3 Breakdown of the top ten prioritized adaptation measures: with 29 interviewees, the maximum score possible for each category would be 145 (from Hill, 2007)

number of years they have been implementing technical measures to mitigate and contain infrastructural damage from melting permafrost and have invested heavily in artificial snowmaking capacity. The mountain guides independently carry out and finance work to repair or stabilize the paths along the mountain routes. Destination tourism consortia mainly focus on diversification and communication measures. Financial compensation measures, if implemented at all, are the responsibility of the canton – but these proved to be the least favoured response at all levels.

Stakeholders from the Tourist Offices, Tourism Council and Local Communal Council were generally more engaged in the issue than those from the private sector at the local level. Hoteliers came across in both areas as the least engaged, and although this could have been due to the sample (Table 1), a common thread in the interviews was that climate change was not yet an important issue for them. However, many of the stakeholders stated that climate change did exert extra pressure at the local level and that the additional ramifications of the ensuing environmental damage are a complex issue for these stakeholders to address.

Artificial snowmaking was ranked as the most important measure and was mentioned the most in interviews across the board. Teich et al. (2007) mirrored the findings that locals see snowmaking as a key factor in the economy, although they recognized the need to diversify away from a model based purely on downhill skiing. Their study underlined the caution with which snowmaking should be viewed. In addition to its high energy and water requirements, artificial snow can have significant ecological impacts (de Jong, 2007), although its impact differs by region and elevation (Teich et al., 2007). In light of the heavy investment costs already being incurred for snowmaking, longer-term projections of the rise in the snow security level need to be taken into account (Lemke et al., 2007).

5. SWOT analysis and inter-stake conflicts

SWOT analysis is a strategic planning method used to evaluate strengths, weaknesses, opportunities and threats, usually within a project or business. The technique originated at Stanford University in the 1960s and 1970s, and it has since been argued that a SWOT analysis, as well as an evaluation of alternative plans, should be a component of any planning process (Grant, 1995; Menon et al., 1999). In this study it is proposed that SWOT may allow human systems to better plan and implement adaptation strategies in an 'effort to reduce potential vulnerability or exploit emerging opportunities even further' (Yohe and Tol, 2002).

The SWOT matrix takes neither a 'top-down' nor 'bottom-up' approach (Smit and Wandel, 2006) but looks holistically at all the collaborative action that all stakeholders could take. The value lies in considering the implications of the identified outcomes (Business Teacher, 2008), thereby assisting a business (or in this case a village) in setting objectives and developing new strategies. Some criticism of SWOT from the corporate world is that it may harm performance (Menon et al., 1999). Such criticism was directed at an older version of SWOT, which did not require that the analysis be derived from an agreed-upon objective. Therefore one of the key elements to a successful outcome is prior consent to a clear and agreed objective.

SWOT can be a simple and cost-effective tool, which can help generate new ideas about how to maximize strengths and highlight and defend against threats. It has been criticized as a tool that does not prioritize different actions and can be insufficiently precise in its focus – e.g. an equally matching list of weaknesses to strengths does not assign weightings which could be used to cancel each other out (Business Teacher, 2008). The following paragraphs describe how a local community could utilize the SWOT technique of matching and converting in order to increase adaptive capacity.

Conflicts between different sets of stakeholders (Hill, 2007) arise not only from the different responses given by different stakeholder groups, but also between the internal and external forces operating within the alpine region (Table 2). Such conflicts are often linked to decision making in urban centres, where rural populations and issues are poorly represented, even in highly decentralized Switzerland. Within the case-study areas, the greatest number of conflicts and issues became apparent at the local level.

Stakeholders alluded to issues with the media's representation of climate impacts; the lack of understanding that tourists had about natural risks; traditional highland vs. lowland conflicts (including attempts to maintain rural knowledge); apathy in the face of climate change; and traditional members of the community vs. pioneers.

Table 2 classifies these conflicts into internal 'strengths and weaknesses' and external 'opportunities and threats', thereby identifying the potential for linking stakeholders of different sizes and locations and revealing patterns for addressing emerging risks or uncertainties. It also takes into account the opportunities for diversification and readdressing former niche offerings. The matrix is used to frame policy solutions for how alpine stakeholders can create a competitive advantage. This is achieved by identifying a fit between internal strengths and prospective threats through the following strategies, thereby increasing adaptive capacity:

- *Strength–Opportunity*: pursue opportunities that are a good fit to stakeholder strengths
- *Weakness–Opportunity*: overcome weaknesses by pursuing opportunities
- *Strength–Threat*: identify ways for stakeholders to use their strengths to reduce their vulnerability to external threats
- *Weakness–Threat*: establish a defensive plan to prevent stakeholder weaknesses from becoming highly susceptible to external threats.

TABLE 2 Stakeholder interactions in adapting to climate change in the Swiss Alps

Stakeholder location	Stakeholder size Small stakeholder	Large stakeholder
'Internal' (within-valley basis)	Individual / Family / Small businesses (e.g. Mountain guides); Local tourism centres / authorities S11 – Traditional identity and customs S12 – Local knowledge of nature and environment S13 – Risk aversion strategies S14 – Mountain stewardship S15 – Alpine nature and products W11 – Financial weakness W12 – Fear of the unknown or perturbations W13 – Reluctance to change behaviour or accept undue risk O11 – Collaboration with other mountain actors to diversify and spread risks O12 – Demand for alpine nature/experience O13 – Demand for off-season niche produce T11 – Erosion of local identity and traditions due to urbanization T12 – Climate change threats to local livelihoods	Destination tourism conglomerates; Tourism consortia S21 – Financial strength to accept some risk in enterprise development S22 – Reliance on proven business/technology for promoting enterprises W21 – Need to satisfy demand of many stakeholders O21 – Trans-boundary collaboration to diversify and spread risks O22 – Arrival of new technologies T21 – Climate change threat to tourism industry T22 – Business mobility to other more profitable destinations T23 – Benefits transfer outside region to third parties
	Cantonal governments; National organizations and research bodies; Multinational corporations; Tourists S31 – Partnerships with consortia to promote enterprise development and spread risks S32 – Technical and financial strength W31 – Lack local knowledge to develop resource-based enterprises W32 – Competing regional, thematic and sectoral issues and pressures O31 – Pressured to engage in rural enterprises by national government O32 – Potential interest in climate change issue (e.g. education centres in Aletsch area) T31 – Climate change threats to alpine cantons T32 – Risks to capital T33– New regulations T34 – Shifts in consumer tastes away from traditional alpine activities	Federal government; International/Multinational consortia and research bodies S41 – Financial strength to accept short-term risks S42 – Macro-economic vision and socio-economic planning S43 – Knowledge and funding for research programmes W41 – Complex and long decision processes W42 – Lack understanding of local socio-economic needs O41 – International recognition or 'brand' development O42 – Increasing interest in climate change research findings T41 – International mobility of multinational consortia in enterprise development T42 – Benefit transfer outside region to third parties T43 – Climate change threats to the Swiss Alps T44 – New regulations
'External' (extra-valley actors)		

S = internal strengths, W = internal weaknesses; O = external opportunities, T = external threats.
Source: Hill (2007).

The SWOT table allowed the project to take into account other factors than climate effects, such as economic marginalization and maintenance of village life (such as the school), which factored heavily in priorities at the local level. The process recognized that mainstream planning activities should ensure that adaptive capacity is not 'constrained or even nullified by broader social, economic and political forces that effectively shape local vulnerabilities' (Smit and Wandel, 2006), and that adaptation tends to take place in a broader context than climate change effects alone.

6. Policy considerations

One method of increasing adaptive capacity is by 'introducing the consideration of climate change impacts in development' (IPCC, 2007). Table 2 suggests a proposed path to reaching this goal. The methodology of SWOT analysis also draws on the importance for human systems to plan and implement adaptation strategies in an effort to reduce potential vulnerability or to exploit emerging opportunities even further (Yohe and Tol, 2002). The weaknesses and threats detailed in Table 2 (e.g. globalization, urbanization, climate change, consumer trends) warrant policy actions to move beyond the snow-sport-dominated image of the past 50 years (Elsasser and Messerli, 2001). Policy makers working in alpine countries and individual stakeholders could collaborate to maximize internal strengths and external opportunities to better manage mounting threats and weaknesses. To achieve this, a comprehensive planning approach is required that includes all stakeholder considerations from source to destination, rather than the fragmented urban/rural and sectoral approaches. The SWOT matrix was used to assist in constructing the following cross-sectoral policy recommendations.

6.1. Small businesses, local level governance

6.1.1. Micro-enterprises and diversification

Creating opportunity and economic diversification could also reduce local vulnerability and reverse the potential threats (*erosion of local identity and traditions, climate change, globalization*) to livelihoods and businesses. One approach to local economic diversification is to capitalize on mountain assets (Mountain Agenda, 1997; Mühlinghaus and Wälty, 2001) outside the tourism sector. Production advantages exist in terms of renewable energy sources, organic and air-dried products, off-season vegetables, medicinal plants and other high-quality, small-scale products for which 'regional trademarks' and 'geographical indications' (exclusive rights to high-quality products from a specific and guaranteed location which all members of the WTO are required to protect) can be secured (Mountain Agenda, 1997).

Other internal strengths (*local nature, niche off-season products*) allow stakeholders to diversify winter and summer offerings in areas such as alpine wellness, retirement offers, and the promotion of traditional crafts and mountain trades (e.g. watch making, local bio-produce, herbal agriculture). Alpine environments have long provided spiritual and health refuges for urban and lowland populations. In Switzerland, many alpine tourism areas have capitalized on 'spa' and 'wellness' offerings, and other resorts could be assisted in developing such offerings through innovative financing structures, since smaller family businesses may find the high initial investment costs difficult to meet.

Such approaches would not require local stakeholders to move far beyond the current livelihood options, but could enable them to profit more broadly from local assets (see S11, S12, S14 and S15 in Table 2). 'Unique alpine selling points' (Hindenlang, 2007) may be developed by capitalizing

on endogenous, vulnerable local resources to create high-quality services that consume few resources. In order to maximize the potential for such strong regional production chains, local stakeholders need to both meet and market for national demands and trends, while ensuring that natural resources are exploited in a sustainable manner (Hindenlang, 2007). Local entrepreneurship and awareness for the market potential of alpine offerings could be fostered through workshops and educational training opportunities in small mountain communities. Canton and federal agencies should support (financial, coordination) local governments to implement this.

6.1.2. Capacity building for change and adaptation

Public, semi-public and private stakeholders all showed increased interest and openness towards collaboration, noting its importance for adapting to the changing environment, both human and natural, in their villages (Hill, 2007). Some private stakeholders also expressed interest in harmonizing across certain business processes in order to make energy savings while increasing margins; for example outsourcing certain hotel services.

A number of stakeholders at the local and destination levels spoke about the reluctance of traditional alpine communities to embark upon behavioural changes or embrace collaboration (W13). While risk aversion within such communities is an important tool in dealing with unexpected shocks, 'pioneer' stakeholders (Hill, 2007) could be supported at the canton or destination level to break down barriers to change behaviour (W13), thereby reducing threats from factors such as climate change (T43) and shifts in consumer tastes (T34). This could be achieved by sponsoring 'learning expeditions' to other alpine areas, thereby building knowledge and experience amongst local actors.

6.1.3. Multi-stakeholder compacts/alliances for change and adaptation

Collaboration is key to enhancing the adaptive capacity of alpine communities. Many of the local strengths can be maximized through collaborative actions to diversify and spread risks (O11), provided that cooperation occurs early enough in the planning process (Teich et al., 2007). In the area of snowmaking, the growing discrepancy between those who bear the costs of adaptation measures (e.g. cable-car companies for snowmaking) and all those who benefit (e.g. restaurants and hotels) could be remedied, in part, by basing payment structures for adaptation measures on ratios founded on cost-benefit analysis; a vital tool in adaptive management (Smit and Wandel, 2006).

6.2. Destination tourism consortia

The tourism consortia at the destination level have considerable marketing reach and the financial strength to accept risk in enterprise development (S21). These consortia can help local businesses and tourism to develop and market new offerings that would increase the overall share of summer tourism and non-snow offerings for the entire region. Partnerships and collaborations with other destinations or the SBB (Swiss Federal Railway) are apparently becoming more popular, while regional stakeholders tended to regard financial assistance or insurance measures with caution (Hill, 2007). Regional stakeholders could maximize on the opportunities detailed in Table 2 by partnering local stakeholders with other consortia to promote enterprise development and spread risks (S31). It is also vital to inform decision making with the experience of local and regional stakeholders (Smit and Wandel, 2006). For example, the Mountain Partnership currently emphasizes the importance of collaboration at the local, regional and national levels (Ross, 2007) to reduce and mitigate the effects of climate change and plan for the future.

6.3. Cantonal and federal governments

6.3.1. Capacity building for change and adaptation

Governments are at the forefront of building bridges, incentivizing and enabling partnership development. To date, the federal government has primarily focused on capacity building through education and research measures, while the cantonal government has provided funding and resources for technical measures. Even though the federal government plays a limited role in Switzerland, future efforts could be directed into supporting the individual regional adaptation processes with increased partnership development, and targeted education and training programmes.

Raising public awareness, investing in incorporating mitigation and adaptation measures into local development strategies, as well as rewarding adaptation and mitigation efforts, could be a good start. Arosa, Davos and St. Moritz, and others, provide examples of how to 'build in' mitigation strategies to the local offerings (see www.saveoursnow.com). Educational actions for local communities, as well as for external tourists and lowland actors, could be a vital step towards encouraging mitigation and adaptive responses (Clayburgh, 2007). Adaptive or diversification measures should be planned and implemented now rather than later (easier and cheaper), while being built into existing planning processes.

The research programmes of organizations such as CIPRA (International Commission for the Protection of the Alps) have aimed to establish alpine-wide networks of small to medium-sized businesses and local municipalities (CIPRA, 2007). CIPRA further ensures that project findings are implemented by actors within the region itself, thereby reducing the implementation gap and maintaining direct stakeholder engagement for a 'credible and legitimate outcome' (Schröter et al., 2005) throughout the research process. It is vital that such work continues and is extended and supported at the local level. Moreover, in Europe, lessons could be learnt from the long-term funding schedule of the Canadian 'Northern Climate ExChange' (see www.taiga.net/nce) (NCE, 2007), which allows researchers to build relationships and trusts in the communities in which they work.

6.3.2. Reforms to regulations and incentives

Strategies could be supported by the cantonal government to increase demand for local endogenous resources (nature, niche products: S15) in the national and international market by capitalizing on the 'outside' opportunity through international recognition and brand development (O41). This may help to combat the sentiment that 'there are no real alternatives to tourism within the mountain area' expressed by a private stakeholder in the study. Examples of this exist in communes such as Grafenort (canton of Nidwalden), where a local farmer commented, 'As well as nourishing and looking after the mountain area, we must also merchandise it' (Schweizer Berghilfe, 2007). Micro-financing support structures should be developed at the cantonal level, to better enable small businesses to move into non-tourism, lower investment-cost business activities.

Conflicts may also be combated by encouraging mountain stewardship (S14), with direct payments for exporting services such as the provision of clean mountain water, electricity generation, minerals and forest products (Mountain Agenda, 1997). By combining advances in science and technology with 'traditional mountain expertise and experience' (Mountain Agenda, 1997), a more bottom-up approach to adaptation based on local knowledge could be developed (Jianchu et al., 2007). These strategies will also need to incorporate threats from increased globalization (T41) and shifts in consumer tastes away from traditional alpine activities (T34). Local knowledge and expertise (S12) should also be built into adaptation frameworks. Cantonal stakeholders could incorporate macro-economic vision and planning (S42) and traditional risk-aversion strategies (S13) into the process, in order to strengthen adaptation opportunities (Smit and Wandel, 2006).

6.4. Broader lessons for the alpine area

Even though this study focused on the two case-study areas of Mürren and Bettmeralp, it is believed that the planning process explored in this article could have application to other alpine resorts. The IPCC (Schneider et al., 2007) recognizes that there has been insufficient investment in adaptation opportunities, especially in relation to extreme events (e.g. the avalanche winter of 1999). Despite the improvement in awareness at the international level with regard to climate change challenges in high-altitude areas, significant work, within the current frameworks, needs to go into better monitoring, understanding, mitigating and adapting to climate change in alpine areas in general (Ross, 2007), as well as improvements in the extent of knowledge sharing.

Lessons could be drawn from the Inuit Circumpolar Council, the international organization representing approximately 160,000 Inuit living in the Arctic regions of Alaska, Canada, Greenland and Chukotka, Russia, which links the isolated Arctic communities culturally and politically, so as to foster unity, development and recognition at the regional and international levels. Within the case-study area, the UNESCO partnership could be better utilized as a means to increase the sharing of knowledge and experience across different World Heritage Sites. The remit of reports such as *Case Studies on Climate Change and World Heritage* (UNESCO, 2007), could be extended to better communicate knowledge across the different UNESCO World Heritage Sites, by sharing experience across the different communities. Finally, the role and remit of tourism networks such as Experts in Climate Change and Tourism (ECLAT) and the UN World Tourism Organization (UNWTO), could be increased to include sensitizing tourists to the issues that alpine tourism areas face. The UNWTO has already initiated pilot projects in Small Island Developing States to develop and demonstrate adaptation policies (UNWTO, 2007), and similar action could be taken for mountain destinations.

7. Conclusions

Adaptations may be anticipatory or reactive, as well as autonomous or planned (Smit et al., 2000). This study has focused on planning techniques to anticipate changes in climate and increase the adaptive capacity of alpine tourism villages. How alpine stakeholders react to climate change will shape the construction of the alpine future. While mountain tourism is fundamental to the overall concept of sustainable mountain development, diversifying the alpine economy to move away from such a one-sided dependence is vital to the creation of more sustainable social, economic and environmental structures (Price et al., 1999).

The 'Summary for Policymakers' of the IPCC Second Assessment Report (IPCC, 1995, p.3) noted that 'successful adaptation depends upon technological advances, institutional arrangements, availability of financing and information exchange'. It further noted that 'incorporating climate change concerns into resource use and development decisions and plans for regularly scheduled investments in infrastructure will facilitate adaptation'. This article has set out one possible path to facilitate adaptation through a comprehensive planning approach.

One key aspect of SWOT analysis is its focus on specifying objectives in the planning process, thereby engaging participation and commitment early on (Armstrong, 1982). If local communities were to adopt such an approach to adaptive planning, early buy-in and commitment from the broad range of stakeholders would be vital to the success of the approach. Dovers (2009) suggested that the 'coherent discussion of the theory and practice of adaptation is quite recent and, for many in relevant policy communities, confusing in terms of scale of necessary response, sources of guidance, and relevance to policy agendas'.

The aim of this article was to contribute to the discussion on how to build adaptation responses and better integrate them into existing policy and local agendas, in order to normalize climate adaptation. It has aimed not only to benefit from local knowledge and expertise but also to identify ways in which climate considerations may be better integrated or mainstreamed into other sectors. It has shown one way of normalizing the considerations of climate adaptation into day-to-day issues that preoccupy the lives of alpine communities at the local level, as well as into existing decision and policy processes, to build a comprehensive planning approach.

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