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FUTURE FORUM ALPS
Liechtenstein

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CLIMATE CRISIS

In the Alps, the average temperature has already risen by around 3°C since 1900 – more than twice the global average. The effects on the Alpine water cycle are profound. Extreme weather events are becoming more frequent, precipitation is falling more irregularly, and snow cover is becoming thinner and more unstable. Heat waves are already occurring 14 times more frequently, while periods of drought are also increasing. Warm air can absorb around 7% more moisture per degree, which leads to more intense thunderstorms and increases the risk of heavy rain and flooding.

GLACIERS

Glaciers are important, non-renewable freshwater reservoirs. Alpine meltwater feeds about 8-12% of the major rivers, namely the Po, Danube, Rhine and Rhone. The term "peak water" refers to the point at which the volume of meltwater reaches its maximum. In the Alps, this has already occurred in 2025. By 2100, the glaciers will have largely disappeared.

PERMAFROST

Permafrost is soil that remains below 0°C for at least two years. Block glaciers, a mixture of ice and debris, are the most common landscape feature of mountain permafrost and are considered an important water reservoir and habitat for cold-adapted aquatic organisms. If the permafrost melts, it can trigger rockfalls, landslides and mudslides. The meltwater is particularly cold, clear and rich in dissolved substances, including heavy metals, which can be toxic for the local area. From 2050 onwards, the impact of permafrost melt on the water balance and ecosystems in the Alps is likely to increase significantly.

ECOSYSTEM SERVICES

Alpine freshwater is an important ecosystem service that supplies large parts of the Alps and Alpine foothill regions with drinking water. It also forms the basis for tourism and agriculture, for example through irrigation, alpine farming, artificial snowmaking and recreational activities such as thermal baths. High water quality is crucial for biodiversity and ecological functions.

AGRICULTURE

Agriculture consumes around 30% of the water used in Europe. Drip irrigation could reduce water consumption by up to 60%; increasing the humus content by just 1% improves water storage. Alpine farming can also manage water efficiently through demand assessment, closed pipe systems, pressure valves and coordinated grazing and water usage plans. Traditional irrigation systems, such as water channels, are included among UNESCO's designated cultural heritage sites, while also aiding flood and fire prevention, tourism and biodiversity.

DISEASES

Water is one of the most common carriers of disease worldwide, as germs multiply particularly well at 20–50°C and in oxygen-rich environments. Cold temperatures do not kill them, but do inhibit their growth. Germs only die when exposed to temperatures over 60°C over a prolonged period. Wastewater is also of vital importance as an early warning system for detecting infections in good time and tracking them epidemiologically.

WINTER TOURISM

In winter, when less water is available, the demands of tourism are particularly high. Around the year 2000, the construction of reservoirs for the production of artificial snow began in sensitive areas such as wetlands, spring areas and lakes. Today, there are around 1,300 of these reservoirs throughout the Alps. Ski resorts now also pump groundwater up the mountain; even, in many cases, drinking water. Sustainable tourism means developing holistic offerings using locally available resources and incorporating economic, social and ecological concerns.

MOUNTAIN HUTS

Mountain huts are increasingly affected by water shortages. They can significantly reduce their water consumption by using dry toilets and increasing their storage capacity with rainwater tanks. Other measures include separating service water from drinking water, and using photovoltaics or hydrogen instead of water turbines. Hikers should plan ahead, pack water filters and, if necessary, not take showers.

BIODIVERSITY

Biodiversity is declining worldwide, mainly due to agriculture, invasive species, urbanisation, pollution and climate change. River valleys are particularly affected, with species diversity in freshwater ecosystems declining by 85% since 1970. Renaturation measures can counteract this decline and are also financially worthwhile: according to the European Commission, every euro invested yields an average return of twelve times that amount.

POLLUTION

Foreign substances can today be detected even in high and remote bodies of water. Diffuse inputs, carried by air and rain, reach the Alps from afar. These include residues of fossil fuels, agricultural chemicals, microplastics, cosmetics, medicines and drugs. Phosphorus-containing Saharan dust is carried by the wind to the Alps, where it acts as a natural fertiliser. To meet these challenges, the gaps in knowledge and communication that exist between science, politics and society must be closed. Digital tools can help to collect climate and water data and make it comprehensible.

SETTLEMENT AREAS

Soil sealing prevents rainwater from seeping away and evaporating, which can exacerbate flooding and contribute to the heating of the surrounding area. Sponge cities and blue-green infrastructure aim to store water in urban areas, use it and release it slowly. Retention basins, green roofs and permeable soils all reduce surface runoff, relieve the burden on the sewage system, aid the formation of new groundwater and, at the same time, create green, cool places in which to spend time.

THE FUTURE OF WATER

How do we move from a reactive to a proactive approach? For centuries, people have mainly reacted, for example by straightening or damming rivers after floods. Today, however, we have much more at our disposal in terms of expertise, communication and models to allow us to shape the future together. Solutions are needed to preserve water as a common good for future generations.

This poster summarises the key findings of the FutureForum Alps on the topic of water, which took place in Liechtenstein on 27 and 28 June 2025. It is based on the scientific findings and practical experience of the participating experts.

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