

TREE GROWTH **Above the timberline.** Mountain forests are expanding – but not at the same rate everywhere. Researchers at SLF are trying to find out why.

Twice a year Esther Frei climbs the slopes of the Stillberg in the Dischma Valley near Davos. She carries measuring instruments in her backpack up there not for pleasure, but as part of her job. Ten years ago, the plant ecologist at the WSL Institute for Snow and Avalanche Research SLF in Davos set up three experimental sites on the slopes between 1900 and 2400 metres above sea level: one in the mountain forest, one at the timberline and one 300 metres above it. While there, she also planted larch and spruce seeds. Since then, she has had to visit the sites many times. In June, she counts seedlings and puts up protective fences. In October, she surveys the plants as well.

Her results so far show that the seeds planted in the forest did not stand a chance. After two years, all the seeds and seedlings had been eaten or had died because of strong competition from other plants. “The vegetation also impeded germination at the timberline,” Esther says. In the long term, however, most of the small trees there have survived better than at the other sites. It was at the site above the timberline that the largest number of seedlings sprouted. The harsh conditions prevailing there, however, led to all the spruce disappearing within four years and only a few scattered larch seedlings have remained.

The timberline does not mean that no trees grow above it. It indicates the height above which no more forest grows. The treeline is higher up, explains Peter Bebi: “Individual larches may even be found several hundred metres higher.” He is head of the ‘Mountain Ecosystems’ Research Group at SLF, of which Esther’s project is a part.

For further information, see: slf.ch/treeline



The Stillberg has been a research site since the 1950s. In 1975, employees of the two forerunners of WSL and SLF planted 92,000 Swiss stone pines, mountain pines and larches there at altitudes between 2075 and 2230 metres above sea level. The aim was to find ways to improve protection against natural hazards, ...

Photo: Walter Schönenberger, WSL

Like the treeline, the timberline is also moving up. It has been rising in the Dischma Valley for a good hundred years, and has risen in the past forty years alone by an average of ten to twelve metres per decade. “The timberline has changed most in areas where the intensity of cattle-grazing has greatly decreased,” says Peter.

But climate change is also contributing to the shifting of forest boundaries worldwide. They are, for example, moving upwards and towards the poles. Esther’s research forms part of the international G-TREE project (Global Treeline Range Expansion Experiment), where the influences on tree germination at the timberline are being investigated at locations ranging from Australia to Alaska.

It’s not only the temperature that counts

It is not enough to simply take the development of the temperature into account, Peter explains, even though it has the greatest influence. “Other factors such as competing vegetation, the duration of snow cover, nutrients, wind, solar radiation and frost events all have an impact on tree growth.”

In addition, animals threaten the young plants through browsing or trampling on them. Esther has protected half of the seeds she planted from this danger by covering them with metal grids. For her analysis of the effects of different conditions, she can refer to many different experimental plots, including those with no protection against grazing, artificial sowing or vegetation.

Where the forest spreads, it can provide better protection against natural hazards such as avalanches and rockfall. The consequences for plant diversity, on the other hand, may be rather negative. This is what a team led by Christian Rixen, an ecologist at SLF, is currently studying. “We assume that the spread of mountain forests will lead to an overall reduction in plant biodiversity as, unlike in forests, species occurring in fens and dry meadows are declining.”

(job)



... 40 years later: metal grids protect young, newly sown plants from being eaten by animals on an experimental plot at an altitude of 2410 metres.

Photo: Esther Frei, SLF