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Research in Graubünden

Plant Laboratory at 2,480 Metres Above Sea Level

Long-term Effects of Warming on Alpine Plants

Warming chamber experiment in Val Bercla. Photo credit: Christian Rixen / SLF

In Val Bercla, above the village of Mulegns, hexagonal plastic structures dot the mountain landscape. They are part of a large network studying the effects of climate change: ITEX, the International Tundra Experiment (https://www.gvsu.edu/itex/). The open-top chambers warm the air inside by about 2 degrees Celsius compared to the outside temperature. They simulate climate warming.

Biologist Christian Rixen from the WSL Institute for Snow and Avalanche Research SLF in Davos has been overseeing the test site in Val Bercla since 2009. The site itself, however, was established over 30 years ago. Rixen explains why ITEX includes not only Arctic regions, but also alpine areas: “Strictly speaking, tundra refers to the treeless areas of the Arctic. But the similarities with high alpine environments are very strong,” he says. Many plant species are identical, and the conditions are similar: long snow cover, low temperatures. For instance, the Opposite-leaved Golden Saxifrage (Chrysosplenium oppositifolium) grows both on the Dom in the Valais Alps at 4,546 m above sea level and at the northern tip of Greenland – just 700 kilometres from the North Pole.

What makes ITEX special is that all participating sites worldwide follow a standardized protocol. This allows for direct comparisons and the identification of shared trends. The temperature difference inside the chambers usually remains constant – except during strong winds. The simple and low-cost setup makes it possible for experimental sites to operate for decades. Among other things, researchers record which plant species occur within the test plots, how

frequently, and how these change over time. It's not only about whether a species becomes more or less common, but also whether it grows larger.

Cold-adapted alpine plants respond very slowly to temperature changes. "They are very, very cautious," explains Rixen. "That's an advantage when it comes to late frosts, for example, but it also makes them vulnerable to competition from faster-growing species." In Val Bercla, this becomes apparent: specialists like the Opposite-leaved Golden Saxifrage are declining, while shrubs such as dwarf willows are spreading. Still, the alpine habitat is relatively well buffered, thanks in part to its topographic diversity – from sunny ridges to shaded hollows. "Our mountains are high, and many species still have room to move uphill," says Rixen.

But it's not just what we see above ground that matters. Cold-climate soils store enormous amounts of carbon. As vegetation composition changes due to warming, soil activity also changes – with consequences for the global carbon cycle. "What we can't yet quantify precisely is how much carbon we are gaining or losing through these processes," Rixen notes. "But we do know that this question is extremely important."

For Rixen, the presence of this kind of biological research in Davos is highly valuable: "The SLF is much more than 'just' an avalanche research institute. It's part of the WSL – the Swiss Federal Institute for Forest, Snow and Landscape Research. Our group in Davos focuses on vegetation, alpine pastures, protective forests, and the impact of climate change on alpine flora."

Christian Rixen and Daniela Heinen

50 Years of the Stillberg Experimental Site
On September 13 (10 a.m.–4 p.m.), the SLF will celebrate the 50th anniversary of the long-term research site at Stillberg. Experts from SLF and WSL will present individual research projects and findings at various stations in the Dischma Valley near Davos. www.slf.ch/de/veranstaltungen-und-kurse/50-jahre-langzeit-forschungsflaeche-stillberg

Christian Rixen.
Photo credit: Martin Breum

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