Recent Chaparral Fuel Modeling Efforts

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A Chaparral Fuel Modeling Workshop was held at the Forest Fire Laboratory, Riverside, CA on March 1-12, 1997. This workshop was a follow-up to the workshop held last April in Missoula, MT. Both workshops were conducted under the auspices of the Fire Modeling Institute (FMI). Dr. Jim Brown (Forest Service Research, ret.) proposed the FMI idea as a mechanism to bring fire modeling researchers together with fire management personnel to work together to solve current problems using current fire-related models. For further information about FMI, contact Wayne Cook, F&AM National Technology Transfer Specialist, Intermountain Fire Sciences Laboratory, Missoula, MT.

The Chaparral Fuel Modeling Workshop was designed to 1) reacquaint fire and fuels specialists in southern California with fuel modeling concepts as described in Burgan (1987) and with the TSTMDL program developed by Burgan and Rothermel (1984) and 2) to develop custom fuel models to describe chaparral fuels that produce expected fire behavior. The workshop was led by David Weise and Jon Regelbrugge of the Riverside Fire Lab and Jack Cohen of the Intermountain Fire Sciences Lab. Fire and fuels specialists from the Angeles, Cleveland, Los Padres, and San Bernardino National Forests, California Department of Forestry and Fire Protection, and Los Angeles County Fire Department participated in the session. The workshop consisted of an introduction to the Rothermel fire spread model, development and fine tuning of custom fuel models, and a "live fire" exercise in which a large fuel bed of chamise was burned in the Riverside Fire Laboratory's new Burn Building. The exercise required the participants to estimate fuel bed characteristics such as fuel depth and percentage of dead material as well as estimating rate of spread and flame length.

Preliminary custom models were developed for 4 chaparral fuel types: manzanita/scrub oak, north slope ceanothus, chamise-dominated, and sagebrush/buckwheat (coastal sage scrub). Two chamise-dominated fuel models were developed (Table 1). These fuel models were developed using fuels information collected from a variety of studies (Conard and Regelbrugge, 1994), expert judgment provided by workshop participants, and adjustment of fuel model parameters to produce fire behavior predictions that seemed realistic to the workshop participants. These models need to be tested by comparing observed fire behavior to predicted fire behavior under a range of environmental conditions. The testing can be used to further refine the fuel models if needed. Remember that these models and others are only intended to provide objective predictions that can be used as an aid in the decision making process.

It was the general consensus of the workshop participants that FBPS fuel model (Albini 1976) generally overpredicts rate of spread in chaparral. Rate of spread predictions produced by the new custom models are compared with standard fuel models 4, 5, and 7 for two sets of environmental conditions (Table 2) These sets may represent prescribed burning (or moderate fuel moisture) and wildfire (or low fuel moisture) conditions. The high rates of spread and long flame lengths produced by FBPS model 4 relative to the other fuel models are evident (Figure 1). This is due in part to the large loading of dead 1 hr fuels in FBPS model 4; this loading is higher than any observed so far in our chaparral fuel inventory work. The custom chaparral models produced significantly lower spread rates than FBPS model 4. At moderate fuel moisture conditions, FBPS model 5 produced similar spread rates, but lower flame lengths than the chaparral models. At the low fuel moisture conditions, the chaparral models typically produced lower spread rates than either FBPS 4, 5, or 7.

The efforts expended by the Chaparral Fuel Modeling Workshop participants at Riverside and Missoula appear to have yielded a working set of fuel models for chaparral fire and fuel managers to use. These models must be field tested before they can be used with some confidence. A computer file containing the information in Table 1 can be downloaded from the Riverside Fire Lab home page at *http://www.rfl.pswfs.gov*. The custom fuel models can be used with BEHAVE and FARSITE™. The TSTMDL program assigns wind reduction factors to each custom model. The wind reduction factor is used when adjusting wind velocity at 20 feet above the vegetation to a midflame wind speed. We recommend Rothermel (1983) to determine appropriate wind reduction factors. The wind reduction factors in the downloadable file have been modified to conform with Rothermel (1983). Observations and comments about the fuel models can be sent to *dweise/psw_rfl@fs.fed.us*, *j.regelbrugge:s27L05a* or *d.weise:s27L05a*. Any feedback will be shared with the workshop participants and posted on the home page if of general interest.

Literature Cited

Albini, F.A. 1976. Estimating wildfire behavior and effects. USDA Forest Service Gen. Tech. Rep. INT-30. Intermountain Forest and Range Experiment Station, Ogden, UT. 92 p.

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Table 1. Summary of preliminary custom chaparral and FBPS fuel model parameters.

Model Number	Model Name	Fuel loadings by size class (tons/acre)					Depth	Heat content	Extinction moisture	Surface area to volume ratios (σ, 1/ft)		
		Dead 1 hr	Dead 10 hr	Dead 100 hr	Live herb	Live woody				Dead 1 hr	Live herb	Live woody
14	Manzanita	3.00	4.50	1.05	1.45	5.00	3.00	9,211	15	350	1,500	250
15	Chamise 1	2.00	3.00	1.00	0.50	2.00	3.00	10,000	13	640	2,200	640
16	Ceanothus	2.25	4.80	1.80	3.00	2.80	6.00	8,000	15	500	1,500	500
17	Chamise 2	1.30	1.00	1.00	2.00	2.00	4.00	8,000	20	640	2,200	640
18	Sagebrush/ Buckwheat	5.50	0.80	0.10	0.75	2.50	3.00	9,200	25	640	1,500	640
FBPS 4	Chaparral (6 ft)	5.01	4.01	2.01	0.00	5.00	6.00	8,000	20	2,000	190	1,500
FBPS 5	Brush (2 ft)	1.00	0.50	0.00	0.00	2.00	2.00	8,000	20	2,000	190	1,500
FBPS 7	Southern rough	1.13	1.87	1.50	0.00	0.37	2.50	8,000	40	1,750	190	1,550

Table 2. Environmental conditions used to make fire behavior predictions using TSTMDL program for custom chaparral and FBPS fuel models.

Environmental variable	Low (Wildfire)	Moderate (Rx fire)
Dead 1 hr moisture content (%)	2	8
Dead 10 hr moisture content (%)	4	9
Dead 100 hr moisture content (%)	5	11
Live herbaceous moisture content (%)	90	150
Live woody moisture content (%)	70	110
Slope (%)	50	50
Midflame wind speed (mph)	10	10

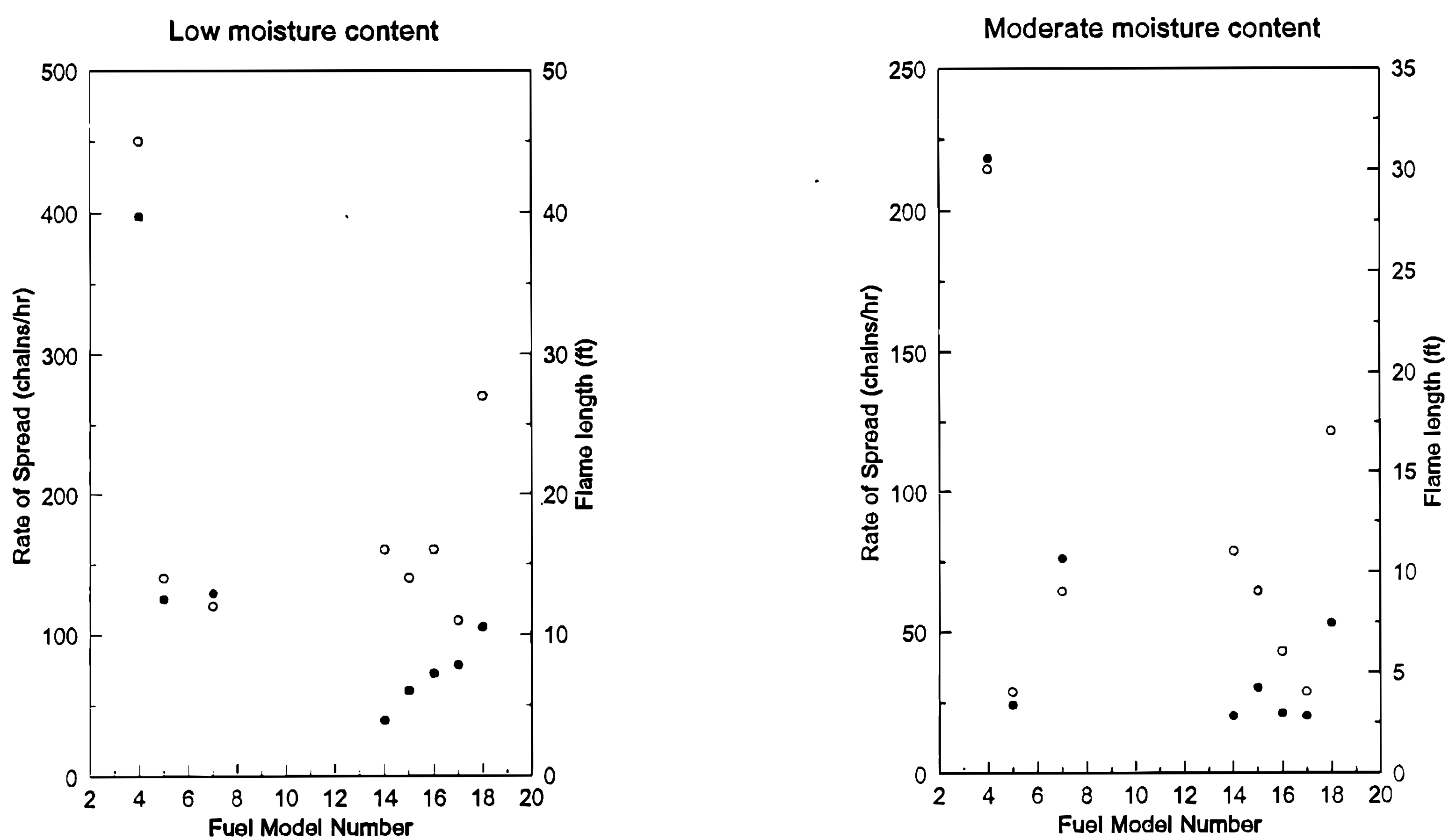

Figure 1. Rate of spread and flame length predictions from TSTMDL for custom chaparral and FBPS fuel models for low and moderate fuel moisture conditions. Solid circles are rate of spread predictions, empty circles are flame length predictions.