

A comparison of five models in predicting surface dead fine fuel moisture content of typical forests in Northeast China

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Abstract: The spread and development of wildfires are deeply affected by the fine fuel moisture content (FFMC), which is a key factor in fire risk assessment. At present, there are many new prediction methods based on machine learning, but few people pay attention to their comparison with traditional models, which leads to some limitations in the application of machine learning in predicting FFMC. Methods: Therefore, we made long-term field observations of surface dead FFMC by half-hour time steps of four typical forests in Northeast China, analyzed the dynamic change in FFMC and its driving factors. Five different prediction models were built, and their performances were compared. Results: By and large, our results showed that the semi-physical models (Nelson method, MAE from 0.566 to 1.332; Simard method, MAE from 0.457 to 1.250) perform best, the machine learning models (Random Forest model, MAE from 1.666 to 1.933; generalized additive model, MAE from 2.534 to 4.485) perform slightly worse, and the Linear regression model (MAE from 2.798 to 5.048) performs worst. Discussion: The Simard method, Nelson method and Random Forest model showed great performance, their MAE and RMSE are almost all less than 2%. In addition, it also suggested that machine learning models can also accurately predict FFMC, and they have great potential because it can introduce new variables and data in future to continuously develop. This study provides a basis for the selection and development of FFMC prediction in the future.

Keywords: fine fuel moisture content, prediction model, temperature, relative humidity, Random Forest, plantations, generalized additive model