Remote sensing enables comprehensive analysis of forest structures and biodiversity

Florian Zellweger has been fascinated by forests since he was a child. While he was studying geography at the University of Zurich, he immersed himself in the diversity of our forests and at the same time learned how to use geographical information systems and remote sensing data – a combination he was able to put to optimal use in his doctoral studies at WSL.

Not every forest has the same diversity. Various factors influence the biodiversity of a forest; for example, the climate, soil characteristics and the forest structure. The more varied the structure, the greater the variety of micro-habitats available to plants and animals. It takes considerable effort to collect data on forest structure in the field; for example, how trees and bushes are distributed or how much light reaches the ground through the canopy.

Nowadays, it’s easier to do this from the air: large parts of Switzerland are documented at regular intervals by plane using laser scanning. Vast LiDAR (Light Detection And Ranging) datasets on the surface structure of the landscape are available, but the potential of this data is in part untapped: “The 3D data can be used in a wide variety of ways and...
can also be linked with other data. This is not happening enough, particularly in the area of biodiversity,” says Zellweger.

**Structure-dependent**

Zellweger wanted to find out if the biodiversity of a forest could be predicted using LiDAR datasets. “Data on forest structure is important in that the structure of a forest can be influenced by silviculture measures,” he explains. “If we know which structures promote biodiversity, we can provide forest management with appropriate recommendations.” In order to find this out, he combined data on the diversity and habitats of individual species groups with LiDAR data. The results are encouraging: he was able to prove, inter alia, that forest structure data can reliably predict the presence of many butterflies. The more diverse the shrub layer is in a forest – for example, along well-structured forest edges – the greater the diversity of butterflies. Many butterflies and caterpillars find food and protection in shrubs.

Additionally, Zellweger was able to show that the forest structure also determines how different species of bats use their habitats. Bat species often found towards the interior of a forest were less active in forest land with consistently dense, vertical foliage and many branches. These structures disturb echolocation calls, and thus the bat’s ability to navigate.

**Added value through new connections**

Forest structure data from remote sensing is also suitable for producing comprehensive predictions of the biodiversity in Swiss forests. The advantage of this method is that it is more practical than recordings of forest structures in the field and can be applied to areas of any size. Changes in forests caused by storms or silviculture measures, for example, can also be easily measured in this way. Zellweger, for one, is certain: “Evaluation of datasets from remote sensing is still far from complete.” (lbo)

www.wsl.ch/more/forest-structure

Structure-rich shrub layers promote butterfly diversity. In the photo, a White Admiral.