FIELD EVALUATION OF THE NELSON DEAD FUEL MOISTURE MODEL AND COMPARISONS WITH NATIONAL FIRE DANGER RATING SYSTEM (NFDRS) PREDICTIONS

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ABSTRACT

The role of dead fuel moisture in prescribed fire and wildfire is especially critical, since dead fuels are typically involved in the start of a wildland fire and are the fuels which carry the fire. In the National Fire Danger Rating System (NFDRS), dead fuels are separated into four time-lag classes: 1-hour, 10-hour, 100-hour, and 1000-hour. Originally developed in the 1970s, these algorithms use once-a-day weather information and are designed to estimate dead fuel moisture for midafternoon conditions. During the 1990s Ralph Nelson of the USDA Forest Service developed a theoretical model for dead fuel moisture to take advantage of frequent weather observations from automated weather monitoring stations. The model accounts for the physics of moisture and heat transfer and includes processes of rainfall and dewfall. The model as originally published was only for 10-hour dead fuels. Since 2000, however, Nelson developed fuel stick parameters to allow the model to be run for the three other size fuel classes using hourly weather data. Inputs to the "Nelson model" are air temperature, relative humidity, solar radiation, and rainfall. This presentation will compare the performance of the Nelson model for all four dead fuel classes against measured dead fuel moisture over a 21-month period at Slapout, Oklahoma, in the Oklahoma panhandle. Twice-daily weighings of ponderosa pine fuel sticks representing all four fuel classes were made during this period, from which fuel moisture was later calculated. Comparisons will also be made to dead fuel moisture calculations from the older NFDRS algorithms. During this 21-month period, the Nelson model showed improvement over NFDRS for each size fuel class, and r^2 values against the measured data ranged from 0.51 (1000-hour fuels) to 0.79 (10-hour fuels). A calibrated version of the Nelson model is currently being used operationally in the Oklahoma Fire Danger Model on the OK-FIRE Web site (http://okfire.mesonet.org). Oklahoma Mesonet data are used to calculate current dead fuel moisture for all four dead fuel classes, while 84-hour forecast output from the NAM model is used to calculate future values. These dead fuel moisture products have relevance to both prescribed fire and wildfire.

Keywords: dead fuels, dead fuel moisture, modeling, Nelson model, NFDRS, prescribed fire, wildfire.

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