# The Vulnerability of the Snow Industry in the Swiss Alps

Authors: Elsasser, Hans, and Messerli, Paul

Source: Mountain Research and Development, 21(4) : 335-339

Published By: International Mountain Society

URL: https://doi.org/10.1659/0276-4741(2001)021[0335:TVOTSI]2.0.CO;2

Mountain Research and Development Vol 21 No 4 Nov 2001: 335–339

# The Vulnerability of the Snow Industry in the Swiss Alps

Hans Elsasser
Paul Messerli



*The future of Swiss alpine winter tourism must be reassessed in view of global climate change in order to determine possible strategies for overall development of mountain regions. At present, 85% of all Swiss ski areas still have sufficient snow cover. A 300-m rise of the snow line, however, would reduce this to about 63%. As a consequence, skiers will expect more artificial snow, go on winter holidays less often, and concentrate on ski areas at higher altitudes. On the supply side, climate change will be used to justify increased use of artificial snow and advances into areas above 3000 m. This raises a variety of new problems, both economic and ecological. Developments in the Swiss snow industry indicate the rise of 2 distinct classes of tourist resorts. Climate change may increase economic pressure in terms of capital concentration and division into "winners" and "losers." Although global climate change certainly has an influence on tourism, it is not the only factor that determines the conditions of tourism.*

**FIGURE 1** Situated at an altitude of 1559 m, the ski resort of Saas Grund in the Valais currently has "reliable snow cover." This view shows a ski field at 2400 m. (Photo by Suter Rud, Keystone)

## Introduction

Tourism, particularly winter tourism, still plays a very important economic role in Swiss mountain areas. Sufficient snow cover at the right time is an indispensable prerequisite for the economic survival of alpine winter sports resorts (Figures 1, 2). Among the diverse needs expressed by vacationers in ski areas, reliable snow cover is the first priority. A combination of Swiss tourism research and practical experience has established the following definition of reliable snow cover (*Schneesicherheit*):

**FIGURE 2** Artificial snow was needed to keep this ski field in Termignon (French Alps) functional. (Photo by S. Fiore, Keystone)

Reliable snow cover—A (Swiss) ski area has reliable snow cover if there is a minimum cover of 30–50 cm (12–20 inches) on at least 100 days in 7 out of 10 winters, from 1 December until 15 April.

Against the background of global climate change, one question that arises is what ski areas might still be considered to have reliable snow cover in a warmer future and which ones will cease to play a role in the winter tourism industry due to insufficient snow cover. Another question concerns the strategies and measures that might be taken to adapt to future developments. This poses problems from an economic point of view at both regional and national levels.

## Scenarios

Projections of future snow conditions presented here are based on global warming scenarios. However, a line of argument that proceeds from climate change to global warming to less snow would be oversimplified. With respect to global warming, it must be kept in mind that the possibility of cooling in Northern and Western Europe resulting from disruption of heat transport through the Gulf Stream cannot be definitely excluded. Furthermore, changes in (winter) precipitation must be considered along with changes in temperature. In this context, the North Atlantic Oscillation (NAO) plays an important role. The heavy snowfall in the Alps in the record winter of 1998–1999 (and particularly in February 1999) was not due to exceptionally cold weather but to a stable northwestern wind with heavy snow and rainfall, which led to a great number of avalanches. From an economic perspective, such a situation certainly cannot be assessed in positive terms. Direct losses to the tourist industry in 1999 through damaged buildings and transport facilities, as well as indirect damage such

as loss of income, were estimated at over US$127 million.

The altitudinal limit for reliable snow cover is currently 1200 m. Of the 230 ski areas in the Central Alps, the Northern Alps, and the Jura, 195 (85%) are considered to have reliable snow conditions (Figure 3). A rise of the snow line to 1500 m would reduce this percentage to a mere 63%. Areas in the Northern Alps, the Ticino, and the Jura would be most heavily affected, while 90% of the ski areas in the Valais and the Grisons would still have reliable snow cover. A further rise of the snow line to 1800 m would cause another substantial deterioration of conditions; only 44% of today's ski areas would have sufficient snow cover. Even about a fourth of the ski areas in the Valais and the Grisons would cease to have reliable snow conditions. Experts and managers at the top resorts expect that the absence of snow in the lowlands will alienate young people from snow and skiing.

## Consequences

It was the mild winters of the late 1980s (1987–1988 to 1989–1990) that attracted particular attention and alerted the tourist industry to its dependence on weather and climate, which influence both supply and demand. It became clear that weather and climate are not constant supply factors, but need to be seen as a highly relevant resource for the tourist industry; hence, the suitability of various destinations as winter sports resorts needs to be reassessed.

Snow cover is subject to great fluctuations, and mild winters are not a recent phenomenon. What is markedly different now by contrast with earlier decades is that in alpine tourism, and thus in Swiss tourism as a whole, more investment and employment is now tied directly or indirectly to the presence of sufficient snow. The dependence of tourism in alpine areas on snow has increased significantly, and there is no real substitute. Even worse, many prealpine ski areas will lack the necessary snow cover, preventing future generations from experiencing snow in the winter season.

### Potential damage costs in Switzerland

A national research program on climate change and natural disasters sought to estimate the potential damage that could be caused by climate change (Meier 1998). Assuming a rise in temperature of 2.3–2.7°C and changes in precipitation of +5% in winter and –7.5–12.5% in summer by the year 2050, the annual costs were estimated at a total of US$1.7–2.3 billion. This amounts to 0.6–0.8% of the Swiss gross national product of 1995. Of this sum, US$1.3–1.6 billion would be lost in the tourist sector alone. On the other hand, gains of US$100 million per year—US$72 million of which would accrue to the tourist sector—could be expected. This is based on the projection that Swiss mountain areas might be visited more frequently by tourists in summer as other destinations lose their attraction because temperatures are too high, for example. Another possibility is that other destinations might no longer be visited due, for example, to a rise in the sea level (Viner and Agnew 1999).

### Demand

Climate change will lead to massive changes in demand. One survey of vacationers in the winter season showed that the demand for ski tourism will decrease significantly and that ski and snow activities will undergo a process of concentration in areas with reliable snow cover. Although only a small percentage of skiers is actually likely to stop skiing altogether, they will certainly be skiing less often than today; this will especially be the case for beginners and occasional skiers. With possible climate change, skiers' expectations of winter as a season, and of activities related to it, will also shift toward alterna-

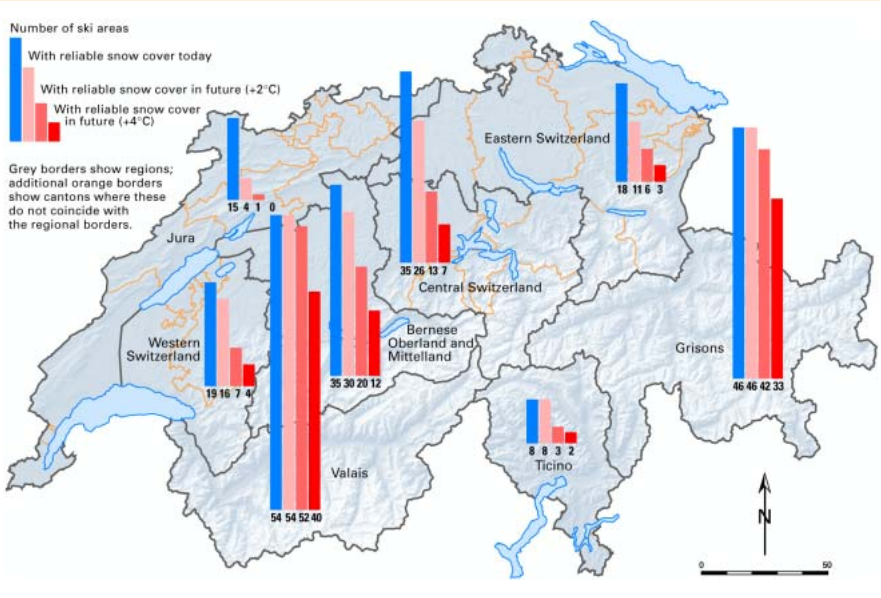


**FIGURE 3** Reliable snow cover in ski areas: current situation and future trends. (Map by Hans Elsasser and Martin Steinmann)

tive activities and destinations. Roughly half of the skiers surveyed deemed artificial snow installations and/or the extension of skiing regions to higher altitudes as important. Less important were attractions and events in the ski area and activities that are not dependent on snow cover. Such special activities will thus not be able to replace missing snow.

### Supply

Although ski resort operators are aware of the great dependence of their industry on snowfall and their vulnerability to mild winters, they do not regard climate change as disastrous. At the same time, the survey reveals the ambivalence of those in the industry toward climate change. On the one hand, they are suspicious of information on climate change and play down its possible consequences. On the other hand, they use it to justify strategies for the future. Together with international competition, global warming is the main argument for the use of artificial snow (including chemical additives; see Figure 4) and for the expansion of ski areas into high alpine altitudes (over 3000 m).

**FIGURE 4** Snow cannon: such devices are expensive and can only be used under very specific climatic conditions. (Photo by Stefano Schröter, Keystone)

## Strategies

There are 2 principal strategic options for tackling the problem of greater variability in snow cover. Adaptation strategies are based on the logic of minimizing losses, discounting new investments with respect to a shorter time horizon, and seeking new locations and resources. Avoidance strategies try to correct mistakes and cure the very causes of global warming. Thus, emission-reducing strategies are predominant. As tourism already accounts for almost 50% of automobile-based mobility in Switzerland, the aim of these strategies, and related measures, is to foster public transport and internalize external (environmental) costs. Even though the necessary calculations are far less complicated in tourism, the controversy that has arisen around the Kyoto Convention and its protocols—namely, whether adaptation or avoidance costs would be more dramatic—remains essentially the same.

At present, adaptation strategies prevail. One of the best known measures for reacting to uncertain snow cover levels and snow scarcity is the installation of artificial snow blowers. When it comes to future improvement of mountain transport facilities in winter, modernization of the facilities and extension of artificial snow installations are a top priority. Estimates for the year 2003 predict that artificial snow runs will account for 7.7%, or 1700 ha, of ski runs, totaling 680 km. This is not much by international comparison, however. Artificial snow installations are cost-intensive: Investment costs per km for artificial ski runs are about US$0.6 million, and annual operating costs are between US$19,000 and 31,000/km. Moreover, artificial snow production is limited; it is impossible if temperatures are too high. Accessing higher areas for ski tourism may guarantee more snow, but it is linked with a series of problems. This strategy calls for high-level technical investments and is thus cost-intensive due, for example, to permafrost. It entails an expansion of ski tourism into ecologically

fragile areas, and rough weather conditions (cold temperatures, wind) may restrict skiing at these altitudes.

As for ski areas at lower altitudes, which are already highly endangered today and for which economic survival has been jeopardized by the mild winters of the past, it would be advisable to plan an exit from ski tourism well in advance and to engage in active downsizing. These areas lack the necessary resources, and financial institutions have restricted credit for their upkeep.

As an industry that is particularly susceptible to climate change, tourism also needs to turn toward avoidance strategies for its own sake. This applies particularly to national and international tourist traffic, especially air traffic, which has exploded during the last decade. It must be noted that open skies and fierce competition among airlines do not favor air fares that reflect environmental costs. In the absence of international agreements on mobility reduction measures, national self-restriction and local and regional adaptation strategies are the only alternatives.

## Conclusions

Climate change is not solely responsible for the development of a "class society" in tourism. On the one hand, the top resorts already offer tourists variety and attraction and will be able to hold their ground in international competition, thanks to their relative independence of snow cover. On the other hand, smaller resorts have a more modest infrastructure, with less to offer and a restricted potential for further development. This selection effect, however, is not just a consequence of climate change and its anticipation; it is also related to the clearly discernible current trend toward capital concentration in tourism. Climate change is thus a catalyst, underscoring the division between more nature-oriented, low-infrastructure resorts and the more capital-intensive and expansive tourist destinations. Joint-stock companies created in the past (eg, the French *Compagnie des Alpes*), which concentrate on the core infrastructure in resorts with reliable snow conditions, foster this development.

To counter this impending sell-off of tourist assets, attempts are being made at creating national or state financing institutions. Projected climate change may not be a threat to the existence of the alpine area, but it is nevertheless a great challenge. It also offers an opportunity to reassess and evaluate the various tourist assets in the Alps. According to Ashby's Law of Requisite Variety, a viable response to the increased variability of weather and climate in the Alps must aim in part at greater variety in the tourist industry ("only variety can destroy variety"). The future of alpine tourism, and hence development throughout the Alps, may not be determined by climate change, but it is certainly influenced by it.

**AUTHORS**

***Hans Elsasser***
Institute of Geography, University of Zurich, Winterthurerstrasse 190, 8057 Zurich, Switzerland.
elsasser@geo.unizh.ch
*Hans Elsasser is professor of geography at the University of Zurich and head of the Economic Geography Division. His main research interests are in the field of economic geography, regional development, spatial planning and tourism.*

***Paul Messerli***
Institute of Geography, Hallerstrasse 12, 3012 Berne, Switzerland.
mep@giub.unibe.ch
*Paul Messerli is professor at the Institute of Geography, University of Berne, and head of the Department of Human Geography. His main research fields are economic geography, regional development and regional policy.*

**ACKNOWLEDGMENT**

This article is based on research funded by the Swiss National Science Foundation (SNSF).

**FURTHER READING**

***Abegg B.*** 1996. *Klimaänderung und Tourismus. Klimafolgenforschung am Beispiel des Wintertourismus in den Schweizer Alpen*. Schlussbericht NFP 31. Zurich: vdf Hochschulverlag an der ETH Zürich.
***Bürki R.*** 2000. *Klimaänderung und Anpassungsprozesse im Wintertourismus.* St Gallen: *Ostschweizerische Geographische Gesellschaft*.
***Elsasser H, et al.*** 2000. Klimawandel und Schneesicherheit. *Petermanns Geographische Mitteilungen* 144:34–41.
***Meier R.*** 1998. *Sozioökonomische Aspekte von Klimaänderungen und Naturkatastrophen in der Schweiz.* Schlussbericht NFP 31. Zurich: vdf Hochschulverlag an der ETH Zürich.
***Messerli P.*** 1990. Tourismusentwicklung in einer unsicheren Umwelt—Orientierungspunkte zur Entwicklung angemessener Strategien. Sonderdruck "Tourismuspolitik der 90er Jahre." *Die Volkswirtschaft* 12:21–27.
***Viner D, Agnew M.*** 1999. *Climate Change and Its Impacts on Tourism.* Report Prepared for WWF–UK. Norwich, UK: Climatic Research Unit, University of East Anglia.