



GLACIER EXPERIENCE TRAIL



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A SLICE OF PARADISE, ...

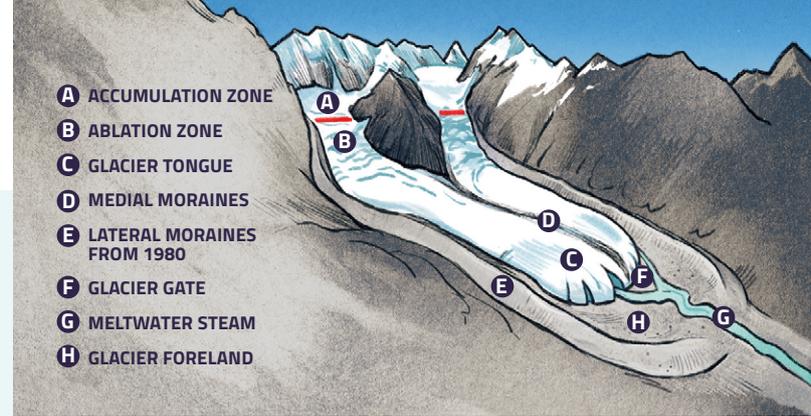
At the height of the last ice age, around 20,000 years ago, the glaciers extended all the way to the foothills of the Alps. At the time, more than a third of the earth's surface was covered in ice.

In order for glaciers to exist, it must be cold enough and there needs to be sufficient snowfall. Above a certain altitude, snow never fully melts, even in summer.

Glaciers form in places where snow remains all year round.

Glacier ice is made of snow that never melts and condenses to form ice over the years. This takes place in the upper section of the glacier, known as the accumulation zone **A**. The lower part of the glacier, known as the ablation zone **B**, melts each summer, leaving the glacier ice exposed to the sun's rays. While new ice forms at the glacier head, glacier ice melts in the ablation zone. (see image)

The climate and weather shape the landscape through a variety of erosion and sedimentation processes. In the high mountains, the traces are often seen in the form of landslides, rockslides, mudslides, floods and avalanches.



... SHAPED BY THE AGES, ...

Without the natural greenhouse effect, the average temperature on earth would be -18°C , which would barely be able to support life.

Some solar radiation does not reach the earth and is dispersed in the atmosphere, some is absorbed by the earth itself and the rest is reflected **I**. The earth emits the absorbed radiation **I** in the form of heat or long-wave infrared radiation. Like in a greenhouse, this atmospheric heat **K** is partially reflected back to the earth. In a greenhouse, it is the glass that does this; in the atmosphere, it's greenhouse gases. This process is what makes the earth habitable for humans in the first place.

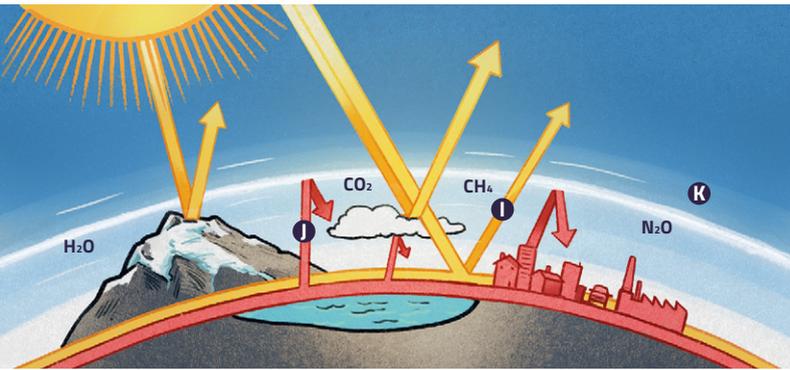
The main greenhouse gases are water vapour (H_2O), carbon dioxide (CO_2), methane (CH_4) and nitrous oxide (N_2O). Human beings have increased greenhouse gases mainly by releasing:

- Carbon dioxide – emitted when burning fossil fuels (transport, heating, power generation and industry) and cement

production (burning limestone).

- Methane – emitted in the production of rice (paddy fields), livestock farming (digestion by ruminants), extraction of natural gas and from landfill sites.
- Nitrous oxide – emitted from fertilised fields, livestock farming, industry and transport.

It is hard to predict how much the greenhouse effect has been exacerbated. However, the influence of human beings on the climate is indisputable, and the effects on glaciers have been striking.



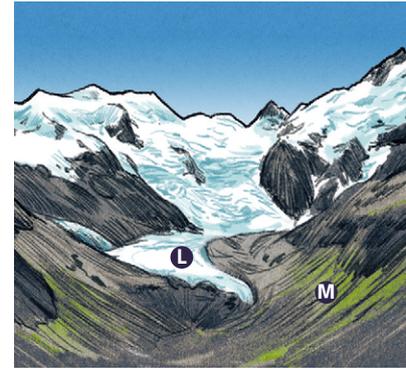
... IN A STATE OF CONSTANT CHANGE, ...

Global warming is causing major changes in the high mountains. It is having a particular impact on glaciers and permafrost areas.

The Morteratsch Glacier has receded by 2 km in the space of 110 years (1900 to 2010) **L**. As the glacier retreats, it has exposed a large area that is now gradually being inhabited by plants **M**. According to model calculations, only seven of the largest 45 glaciers in the

Upper Engadine will still exist in 100 years' time. In order to prevent a glacier from melting, around two thirds of its total area must be covered in snow at the end of the summer. Without this, it is not possible for enough new ice to form.

Global warming not only affects glaciers, it also has an effect on permafrost areas. Permafrost is a permanently frozen sub-surface. The lower boundary of permafrost layers in the Engadine sit at an altitude of between 2,100 and 3,000 metres, depending on the location. The ground can be frozen to a depth of up to 100 metres. When the permafrost melts, this can cause rockslides or mudslides in the case of scree. If these come down the sides of a valley, they pose a danger to paths, roads and even villages.



... LEAVING LASTING TRACES, ...

Glaciers are Switzerland's most important water reservoirs. They are also a distinctive feature of the landscape and a significant tourist attraction.



Glaciers are not only a key source of freshwater; they are also used to produce energy. The meltwater from glaciers is estimated to generate 4% of Switzerland's hydropower production. The rising temperatures in recent years have caused glaciers to melt increasingly fast. As a result, glacial lakes or 'water pockets', lakes inside glaciers, are formed.

These can cause sudden outburst floods if they are dammed by unstable glacier ice or loose moraine **(N)**. For this reason, in 2000 the village of Samedan decided to divert the river Flaz in order to reduce the risk of flooding.

Melting glaciers are not the only danger. Warming permafrost can also cause significant damage. Thawing loosens the subsoil, which can trigger rockslides or mudslides. In response to this, in 2003 Pontresina installed a pioneering retention dam to protect the town against avalanches in winter and mudslides in summer.

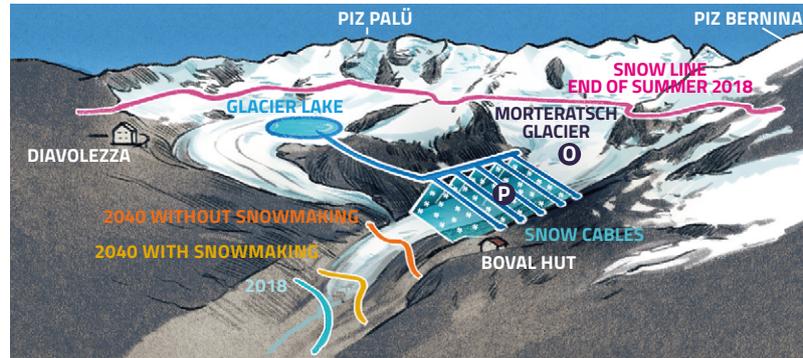
The natural phenomenon of glaciers plays an important role for tourism in the Engadine. Their disappearance will have a negative impact on the local tourism industry, at least in the short term.

... TO WHICH WE ALL BEAR WITNESS.

The MortAlive project aims to save the Morteratsch Glacier using artificial snowmaking.

'Snow is the best protection there is for ice,' says glaciologist Felix Keller. Snow reflects sunlight, thereby preventing the surface from warming up. To prevent a glacier from melting, a certain amount of its surface must remain covered in snow throughout the summer. The MortAlive project **(O)** has taken this on board and developed an innovative snowmaking system. The idea is to install snow cables **(P)** with built-in nozzles across an area of 1 km². The water required will come from a future glacial lake that will form at the higher lying Pers Glacier. The altitude difference will give sufficient pressure in the water ducts, so no additional energy will be required to create the snow.

According to the calculations, the project could prevent the Morteratsch Glacier from melting for another 50 years. But this is not the only aim of the pioneering project; it also hopes to develop a new and more efficient snowmaking system that could be used in alpine areas around the world.



GLACIER EXPERIENCE TRAIL



WELCOME TO THE GLACIER EXPERIENCE TRAIL.

Experience the glacier up close in this 1.5–2-hour trail. The nature trail takes you past five stations that explore the changes undergone by the glacier and explain the shifts in the sensitive Alpine habitat that are already visible, and which are highlighted in this guide.

If you would like to find out more about the world of glaciers, the QR code will take you to our website, where you can discover more in-depth and interesting information. Enjoy your trip to the glacier!

