

EGU21-11209, updated on 14 Jun 2021

<https://doi.org/10.5194/egusphere-egu21-11209>

EGU General Assembly 2021

© Author(s) 2021. This work is distributed under the Creative Commons Attribution 4.0 License.



Wide-area shrub forest map based on multi-sensor data and active learning

Marius Rüetschi¹, Dominique Weber¹, Tiziana L. Koch¹, David Small², and Lars T. Waser¹

¹Department of Land Change Science, Swiss Federal Institute for Forest, Snow and Landscape Research WSL, Birmensdorf, Switzerland

²Remote Sensing Laboratories (RSL), University of Zürich, Zürich, Switzerland

In the past few decades, the occurrence of shrub forest dominated by the two species Green alder (*Alnus viridis*) and Dwarf mountain pine (*Pinus mugo*) has increased in the Swiss Alps. Up-to-date and area-wide information on its distribution is required for countrywide forest reporting (5 % of Swiss forest consists of shrub forest) and of great interest to the forestry sector. Such information helps to better understand forest succession and supports the evaluation and management of protection forests. Until now, this information has been based on estimates from the Swiss National Forest Inventory (NFI). Due to their sampling scheme that uses a regular grid, these data are not area-wide maps. However, new developments in remote sensing techniques in combination with high spatial and temporal resolution data have facilitated the production of maps over large areas, e.g. the whole of Switzerland (41'285 km²).

To map the shrub forest areas, we developed an approach that uses a Random Forest (RF) model, active learning techniques and data from multiple remote sensing sources. The training data was produced via aerial image interpretation of areas covered by shrub forest. We used predictor data from different sensors and technologies, complementing each other by their diverse sensitivity to properties of shrub forests. These data included airborne Digital Terrain (DTM) and Vegetation Height Models (VHM), and spaceborne Synthetic Aperture Radar (SAR) backscatter from the Sentinel-1 constellation and multispectral imagery from Sentinel-2. To improve mapping quality, an iterative and semi-automatic active learning technique was used to generate further training data.

The above outlined workflow enabled the production of a shrub forest map for the whole of Switzerland with a spatial resolution of 10 m. An accuracy assessment was performed using independent validation data of a total of 7'640 regularly distributed NFI plots. Mean shrub forest cover per plot (50 m x 50 m) was slightly underestimated by 1.5 % with a root mean square error of 10 %. The influence of the active learning was observed and revealed higher accuracies after each additional iteration of training data production. The proposed approach underscores the potential of multi-sensor data combined with active learning techniques to provide cost-effective and area-wide information on the occurrence of shrub forest in a manner complementary to the NFI measurements.

