Long-term Forest Ecosystem Research LWF and Sanasilva inventory

lwf

Identifying and investigating effects of environmental changes on forests

WSL

Air pollution and climate change impact forests. We research these effects with the Sanasilva inventory and the Long-term Forest Ecosystem Research programme (LWF).

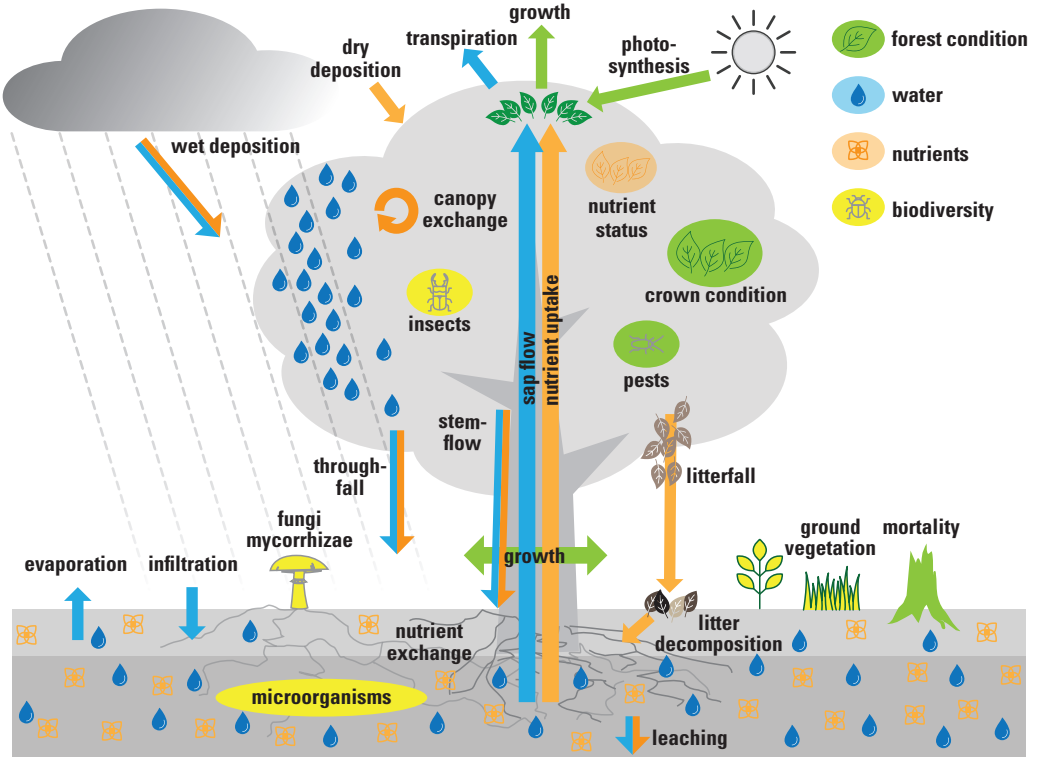
Objectives

- Early detection and monitoring of changes in forest condition (Sanasilva and LWF)
- Analysis of cause–effect relationships between environmental drivers and forest ecosystem responses, and development of forest health indicators (LWF)
- Facilitation of further research projects through a dedicated platform (LWF)

We aim to assess the risks to forests under future climate and pollution scenarios.

Further information
lwf.wsl.ch

Processes

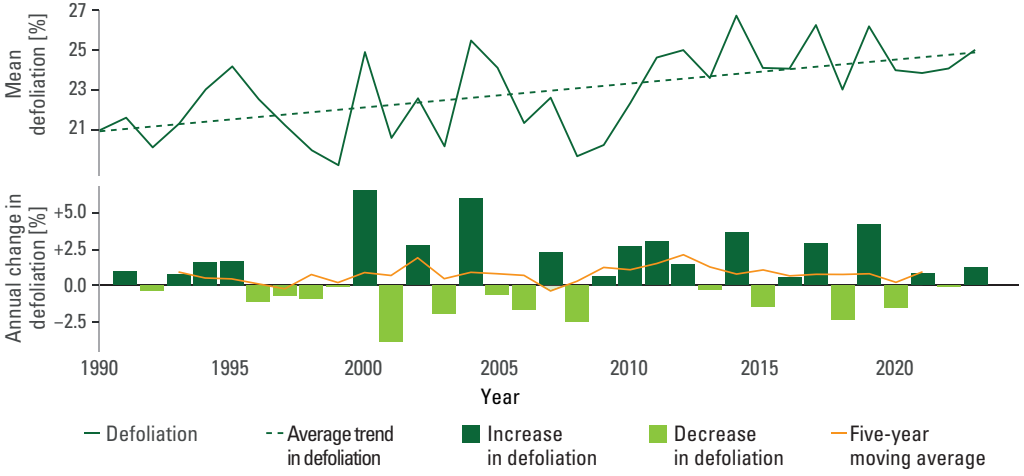


In the Sanasilva plots, we monitor forest condition. In addition, at the LWF sites we assess tree growth, the water and nutrient cycles, and biodiversity. The combination of automatic measurements, collectors, periodic sampling, and visual surveys provides a better understanding of the relationships between environmental factors and their effects on forest ecosystems.

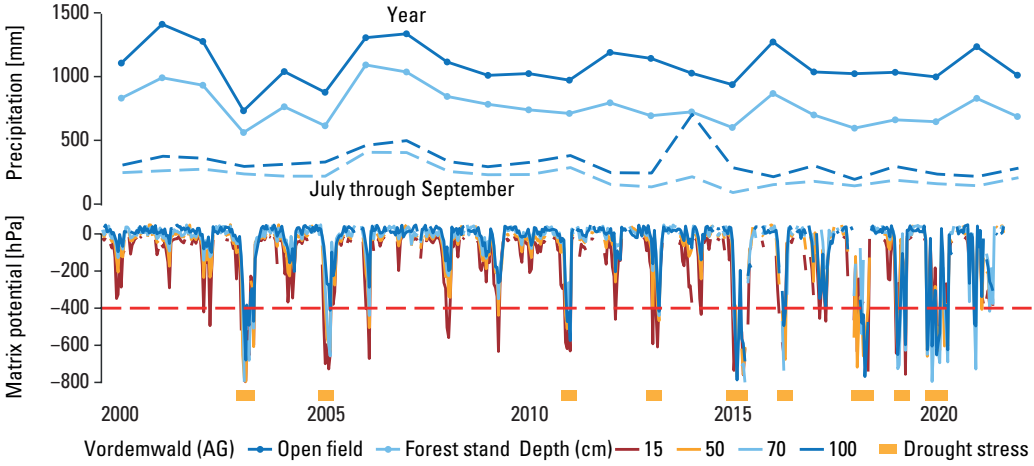
Forest condition and forest growth

- We monitor the long-term development of forest condition in the representative sample plot network of the Sanasilva inventory.
- An important indicator of tree health is tree crown defoliation (leaf and needle loss).
- Since 1990, defoliation has increased and forest growth has decreased.
- The main cause of these trends is increasing drought stress.
- After dry summers or extreme storms, crown defoliation increases markedly the following year.

Defoliation has increased since 1990, with pronounced annual fluctuations.



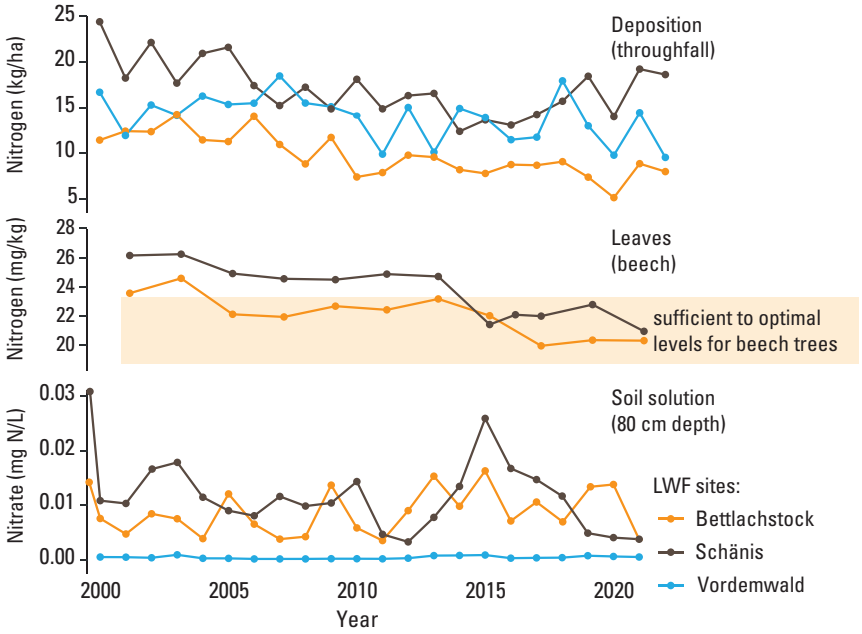
Water cycle



- In selected plots, we measure precipitation (open field), throughfall (below tree canopy), and water availability in the soil.
- When water is scarce, trees need more suction force to take up the water trapped between fine soil particles.
- A measure of this suction force is the matrix potential, expressed in hPa. At about –400 hPa, trees start to show responses to water shortage.
- The frequency of years with limited water availability is increasing.

Nutrient cycle

- We continuously sample soil solution and atmospheric deposition, and we collect leaf samples every other year.
- Nitrogen deposition has decreased in recent decades as a result of air pollution reduction measures.
- Nutrient concentrations in leaves are an indicator of the trees' nutrient status.
- Nutrient concentrations in the soil solution reflect the availability of the main nutrients. They can also be used to assess the quality of water percolating through the soil.
- Long-term series are necessary to detect changes in the chemical composition of the soil solution.



Biodiversity

- We regularly survey ground vegetation (photos: LWF site Isone).
- The sites differ in terms of the diversity of the ground vegetation, soil fungi and bacteria.
- Sites with many fungal species also host a large number of bacterial species in the soil. However, the number of plant species is not clearly correlated with the species diversity of fungi and bacteria.

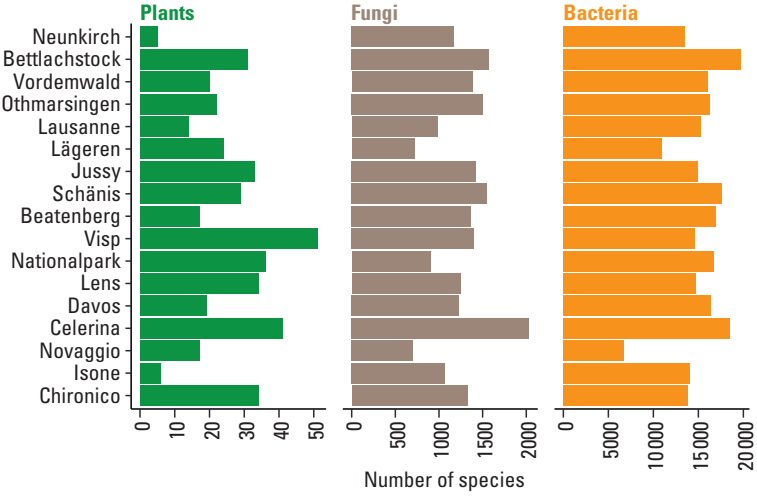
Plot B3, Isone (TI)

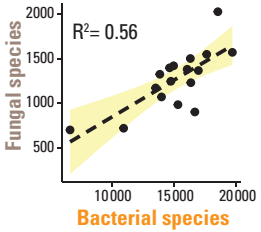
1996

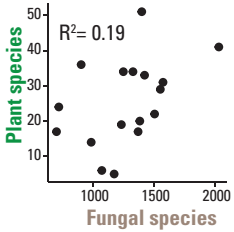
1998

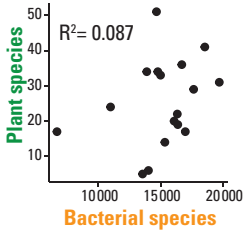
2011

2021

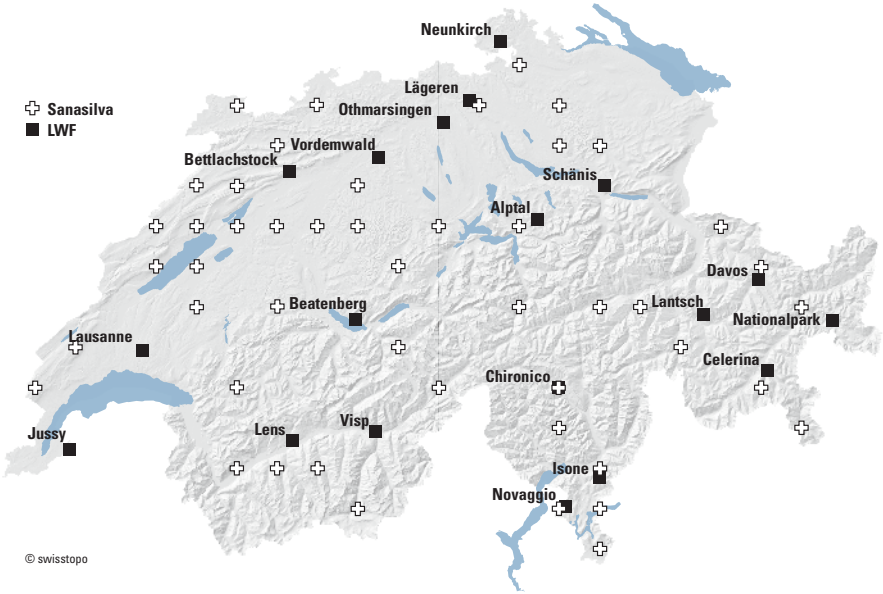








Locations and cooperation



With the data collected in the Sanasilva plots and at the LWF sites, we contribute to international programmes such as ICP Forests (International Co-operative Programme on Assessment and Monitoring of Air Pollution Effects on Forests) and the LTER-Europe network (Long-Term Ecosystem Research in Europe).

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A mandate of the Swiss Confederation within the framework of Swiss forest law and international agreements