INTERVIEW

Detecting forest damage early. Arthur Gessler is convinced that monitoring the health of the forest over the long term is worthwhile. In this interview, the WSL researcher talks about the influence of climate warming, and the importance of long-term datasets and networking among institutions and researchers.

WSL researchers have been monitoring the health of the forest at around seventy sites in Switzerland for over thirty years. Is this really worth the efforts and costs involved?

The state of the forest frequently changes, for example, after a drought year or a storm. But it is impossible to extrapolate long-term trends from such 'snapshots'. Only if we observe the forest for many years can we identify gradual changes occurring over decades. This is why I believe it is important to support long-term monitoring.

The beginnings of forest monitoring date back to the 1980s, when the topic of forest dieback worried many people.

Yes, including researchers. Back then, severe dieback was clearly noticeable in some parts of the forest. It occurred in particular places such as those where the forest was contaminated by, for example, emissions from industry. But damage was also observed over large areas. It was especially in areas where the damage was extensive that it was difficult to assess the situation realistically because no long-term data was available: is this a phenomenon that has also occurred previously or is it a completely new development? This is why monitoring networks were set up to observe the state of the forest and to be able to make sense of the changes in the long term. Through monitoring we can also record changes whose significance at some point in the future we cannot foresee today.

What kinds of trends are emerging?

The forest as a system reacts slowly. Trees cannot adapt to new conditions very fast. Look, for example, at how the nitrogen deposition that occurred in the 1980s and later is still affecting the forest. When trees receive a lot of nitrogen, they may become more sensitive to drought. With climate change, this sensitivity could play a more important role in future. In the long term, climate change will also alter the species composition in forests. In Canton Valais we have observed that many pines are dying on one of our monitoring sites. This information can be used, together with other data, to develop forecasts about what the forest in future will look like and which tree species could be planted under future climate conditions.

How can the condition of the forest be recorded?

We have two networks that complement each other: Sanasilva

Arthur Gessler is head of the Research Programme 'Long-term Forest Ecosystem Research LWF' at WSL

Photo: Bruno Augsburger, Zurich

As part of the monitoring programme, LWF researchers at WSL use a tensiometer to measure the forces that a plant must overcome to be able to take up water from the soil.

and Long-term Forest Ecoystem Research (LWF). In the Sanasilva inventory, around 1100 trees each year have been investigated since 1985 on fifty sites distributed across a 16 × 16-kilometre grid that covers the whole of Switzerland. Experts assess the condition of their crowns, their increment and how many trees have died. We also collect the same data on nineteen monitoring sites belonging to LWF. In addition to these measurements, we carry out numerous other measurements at these sites. These should help us determine the reasons for changes in the trees' health and growth. We determine the nitrogen and sulphur depositions as well as the ozone contents in the air, and also examine the water- and nutrient-balance in the soil.

What happens to all the data?

We analyse and compare the values measured to identify any variations between the individual years and any long-term trends. In order to store the data for the long term and make it accessible for other scientists, we deposit it in our databanks. We then pass it on in condensed form to the Federal Office for the Environment (FOEN). In addition, MeteoSwiss uses the data from our weather stations and will include it in future in their forecasting models. All the data is also transferred to the central databank of the European Network ICP-Forests, the International Co-operative Programme on Assessment and Monitoring of Air Pollution Effects on Forests. LWF and Sanasilva are

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Photo: Peter Waldner, WSL

part of this Network, in which almost all countries in Europe are involved. In all the countries participating, monitoring sites have been selected according to the same criteria and the same methods are used.

How important is this international networking?

It is very important. Thanks to the ICP-Forest networks, researchers can see how, for example, air pollution affects the forest in not only their own country, but the whole of Europe. The international cooperation and the widespread collection of data are also important for scientific analyses. WSL researchers are interested in understanding, for example, how nitrogen deposition, the ozone concentration or changes in temperature affect tree growth. These kinds of questions can only be answered with the help of large datasets for the whole of Europe that cover very long periods of time.

For further information on forest monitoring, see: *www.wsl.ch/forest-monitoring*

You were one of the initiators of SwissForestLab, another network, which was set up in 2017. What is the idea behind it?

We want to pool synergies in the SwissForestLab by bringing together researchers, as well as different infrastructures – including that of LWF – in Switzerland. As part of the SwissForestLab, there is, for example, a project to collate the data on forest growth in Switzerland with the aim to develop better models for forecasting forest growth under future climate conditions. In addition, we want to involve people working in forestry so that new insights can be applied as quickly as possible. We plan to organise annual workshops, in which we will ask our stakeholders, such as forest owners or cantonal head foresters, what they see as urgent problems for research and monitoring to address.

What does the future of forest monitoring look like?

We will use the latest technology to obtain more information in future from satellites and drones about the condition of the forest ecosystem. To this end, we are already working on evaluating image data using artificial intelligence with colleagues from Remote Sensing at WSL and at ETH Zurich. Satellite images may provide spatial and temporal information at high resolution, and also record small-scale and short-term changes in the condition of the forest. These methods will not, of course, replace classical monitoring, in which experts on the ground observe and measure parameters, but should usefully complement them. *(sni)*