EGU23-15446, updated on 31 May 2023
https://doi.org/10.5194/egusphere-egu23-15446
EGU General Assembly 2023

Forest management strategies to improve water-related ecosystem services in central Italy

Marco Lompi[1,2], Tommaso Pacetti[1,2], Giovanni Pasini[2], and Riccardo Santolini[2,3]
[1]University of Florence, Department of Civil and Environmental Engineering, Firenze, Italy (marco.lompi@unifi.it)
[2]Centro Ricerche Ecologiche Naturalistiche – CREN
[3]Department of Humanities, University of Urbino Carlo Bo

Forest management can represent a powerful tool to optimise ecosystem services related to water, as water availability is deeply connected with forests and their management. The objective of this study is to improve the understanding of the forest–water connection, developing a methodology that can explain which forest types and management strategies can increase water availability and flood protection in Casentino Forest National Park (Parco Nazionale delle Foreste Casentinesi). The different forest management types for every species considered in the study are abandoned or unmanaged forest, coppice, coetaneous and non-coetaneous high forest. The Casentino Forest National Park in Central Italy on the Apennine Mountains covers a set of 25 small river basins, which have been chosen as a case study to test a methodology based on hydrological modelling and machine learning tool. First, the Soil Water Assessment Tool (SWAT) has been calibrated and used to model the baseline scenario, evaluating the ecosystem services the forest park provides. The baseline scenario has been built in the SWAT model, characterising the forest-related parameters, such as the leaf area index, the leaf-to-biomass fraction, the biomass of the forest or the canopy storage among others. This information has been retrieved with land use data, such as the Corine Land Cover, available forest technical map and MODIS satellite images. The following step has been the analysis of multiple land use scenarios to understand the potential effect of different forest management on water-related ecosystem services. Nevertheless, the SWAT model is hugely time-consuming in modelling several land use scenarios, as each forest management strategy needs to be described with a new set of parameters and model runs. For this reason, a Support Vector Machine (SVM) learning model has been trained to reproduce the hydrological behaviour of the Park using the SWAT model outputs for the baseline scenario as a training dataset. The SVM has been validated with a Jack-Knife cross-validation to test its reliability in determining the average annual water yield, runoff, evapotranspiration and percolation in the river basins using the different forest management types as input. Then, the SVM has been used to model a set of 4200 different land use scenarios to understand the type of forest with the higher water yield content or lower surface runoff. The results show that the oldest forests, especially with a prevalence of oaks, have great potential in regulating services, while the coppices contribute more to the provisioning services.