



THE IMPACT OF SKIING ON MOUNTAIN AREAS IN EUROPE

Introduction

For many of the European Alpine resorts, winter is an important source of income and snow is heavily relied upon for related sports such as skiing, snowboarding, winter hiking and ice-climbing. While skiing brings great economic benefits – employment, investment and infrastructure – it also brings environmental costs to the region.

Winter sports can have many negative impacts on the environment. The huge expansion of ski resorts since the 1970s has, according to environmentalists, had numerous effects on the water levels of lakes and streams; damaged mountain wildlife through the destruction of habitat and noise and air pollution, as well as affecting annual climate conditions. Skiers damage trees by knocking off branches and killing young shoots underneath. Other activities, not caused only by winter sports, can have a very serious impact in cold environments, e.g. cigarette butts taking up to 5 years to disintegrate may be contributing to the ‘alleged’ increase in lung cancer amongst marmots; and tissues and plastic sweet wrappers break down slowly in Alpine areas.

The impact in Europe

Europe is one of the most densely populated areas in the world. Its mountains are one of the few remaining wilderness areas in Western Europe that are relatively uninhabited and relatively untouched by human activity. However, mountain areas are becoming increasingly popular destinations for tourists. Most of the tourism in mountainous areas of Europe is concentrated in the Alps, which receives about 100 million tourists each year. Without tourists, many Alpine areas would not be economically viable. In some places, over 80% of jobs depend on them.

The alpine environment is extremely sensitive environmentally. Recently introduced human activities, especially skiing, have led to in environmental hazards and threaten delicate ecosystems. Other effects include an increase in levels of pollution, deforestation and soil erosion.

Environmental impact of skiing – direct and indirect

The environmental impacts of skiing, especially downhill skiing, are far reaching. They include the construction of the ski pistes and related facilities such as access roads, parking, cafeterias and toilet facilities. Skiing removes habitats, removes the natural protection against avalanches and degrades the natural landscape. As most visitors travel by car, exhaust fumes lead to further forest damage through acid rain. Air travellers may be causing harm to the environment through the emission of fossil fuels at very high altitudes.

One of the major impacts has been the **development of ski runs and ski lifts**, e.g. in Switzerland the number of installations has increased from about 250 in 1954 to near 2,000 by 1990.

Over 100 km² of **forest has been cleared** throughout the Alps and has led to higher rates of avalanches. In Austria, the creation of just 0.7km of ski runs in 1980, for the Winter Olympics, led to a major mudslide. New resort construction involves bulldozing, blasting, and reshaping of slopes. This increases slope instability and leads to a higher incidence of avalanches.

Another increasing hazard is **water pollution and sewage disposal**. In the French Pyrennees sewage from summer tourist resorts discharges directly into streams. In the Alps, chemicals used in preparing 36 glaciers for skiing have caused increases in nitrogen and phosphorus levels in drinking water.

The increasing popularity of skiing has created a demand for larger accommodation blocks to be built in the popular resorts, such as Mayerhofn in the Austrian Tyrol. With limited space for new apartments and chalets on the valley floor, this forces more development of the surrounding hillsides. The improvement in resort facilities ultimately leads to an increase in the number of individuals visiting the resort which, in turn, creates pressure to improve transport links to these resorts and so the cycle continues.

Exam Hint: Always convert text to diagrams to show the cycle of degradation.

Table 1 Effects of downhill skiing on the environment.

Type of development	Processes	Results
Piste preparation	Removal of vegetation and boulders to a depth of 20cm to allow snow accumulation	<ul style="list-style-type: none"> Ecosystem damage, e.g. loss of arctic-alpine vegetation Visual pollution - loss of aesthetic quality, especially in summer
	Deforestation of the mountainsides	<ul style="list-style-type: none"> Increased avalanche risk and propensity for mudslides Disturbance of wildlife, e.g. black grouse in the French Alps
Lift installation	Early ski areas built roads up the mountainsides to transport pylons	Ecosystem disruption - destruction of vegetation; disturbance to wildlife and loss of habitats
	Use of heavy cables to support tows and chairs	Death of birds colliding with cables
Artificial snow-making equipment	Increasing use of artificial snow cannon, which involves great water usage, e.g. 1ha of skiing surface requires 200,000 litres of water	<ul style="list-style-type: none"> Increase water usage: diversion of water, lowering of water table Energy consumption Noise pollution Use of additives to aid crystallisation of the water into snow leading to contamination of the soil
Increased infrastructure development	Building of extra roads to transport skiers	Land-use transformation; noise and air pollution
	Hydroelectric schemes	Increased levels of salination causing loss of flora
Superstructure development	Construction of hotels and other usual amenities, e.g. cafes, restaurants, bars	Land-use change Air and water pollution

Increasing Impacts

1. Climate change and impact on skiing

High temperatures experienced during the summer of 2002 caused some of the European glaciers to recede by up to 10%. As pressure mounts on the ski companies to build higher into the mountains to reach reliable snow areas, sensitive high mountainous environments have been affected. The increases in global temperatures will have a serious implication for the many ski resorts located at lower altitudes.

As a result of less snow at lower altitudes:

- some skiers have moved higher up on to glaciers
- artificial snow machines create more snow, and
- higher lifts are used more regularly.

Ski resorts face uncertain future

According to a report by the Organisation for Economic Cooperation and Development (OECD) global warming could devastate European ski resorts within decades, forcing lower-altitude resorts to close. In December 2006 the World Cup skiing slalom race for women in the French resort of Megève was cancelled because of the lack of snow. To combat the lack of snow, ski stations are either bringing in snow from neighbouring peaks, creating snow with machines or trying to entice tourists with spa weekends, Christmas markets, Nordic walking and curling.

So great is the economic risk considered to be, for low altitude resorts, that banks in Switzerland are refusing to lend money to resorts below an altitude of 1,500m (nearly 5,000ft) and some small firms are closing. Germany is even more at risk, with the low-lying ski areas in Bavaria threatened. Austria, where winter tourism accounts for 4.5% of the national economy, follows close behind. Also affected were France, where the ski industry had a turnover of €20bn in 2005, and Italy. The report found that 1994, 2000, 2002 and 2003 were the warmest years on record in the Alps over the past 500 years.

Predictions showed 'even greater changes in the coming decades, with less snow at low altitudes and receding glaciers and melting permafrost higher up'. A 2° rise in temperature would reduce the number of viable slopes from 666 to 400, a change that could occur by 2050 (Fig. 1).

The OECD report said that in the longer term making snow by machine was environmentally damaging and it would in any case not work above a certain temperature. It also found that plastic sheeting could protect glaciers but would not prevent 'the eventual loss of glaciers if warming trends continue'.

Fig. 2 The effects of temperature change on ski resorts.

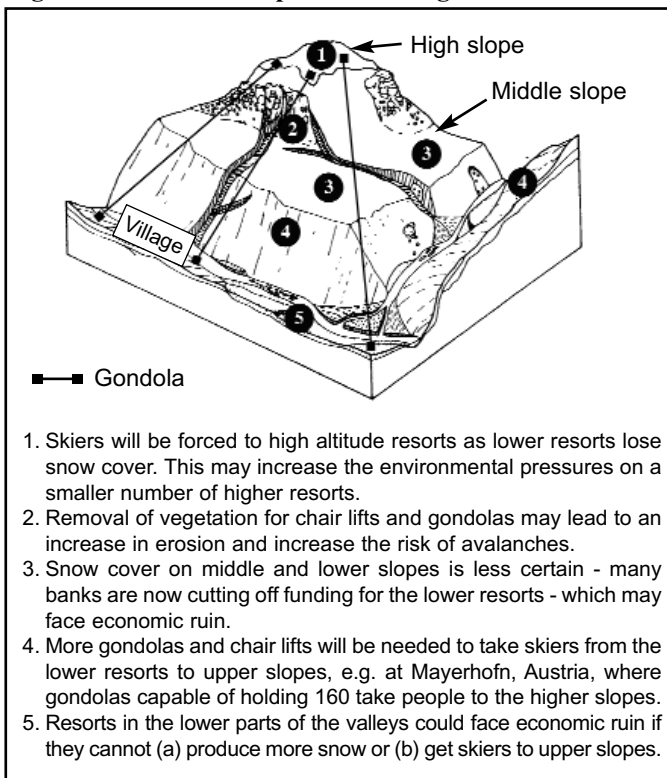
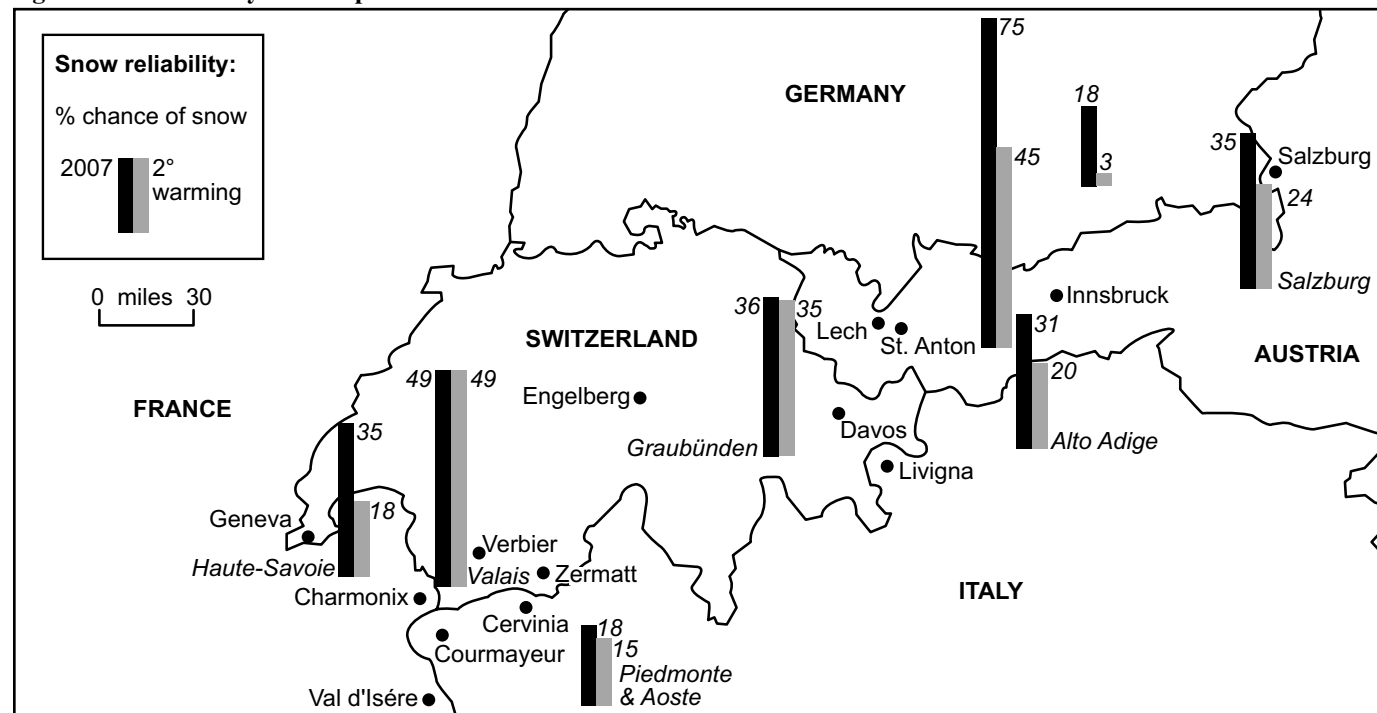


Fig. 1 Snow reliability at European ski resorts.



2. Artificial snow and water supply

Research by the Swiss National Science Foundation has found that by 2050 only those resorts offering skiing at 1500m and above will be sure of having enough snow to enable use of facilities for at least 100 days a year. Such resorts account for only 63% of the country's total ski areas, much less than the 85% that guarantee snow today, when 1200m is high enough to ensure 100 days of skiing.

Less snow means less water and some resorts have begun to stringently control their water supply. The reduction in the volume of snowfall across the Alps in recent years has led to an increase in the use of artificially created snow. Snow cannons spray water at great pressure into sufficiently cold air which then falls as snow on the ground. These machines consume lots of energy and use huge amounts of water: about 800 tonnes to cover an area of 2.5 acres with snow 8 inches deep. They take the water from reservoirs and streams at a time of year when water is running low. This water is effectively dumped elsewhere, harming soil and plants. To make matters worse, artificial snow quickly forms a hard surface and needs frequent fresh snow to keep the pistes usable.

The basic process of making snow

- The ingredients are compressed air and water. These are piped to the mountainside and combined in a snow cannon powered by electricity.
- Airless 'fan guns' launch the droplets further above the ground - the higher the trajectory, the more time a droplet has to freeze before it lands.

Only 15% of America's ski resorts have the sort of automated snowmaking equipment that would allow them to open earlier in the autumn and close later in the spring. Man-made snow is used on about 10% of Switzerland's slopes, while the average in Austria, Switzerland's main competitor, is about 30%. Arosa is an exception. It already covers about 20% of its ski area with artificial snow. The Arosa cable car company wants to double this in the near future.

The proportion of pistes with cannons available is five times what it was in 1990. Supporters of the procedure point out that they keep people away from danger areas, like slopes exposed to sun or wind, or glaciers. They also say that without the possibility of skiing down to the very bottom, people would stay away from upper slopes too, damaging their tourist industry.

By the 1990s 4,000 snow cannons were producing artificial snow to lengthen the ski season in the Alps. These used 28 million litres of water per kilometre of piste. Artificial snow melts slowly reducing the short recuperation time for the alpine vegetation. Furthermore, skiing in sparse snow conditions contributes to erosion and damages sensitive vegetation. The result is a severe reduction in water absorption and water holding capacity of mountain slopes. There is also an increased risk of run off and avalanches. Environmental groups are also concerned about the use of a chemical additive which increases by a couple of degrees the temperature at which snow can be made. The additive is an ice-nucleating protein derived from naturally occurring bacteria. The effects the additive has on alpine vegetation are, as yet, unknown.

Low lying resorts such as Les Gets (1172m) are spending up to €300,000 searching for additional water supplies. In response to their use of snow cannons, Les Gets stressed: '*the manufacture of artificial snow does not have any impact on the water supplies*', further....*Snow cannons principally use water supplies which are unsuitable for drinking water.*' In Val d'Isere a 36,000m² reservoir has been built to supply water for the snow cannons that will boost the summer skiing available on the Pissailas Glacier.

In the end, skiers have proven they are willing to pay the price for artificial snow. They pay for the lift tickets and accommodation in the ski resorts, and hence foot the bills.

3. The impact of snow boarding – a new sport

According to the World Wide Fund for Nature (WWF), skiers and snowboarders often unintentionally infringe on wildlife habitats. This led to the WWF developing a course to educate snowboarders about the kinds of animals they may encounter and how sensitive they are to human disturbance, e.g. a chance encounter with an ibex or chamois can send the animal scurrying for cover, forcing it to use 60 times more energy than normal. That can lead to exhaustion, robbing the animal of valuable reserves needed for survival. In the second part of the course, the WWF tries to convert the snowboarders to travel

to their back-country destination by public transport, to reduce the impact on the climate. The course also includes a lesson on rubbish, e.g. a discarded banana skin can affect the fragile ecological balance as much as a cigarette butt.

The innovative course has received a positive response from the hundreds of participants who have taken it so far. Nearly half of those surveyed say they now use public transport to travel into the mountains and about 90% said they tried to avoid free-riding through forests out of respect for the flora and fauna.

Elsewhere, such as at Jotunheimen, Norway, recreation has had a negative impact on animal species. Brown bears, wolverine, lynx, Arctic foxes, otters and wild reindeer have all become less common. Road construction, power lines, visitor impact and long-range air pollution have all added to a decline in the wilderness value of the area, and to the productivity of the ecosystem. These trends may increase the environmental problems because skiers are skiing on more sensitive areas and the lengthening of the season reduces the time available for ecosystems to regenerate.

Covering glaciers with blankets

A novel approach to protecting the ski industry occurred on the Gurschen glacier at the top of the Andermatt ski resort. It has lost 20m of thickness of ice over the past 15 years. To prevent further melting, the Andermatt ski-lift company has laid a synthetic carpet over 2,500m² of glacier in an experiment to ward off the effects of global warming. The reflective high-tech material is designed to stop the Gurschen glacier from melting away beneath the resort's upper cable-car station. Environmental organisations have criticised the move as an ineffective way of combating global warming.

Nevertheless, if it proves successful, other ski resorts which also depend on rapidly shrinking glaciers, including Zermatt, Saas Fee and Engelberg, could follow Andermatt's example. The material's resistance to ultra-violet rays give it a lifespan of at least ten years. The WWF maintains that such measures merely combat the symptoms of global warming and demonstrate the high economic cost of having to adapt to climate change. They claim that the only effective means of stopping climate change is to drastically reduce CO₂ emissions. To this end, resorts like Andermatt should become models of energy efficiency by lessening their dependence on fossil fuels.

Conclusion

The benefits of winter sports are clear – economic development, employment, investment and development of infrastructure. There are benefits also for those able to enjoy a winter holiday. However, the nature of winter sports tourism is changing. Climate change appears to be forcing skiers higher. This could have a devastating effect on the economy of lower resorts. In addition, the environmental impacts of skiing are far reaching – pollution, erosion, avalanches, landslides, and impacts on biodiversity. If skiing is to be concentrated in fewer, higher resorts, the negative effects are likely to be magnified, unless some form of sustainable management can be introduced.

Questions

1. Describe and explain the effects of tourism on mountain areas. Use examples to support your answer.
2. How are pressures on mountain areas likely to change over the next few decades? Justify your answer.

Useful websites

- The Swiss Glacier Monitoring Network: <http://glaciology.ethz.ch/swiss-glaciers/?locale=en>
- Switzerland's news and information platform: www.swissinfo.org/sen/swissinfo.html?siteSect=100
- <http://mikeaz.free.fr/dfb/dfb2.htm> - images of glaciers in the 19th century and early days in the development of tourism in the region.

Recommended reading

Exploring environmental issues. Kemp, D., 2004 Routledge
Physical geography, a human perspective. Huggett, R. et al. 2004 Arnold 2844

Acknowledgements

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