Designing forests of the future – tree species for a changing climate

Fact sheet

How the tree species app works

In forest management, a forest is not just a forest. Forest experts distinguish between various types of forest sites and communities, which have different water and nutrient supplies and are classified into various altitudinal vegetation zones. The tree species composition of these different forests and the corresponding biological communities are equally diverse and varied, and are depicted in ecological diagrams. For example, the tree species that grow on a dry, south-facing slope at Lake Lucerne are completely different to those that grown on wet, north-facing marshy soil 1,000 metres above sea level in Schlierental.

The Forests and Climate Change research programme has found that altitudinal vegetation zones will shift upwards by 500-700 metres in altitude by the end of the 21st century, depending on how the climate develops. In practical terms, this mean that deciduous trees will spread to large areas where coniferous or mixed forests thrive today. The Forests and Climate Change research programme carried out by the Federal Office for the Environment (FOEN) and WSL, combined this finding with the ecological diagram approach as a way to estimate the expected changes to site conditions and types. This in turns makes it possible to identify now which tree species will flourish in specific locations in Switzerland at the end of the 21st century.

The site-ecological basic principles for forest management in the face of climate change developed during the research programme are currently being incorporated into an app that will be presented as a prototype at the Forest Fair[1]. The tree species app gives forest specialists an idea of which forest community will emerge in the future in any given area of Switzerland's forests. This will make it clear which tree species have a future and should be promoted now when regenerating forests and tending young forests.

Facts about climate change and its impact on forests

- In Switzerland, the mean annual temperature rose by 1.8°C between 1864 and 2000, twice the global average.
- Even if the global temperature increase is kept well below 2°C, as agreed at the Paris climate change conference in 2015, further warming of 1 to 2°C is expected in Switzerland.
- This means that, even if the climate targets agreed in Paris are met, forests will still change dramatically almost everywhere in Switzerland in the coming decades.
- The higher temperatures will cause the altitudinal vegetation zones to rise. The expected increase of 3.1 to 4.3°C will shift altitudinal vegetation zones upwards by around 500 to 700 metres in altitude.
- This means that some tree species that are currently well suited to their location will reach their ecological limits in their current habitat within a few decades. Distribution models show that the habitats of species that prefer montane zones (700-1,000 metres, e.g. beech, fir) and subalpine

zones (1,300-1,900 metres, e.g. Norway spruce) are shrinking. Deciduous trees, however, are spreading to higher altitudes.

- This has a considerable impact on all the forest functions we depend on; their ability to protect against natural hazards, promote species diversity, produce timber and provide recreational spaces may be weakened or even curtailed.
- Events likes drought, forest fires, pest infestations and storms in particular could threaten forest functions if they occur at the same time (negative feedback). The main driver of these events is the increasing frequency of summer droughts.
- The last couple of decades have been marked by a series of events believed to be connected to climate change: dry summers in 2003, 2015 and 2018, and increasingly frequent forest fires.
- Climate change can also trigger unwanted biotic phenomena such as the infestation with bark beetles in Norway spruce and fir trees. Added to this is global trade, which facilitates the spread of new forest pests and pathogens.