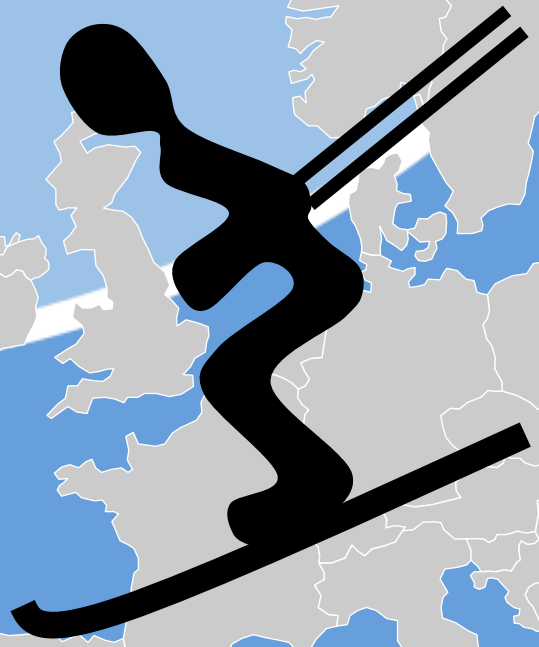
Europe's winter sport tourism in a changing climate



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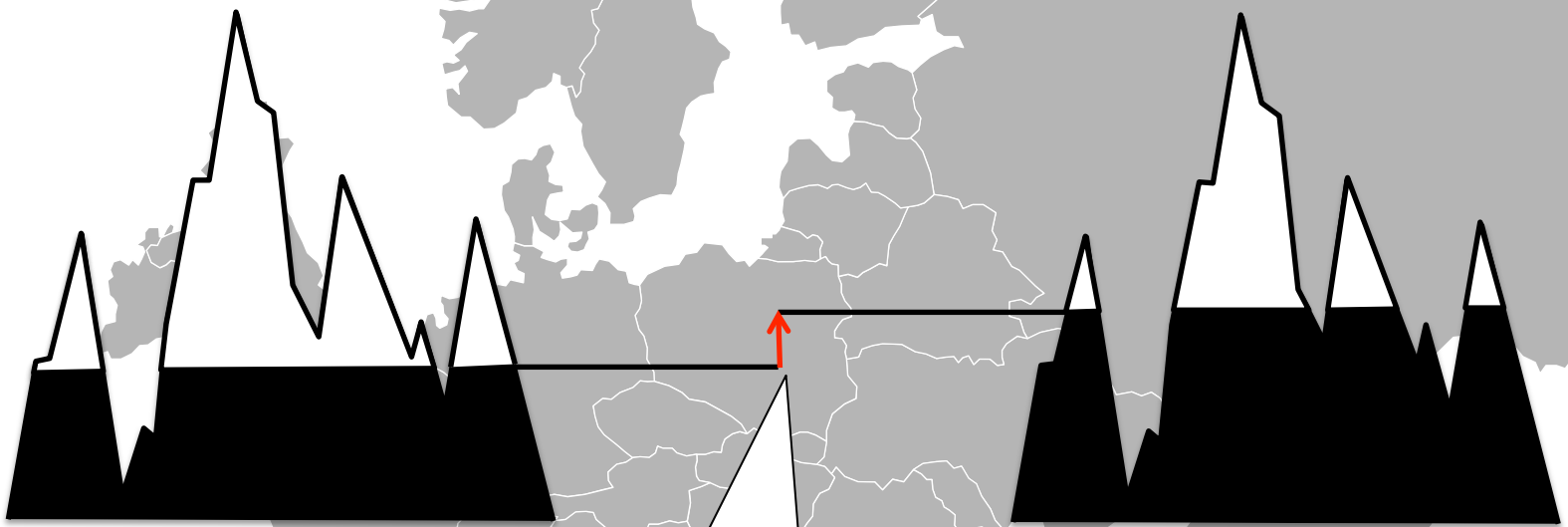
Winter sport tourism

Definition snow reliability

When are ski-resorts 'snow-reliable'? The '100-day rule':

A ski resort can be considered snow-reliable if, in 7 out of 10 winters, skiing is possible on at least 100 days between December 1 and April 15 (with a 30 cm snow depth). At the moment, there is reliable snow at altitudes above about 1,200 metres in the Alps.



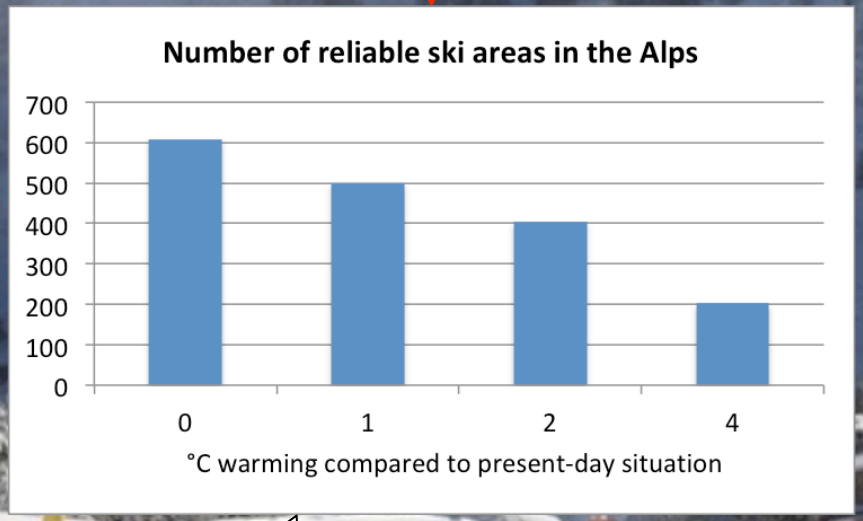
It is estimated that the snowline, as well as the line of natural snow-reliability, will rise by 150 m with 1°C warming.

Winter sport tourism

Decrease snow reliability

Future decrease number of 'snow-reliable' ski-resorts: the case for the Alps

A 1°C rise leads to four fewer weeks of skiing days in winter and six fewer weeks in spring at the most sensitive elevation in the Austrian Alps (600 m in winter and 1400 m in spring) and with no snowmaking adaptation.



A 2°C warming could reduce the seasonal snow cover at a Swiss Alpine site by 30-50 days.

Under present climate conditions, 609 out of the 666 (or 91%) Alpine ski areas in Austria, France, Germany, Italy, and Switzerland can be considered as naturally snow-reliable. The remaining 9% are already operating under marginal conditions. The number of naturally snow-reliable areas would drop to 500 under 1°C, to 404 under 2°C, and to 202 under a 4°C warming of climate.

Winter sport tourism

Past

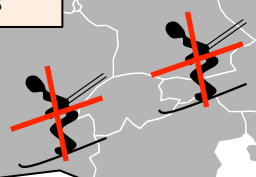
First low-lying ski-resorts have been shut down

It was the winters with little snow in the Alps at the end of the 1980s that caused a stir. The big difference to earlier periods with little snow was that the capital intensity of ski tourism had considerably increased. The snow shortage at the end of the 1980s left a clear mark on the tourist trade. The earnings of cable-way companies decreased by 20% compared to the 'normal' winter of 1986/1987. Particularly affected were smaller companies at lower and medium altitudes.

An example of successful withdrawal from ski tourism is Gschwender Horn in Immenstadt, Bavaria. At the beginning of the 1990s, after a series of snow-deficient winters, it was decided to withdraw from the non-profitable ski operation. The facilities were dismantled, the ski runs re-naturalised. Today, the area is used for summer and winter tourism, namely hiking, mountain biking, snowshoeing and ski touring.

Bavaria, German Alps

Abondance, French Alps



The city council of Abondance in the French Alps has decided to shut down the ski station that has been its economic raison d'etre for more than 40 years. The reason: not enough snow. Abondance (at 930 meters) falls in the altitude range climate scientists say has seen the most dramatic drop in snowfall in recent generations. Whether this shut down is due to climate change or not is disputed, however. There are 20 other low-lying Haute Savoie resorts that some say are on the brink of closure.

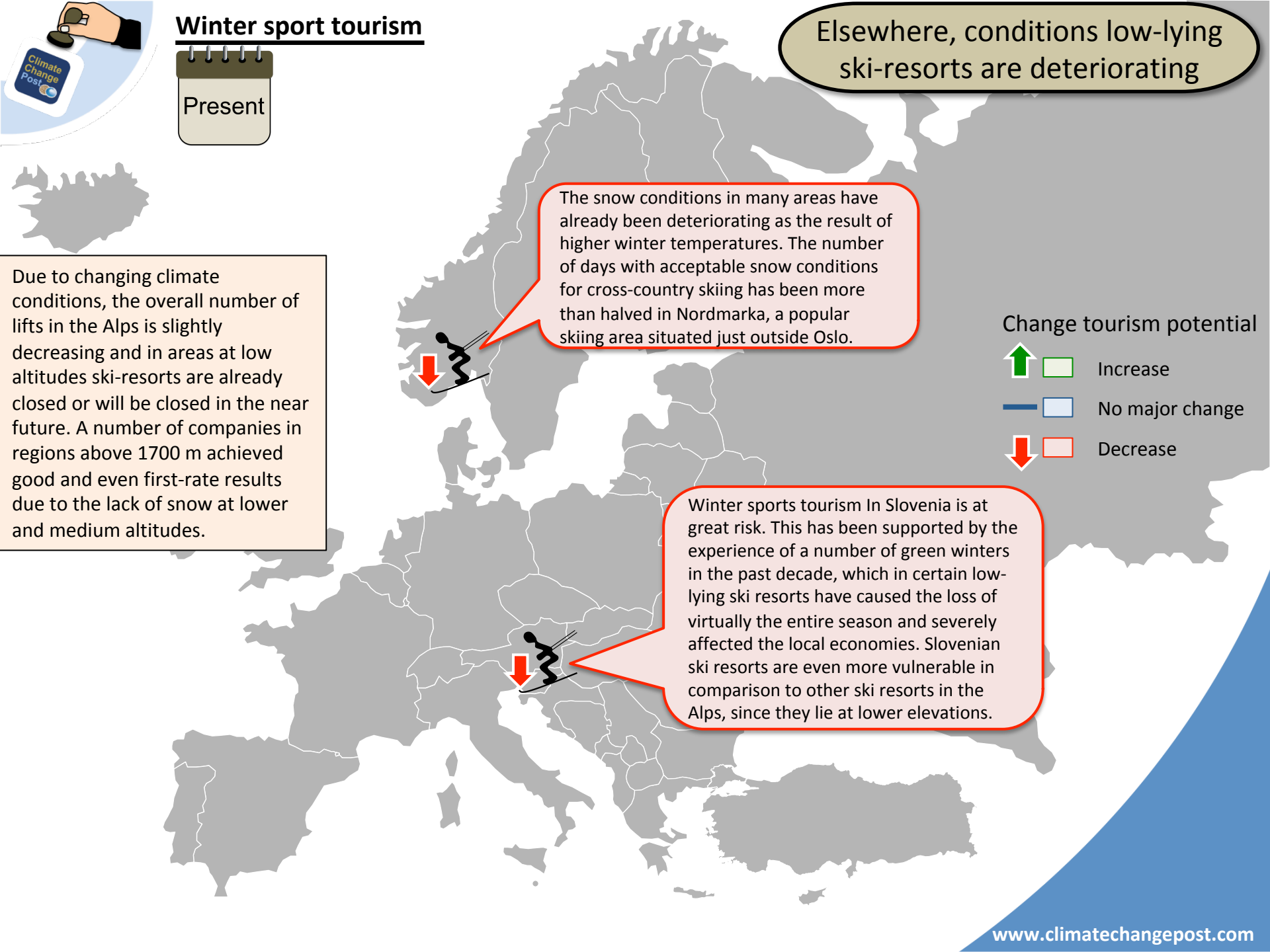
Winter sport tourism

Present

Elsewhere, conditions low-lying ski-resorts are deteriorating

Due to changing climate conditions, the overall number of lifts in the Alps is slightly decreasing and in areas at low altitudes ski-resorts are already closed or will be closed in the near future. A number of companies in regions above 1700 m achieved good and even first-rate results due to the lack of snow at lower and medium altitudes.

The snow conditions in many areas have already been deteriorating as the result of higher winter temperatures. The number of days with acceptable snow conditions for cross-country skiing has been more than halved in Nordmarka, a popular skiing area situated just outside Oslo.



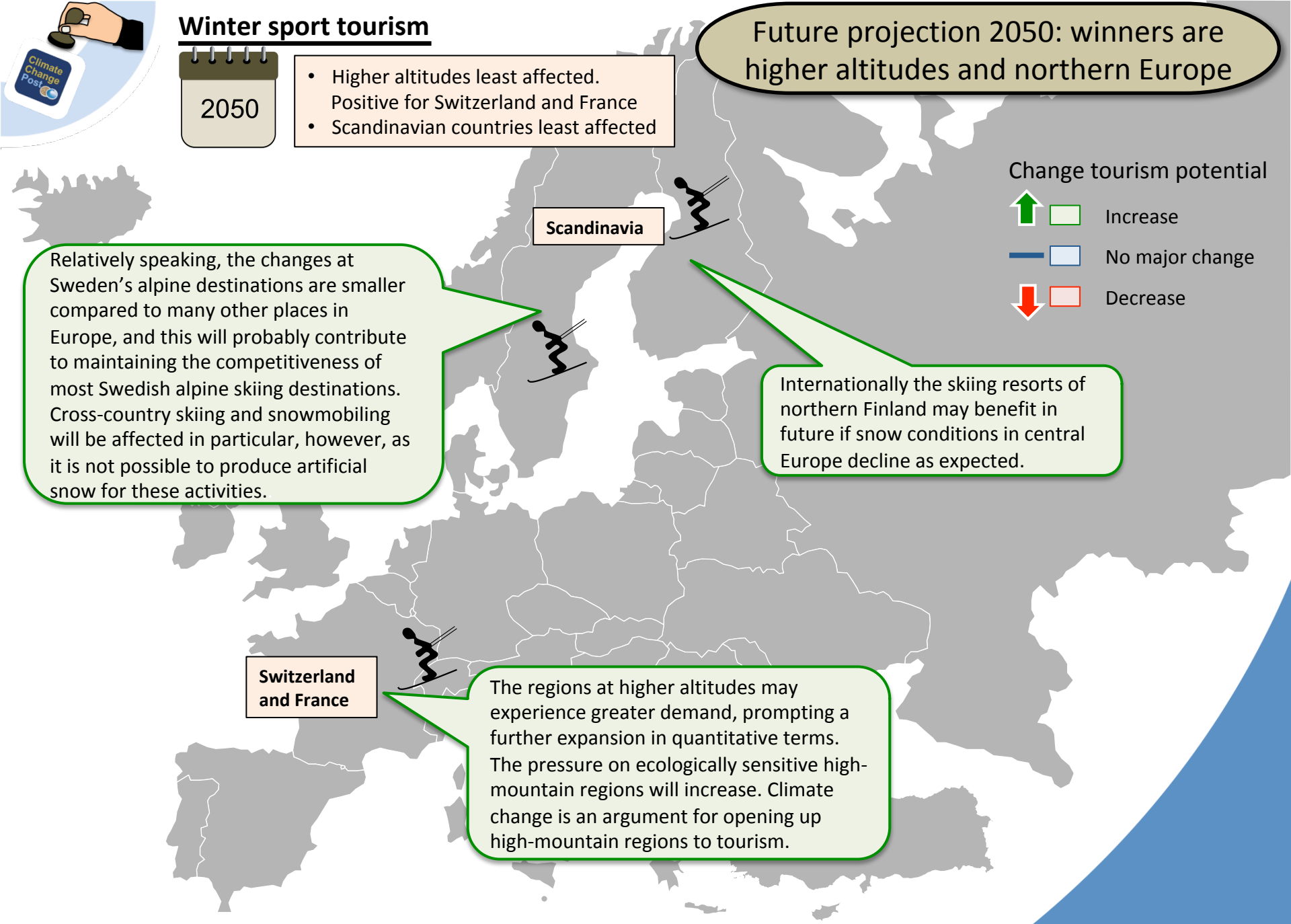
Winter sports tourism In Slovenia is at great risk. This has been supported by the experience of a number of green winters in the past decade, which in certain low-lying ski resorts have caused the loss of virtually the entire season and severely affected the local economies. Slovenian ski resorts are even more vulnerable in comparison to other ski resorts in the Alps, since they lie at lower elevations.

Winter sport tourism

2050

- Higher altitudes least affected. Positive for Switzerland and France
- Scandinavian countries least affected

Future projection 2050: winners are higher altitudes and northern Europe



Winter sport tourism

2050

Winners in 2050: some details

In Sweden, the skiing season in Åre up until 2039 may decrease by up to 5 weeks, but this is not expected to entail any major changes for Åre as a tourist destination. Instead it is asserted that, in a 30 year perspective, Åre may be a winner, when other destinations in Europe are affected more by climate change.

With regard to winter tourism, Finland's largest ski resorts are located in the provinces of Lapland and Oulu. The coverage of artificial snow equipment at Finnish ski resorts is one of the most extensive in the world; an estimated 80% of the total slope area is covered with artificial snow. Climate change in Finland is not predicted to shorten the length of the snow season below the critical length. The future of winter tourism in Finland and similar areas may be more sensitive to the changes in the frequency and severity of weather extremes than to the changes in the season lengths.

Winter sports tourism in the French Alps could be left largely unscathed by climate change for the moment. Many important ski areas are at high altitude: until 2030 lack of snow should normally either be no problem or could be compensated for by artificial snow production. Some of the glaciers provide year-round reliability for winter sports activity. In addition, substitution effects from other ski areas in the European Alps could mean that the winter sports areas in the French Alps will gain. In contrast, the reliable snow cover in the French Pyrenees is noticeably reducing.

Swiss winter sports tourism could even benefit from climate change up to 2030. Winter sports tourism in Switzerland should be less negatively affected by climate change than Austria. The ski resorts in the Swiss part of the Alps are generally higher. The regions with reliable snow could be successful in attracting tourists both from other parts of Switzerland and from the more seriously disadvantaged areas, such as Germany and Austria.

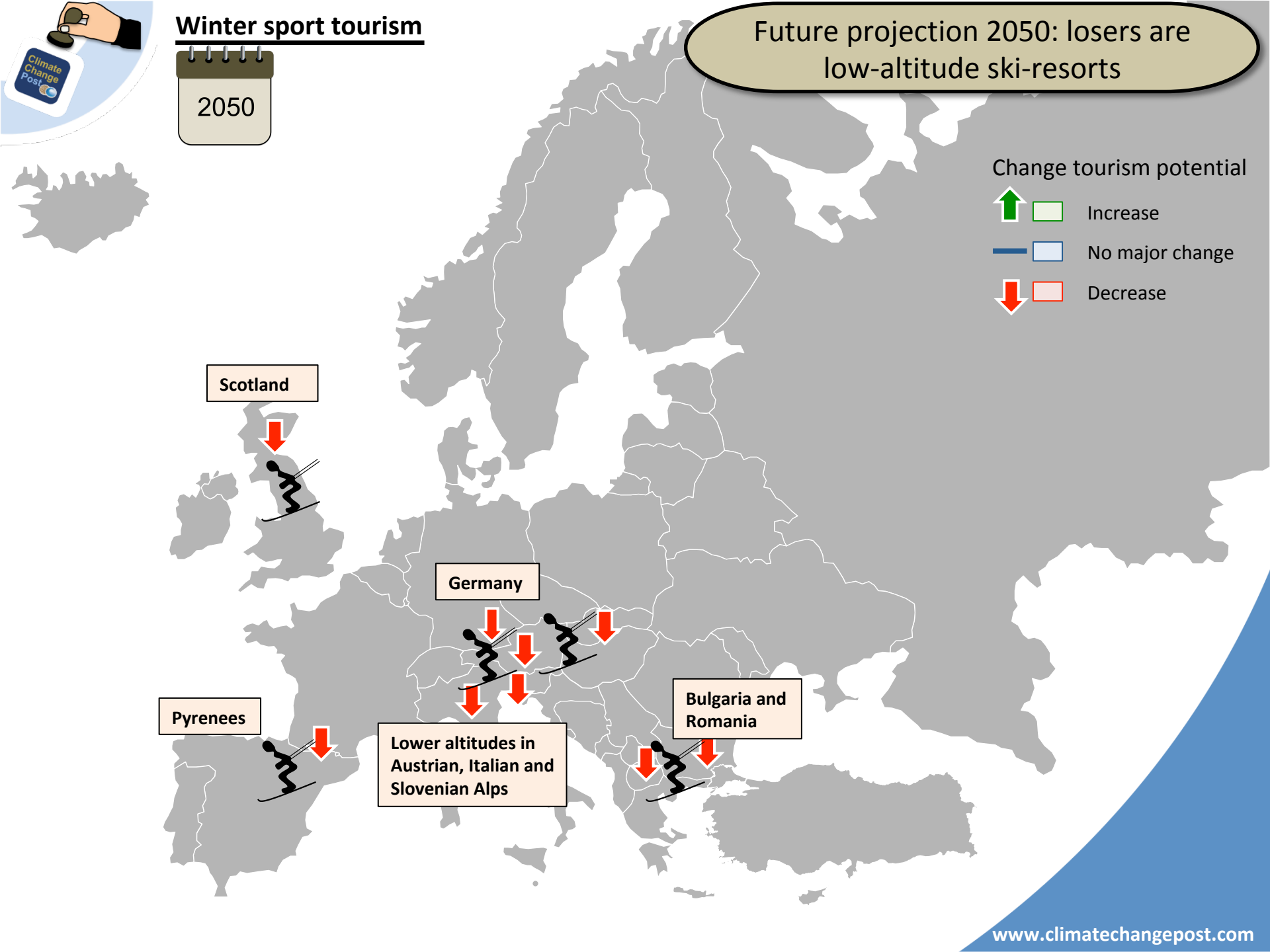
Change tourism potential

- Increase
- No major change
- Decrease

Winter sport tourism

2050

Future projection 2050: losers are low-altitude ski-resorts



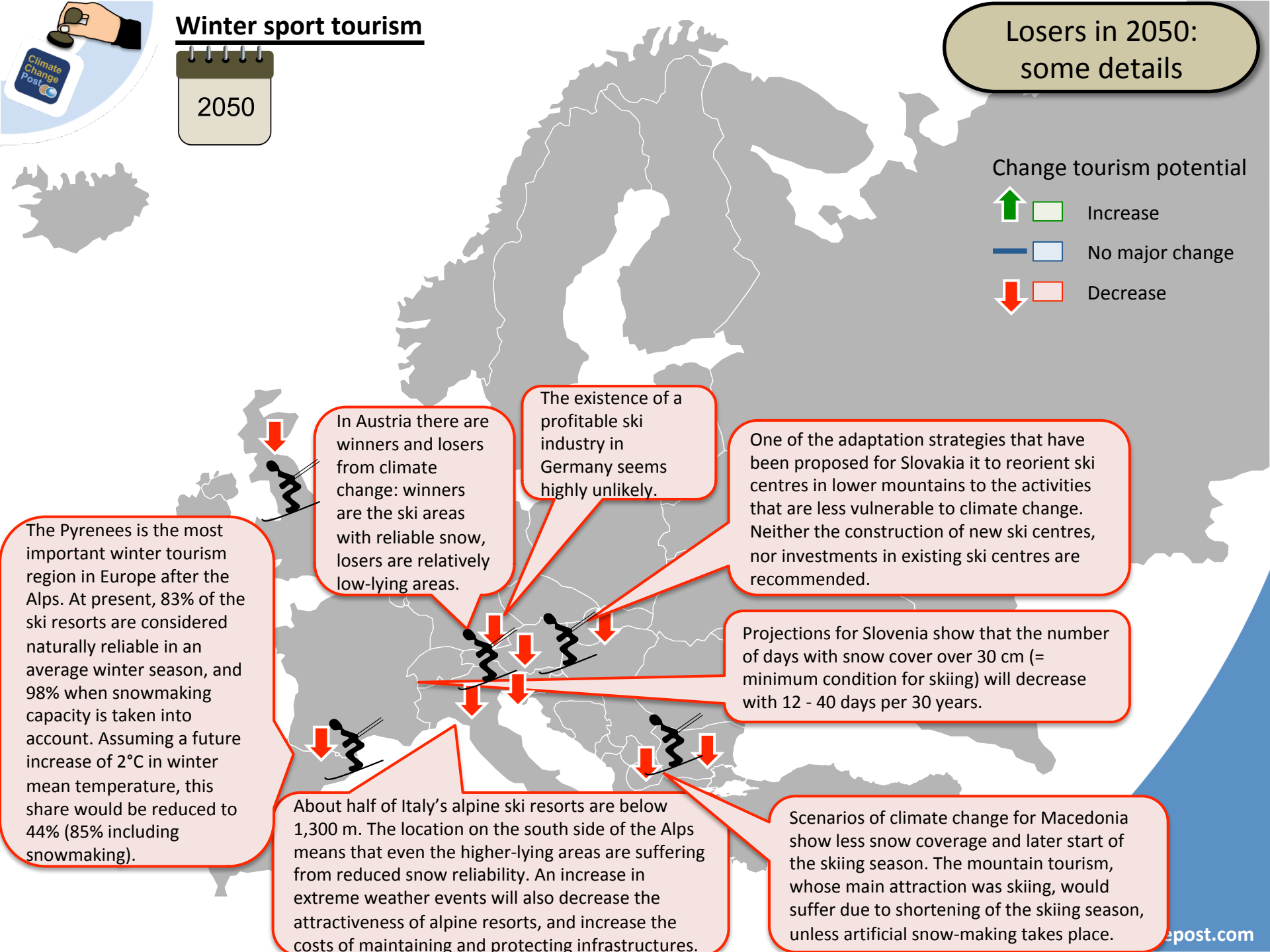
Winter sport tourism

2050

Losers in 2050: some details

Change tourism potential

- Increase
- No major change
- Decrease



In Austria there are winners and losers from climate change: winners are the ski areas with reliable snow, losers are relatively low-lying areas.

The existence of a profitable ski industry in Germany seems highly unlikely.

One of the adaptation strategies that have been proposed for Slovakia it to reorient ski centres in lower mountains to the activities that are less vulnerable to climate change. Neither the construction of new ski centres, nor investments in existing ski centres are recommended.

Projections for Slovenia show that the number of days with snow cover over 30 cm (= minimum condition for skiing) will decrease with 12 - 40 days per 30 years.

The Pyrenees is the most important winter tourism region in Europe after the Alps. At present, 83% of the ski resorts are considered naturally reliable in an average winter season, and 98% when snowmaking capacity is taken into account. Assuming a future increase of 2°C in winter mean temperature, this share would be reduced to 44% (85% including snowmaking).

About half of Italy's alpine ski resorts are below 1,300 m. The location on the south side of the Alps means that even the higher-lying areas are suffering from reduced snow reliability. An increase in extreme weather events will also decrease the attractiveness of alpine resorts, and increase the costs of maintaining and protecting infrastructures.

Scenarios of climate change for Macedonia show less snow coverage and later start of the skiing season. The mountain tourism, whose main attraction was skiing, would suffer due to shortening of the skiing season, unless artificial snow-making takes place.

Winter sport tourism

2100

Future projection 2100: no winners, although high-altitude ski-resorts are hardly affected

Change tourism potential

- Increase
- No major change
- Decrease

Scandinavia

Sensitivity to climate change varies markedly among the Alpine countries.

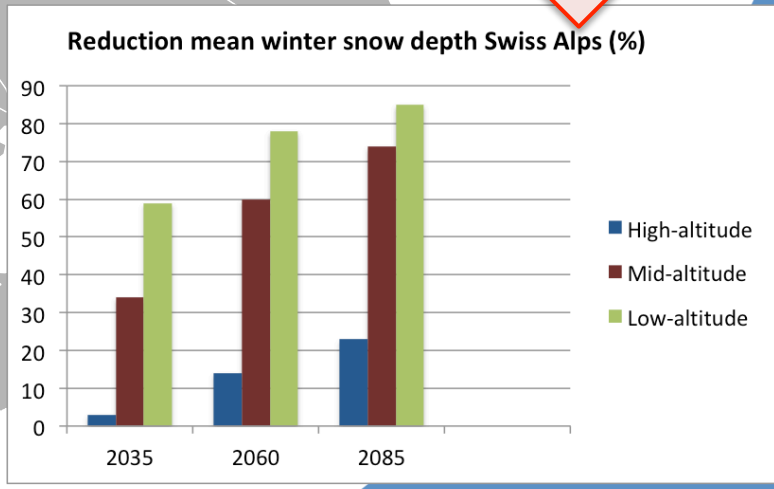
Alps

Many of the Austrian ski areas have low base points. With climate change the natural snow-reliability of Austrian ski areas will reduce substantially.

Pyrenees

In France, Switzerland and Italy many ski areas operate at fairly high altitudes. The impact of climate change is relatively small.

Snow reduction compared with current conditions:



Winter sport tourism

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No more winners in 2100: some details

Change tourism potential

- Increase
- No major change
- Decrease

Germany is most sensitive of all Alpine countries, with only a 1°C warming leading to a 60% decrease (relative to present) in the number of naturally snow-reliable ski areas. Practically none of the ski areas in Germany will be left naturally snow-reliable under a 4°C warming.

Towards the end of the century it is likely that the problems will be on the increase. The shortened skiing seasons at the end of the century will entail significantly reduced earnings for the Swedish skiing industry.

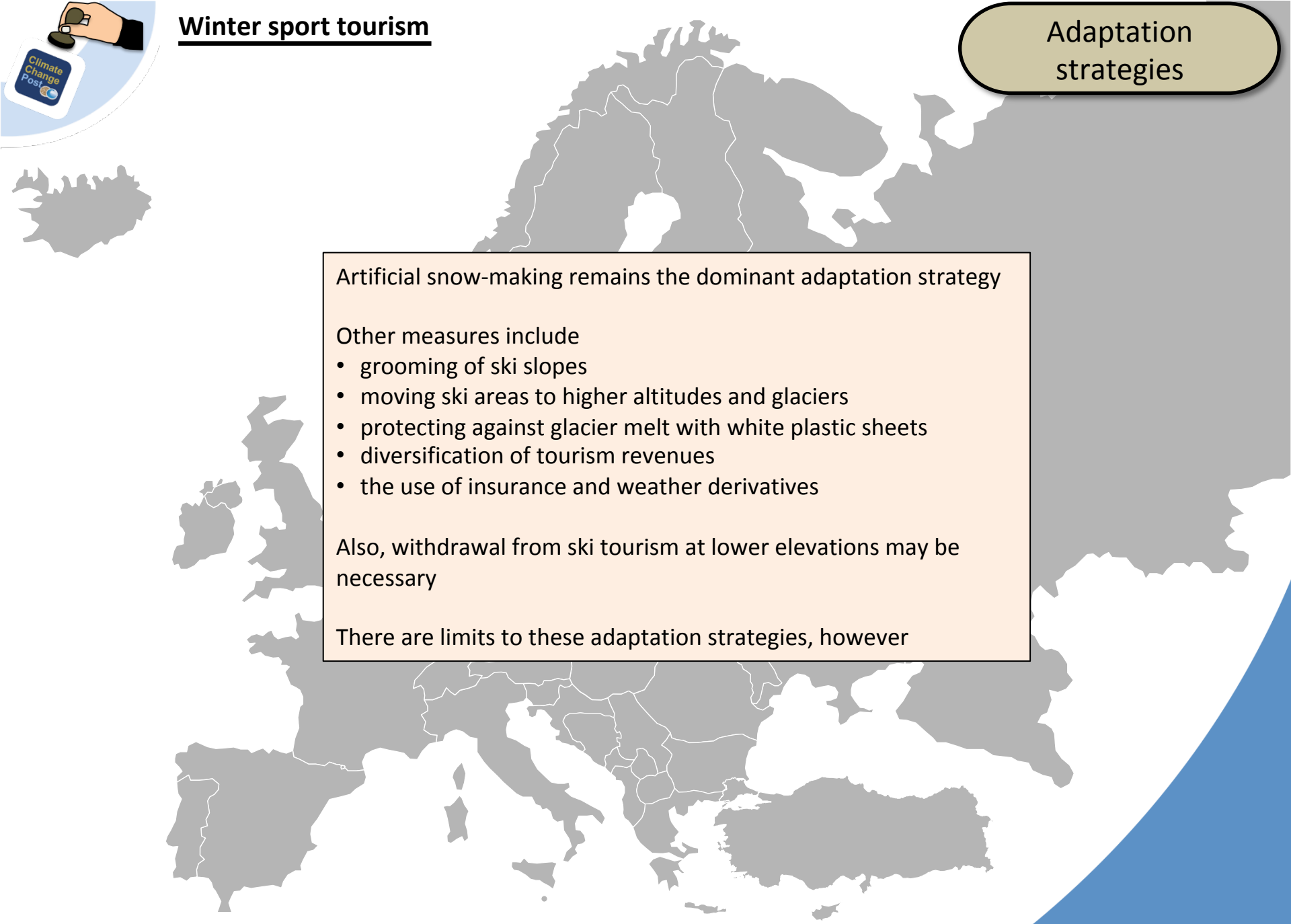
Switzerland is the least sensitive of all Alpine countries, with a 1°C warming leading to only a 10% decrease, while a 4°C warming would lead to a 50% decrease (relative to present) in the number of naturally snow-reliable areas.

At 4°C winter temperature increase the total share of reliable ski resorts in the Pyrenees would be dramatically reduced to only 7% (and no improvement with snowmaking). Snowpack is most affected by climate change in the eastern part of the Spanish Pyrenees; south-oriented slopes are most vulnerable.

In Switzerland, mid-elevation stations are expected to have a mean winter snow depth of less than 20 cm toward the end of the century. At low elevations, it is likely that winters without any snowfall at all occur toward the end of the century while half of the studied mid-elevation stations no longer have a continuous snow cover for at least 30 days. The highest elevation station preserves a continuous snow cover even at the end of the century.

Winter sport tourism

Adaptation strategies



Artificial snow-making remains the dominant adaptation strategy

Other measures include

- grooming of ski slopes
- moving ski areas to higher altitudes and glaciers
- protecting against glacier melt with white plastic sheets
- diversification of tourism revenues
- the use of insurance and weather derivatives

Also, withdrawal from ski tourism at lower elevations may be necessary

There are limits to these adaptation strategies, however

Winter sport tourism

Adaptation strategies

Artificial snow-making

Snow-making has effects on water consumption, energy demand, landscape, and ecology. If ambient temperatures increase beyond a certain threshold snow-making will simply not be viable.

In Germany, artificial snow to increase snow safety and elongate the season will only be an appropriate adaptation measure in the short- to medium-term, since rising temperatures will render artificial snow making impossible at lower altitudes. German winter tourism will therefore rely importantly on alternative activities (hiking, cultural travels, wellness).

Snowmaking cannot completely solve the problem for all ski resorts in the Pyrenees, as the measure can only act as a robust adaptation strategy in the region provided climate change is limited to +2 °C. Snowmaking should only be considered as a suitable short-term strategy, rather than a sustainable long-term adaptation strategy.

Ski season simulations show that snowmaking technology can maintain snow-reliable conditions in Austria until the 2040s to the 2050s, but by the end of the century the required production in snow volume is projected to increase by up to 330%.

Climate change and global warming, together with international competition, have been used as the key arguments for constructing artificial snow-making facilities in Switzerland, as well as for extending existing ski runs and opening new ones in high alpine regions (at above 3000 a.s.l.).

Snowmaking is surely the most common and widespread adaptation strategy in Italy (about 77% of the Italian ski areas are already covered by snowmaking systems). A rise in average temperature will lead to an increasing need to use artificial snow, therefore increasing both the costs and the likelihood of conflicts with other water users.

Winter sport tourism

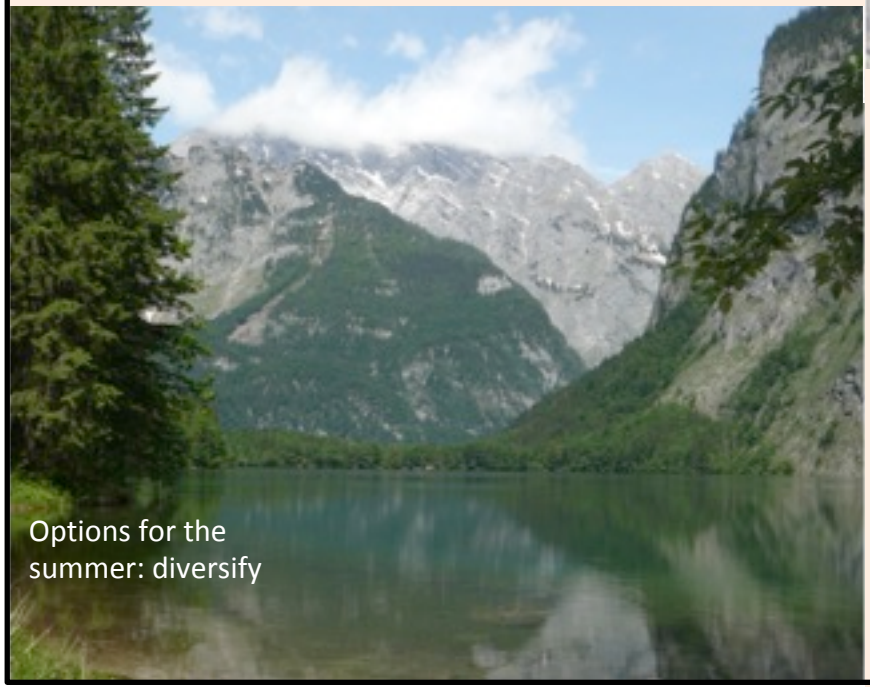
Other strategies for the winter:

Grooming of ski slopes can reduce the minimum snow-depth required for ski operations by 10 or 20 cm. However, no amount of grooming can overcome significant declines or the total absence of snow cover.

Plastic sheets have been shown to be cost-effective in protecting glacier mass, but there are limits to the area that can be covered by such sheets and they cannot prevent the eventual disappearance of glaciers if warming trends continue.

Insurance can reduce the financial losses from occasional instances of snow-deficient winters, but cannot protect against systemic long-term trends towards warmer winters.

Limitations to other adaptation strategies in the winter



Options for the summer: diversify

Diversification in the summer:

Ski resorts will be able to compensate for the shortening of the winter season at least partly by attracting tourists to the mountainous regions during the summer.

In Switzerland, the promotion of year-round tourism, innovation, and the diversification of the tourism offer are generally seen as the most implemented and most effective measures.

Losses in winter tourism in Germany could possibly be balanced by gains in summer. A range of effective adaptation options is available that is expected to lead to a reduction to “low” vulnerability of the tourism sector to climate change.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