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Prediction of Forest Fire Danger Rating using meteorological information observed from the Automatic Mountain Meteorology Observation Stations network

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Approximately five hundred forest fires occur and inflict the losses of both life and property each year in Korea during the forest fire seasons in the spring and autumn. Most of forest fires were occurred by human error in the republic of Korea, though the meteorological factors are major contributors to fire behavior and spread. Therefore, both of meteorological and social factors should be considered in the forest fire danger rating system to improve the prediction capability. In this study, the objective is to develop and improve the Korea Forest Fire Danger Rating System (KFFDRS) to support forest fire prevention strategy by fusing the mountain meteorology records from the Automatic Mountain Meteorology Observation Stations (AMOSs). Korea Forest Service (KFS) is operating the 150 meteorological stations over the mountainous regions, and is observing the weather situation with 1 minute interval. In order to improve the forest fire predictability, the AMOSs should be observed at the most optimal sites. The methodology through spatial analysis and an on-site assessment criteria was developed to select the optimum AMOS site in the national forest. The KFFDRS consists of three indices, that is classified as 10-scale, including the daily weather index (DWI), the fuel model index (FMI), and the topography model index (TMI). DWI representing the meteorological characteristics related to forest fire was developed based on the logistic regression models using meteorological variables such as air temperature, relative and effective humidity, and wind speed produced by Korea Meteorology Administration (KMA). The DWI model for the forest fire occurrence probability was $[1+\exp\{2.706+(0.088\times\mathrm{Tmax})-(0.055\times\mathrm{RH})-(0.023\times\mathrm{EH})-(0.104\times\mathrm{WSmean})\}^{-1}]^{-1}$ and all weather variables significantly ($p<0.01$) affected the probability of forest fire occurrence in the overall regions. The predictive value of the model is 86 percent in 2016. Also we estimated accuracy of forest fire occurrences in case of pre or post-fusion of mountain weather data with 55 random sampling in forest fire event days. The result showed better accuracy when AMOSs records was fused in model. The results indicate that AMOSs can be contributed to the policy makers for the forest fire prevention and management in the Republic of Korea.