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Computerization of Hungarian reforestation manual with machine learning methods

Kornél Czimber (1), Borbála Gálos (2), Csaba Mátyás (2), András Bidló (2), and Zoltán Gribovszki (1)

(1) Institute of Geomatics and Civil Engineering, University of West Hungary, Sopron, Hungary, (2) Institute of Environmental and Earth Sciences, University of West Hungary, Sopron, Hungary

Hungarian forests are highly sensitive to the changing climate, especially to the available precipitation amount. Over the past two decades several drought damages were observed for tree species which are in the lower xeric limit of their distribution. From year to year these affected forest stands become more difficult to reforest with the same native species because these are not able to adapt to the increasing probability of droughts.

The climate related parameter set of the Hungarian forest stand database needs updates. Air humidity that was formerly used to define the forest climate zones is not measured anymore and its value based on climate model outputs is highly uncertain.

The aim was to develop a novel computerized and objective method to describe the species-specific climate conditions that is essential for survival, growth and optimal production of the forest ecosystems. The method is expected to project the species spatial distribution until 2100 on the basis of regional climate model simulations.

Until now, Hungarian forest managers have been using a carefully edited spreadsheet for reforestation purposes. Applying binding regulations this spreadsheet prescribes the stand-forming and admixed tree species and their expected growth rate for each forest site types.

We are going to present a new machine learning based method to replace the former spreadsheet. We took into great consideration of various methods, such as maximum likelihood, Bayesian networks, Fuzzy logic. The method calculates distributions, setups classification, which can be validated and modified by experts if necessary. Projected climate change conditions makes necessary to include into this system an additional climate zone that does not exist in our region now, as well as new options for potential tree species. In addition to or instead of the existing ones, the influence of further limiting parameters (climatic extremes, soil water retention) are also investigated. Results will be integrated into the Agroclimate Decision Support System we are developing.

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