Use of the BehavePlus Fire Modeling System for Prescribed Fire Planning

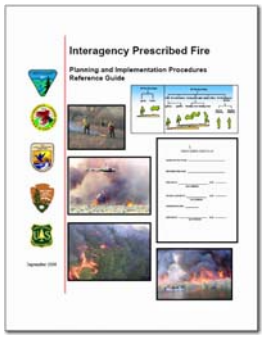
Patricia L. Andrews[1] and Tobin M. Kelley[2]

[1]US Forest Service, Rocky Mountain Research Station, Fire Sciences Laboratory, Missoula MT

[2]US Forest Service, Stevensville Ranger District, Stevensville MT

Modeling for Prescription Development

"**Prescription** is defined as the measurable criteria that define a range of conditions during which a prescribed fire may be ignited and held as a prescribed fire."



"Parameters are quantitative variables expressed as a range that result in acceptable fire behavior and smoke management."

"Holding and contingency plans must be developed with the consideration of the predicted fire behavior outside of the project boundary."

"Fire behavior characteristics for fuel models within the maximum spotting distance and/or adjacent to project boundaries must be considered and modeled using worst-case fire behavior predictions."

Most of the models in BehavePlus can be used for prescribed fire planning.

The user is responsible for understanding fire model assumptions and limitations for proper application.

Site Description variables

For inside and outside the unit

- Slope
- Surface fuel model
  - 13 + 40 standard fuel models
  - Custom fuel models
  - Palmetto-Gallberry special case fuel model
- Overstory (depending on what is being calculated)
  - Canopy cover
  - Canopy height
  - Tree height
  - Crown ratio
  - Canopy bulk density
  - Tree species
  - DBH
  - Bark thickness

Environmental description variables

Used to define the prescription

- Wind
  - Midflame, 20-ft, wind adjustment factor
- Fuel moisture
  - Dead, 1-h, 10-h, 100-h, and characteristic dead mois
  - 1000-h not used in any current B+ calculations
  - Live fuel, herbaceous and woody, curing level
  - Conifer foliage

from Wade and Lunsford (1989)

Containment variables

Used for contingency planning

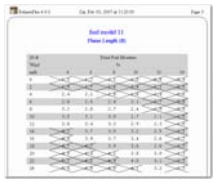
- Elapsed time
  - From beginning of steady-state spread to attack
  - Resource arrival time
  - Resource duration
- Suppression tactic, head or rear
- Line construction offset
- Resource line production rate
  - Single resource.
    Can look at a range of line construction rates
  - Multiple resources.
    With different line production rates, arrival times, and durations.

Tobin Kelley, USFS

The Basics – A simple example

Prescription, within the planned burn area
Desired flame length = 2 to 4 ft
Find associated moisture and wind speed

Eric Siemer, Klamath NF (2004)



Spotting distance from a torching tree in the unit based on high-end wind speeds

Mick Harrington, USFS

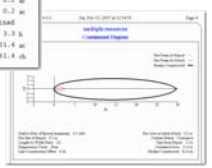
Probability of Ignition for a spot outside the unit

Fred Way, USFS

Line production rate needed to contain a spot fire

Containment of an escape given specific suppression resources

Colin Hardy, USFS



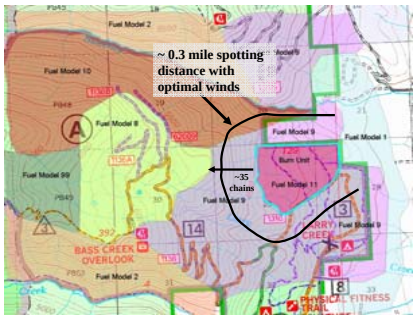
Suggestions and Comments are welcome

tkelley@fs.fed.us pandrews@fs.fed.us

Application Considerations

Contingency planning--

- How are fuel models actually arranged on your landscape?
- What is your projection area/period?
- When conditions change, what happens to fire behavior?

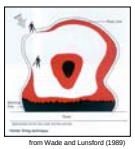


- Use modeling results to spur line officer involvement and to develop critical thinking
- Line officer tolerance for size of escape and costs.
  - Less line production = longer time period to contain, but need to examine where it is going (i.e. a slower fuel model and/or moderating conditions)
  - Minimizing escape size may require more holding resources on site

The Prescribed Fire Guide recognizes the limitations of models and allows the prescribed fire planner to use experience.

"Empirical evidence (historical evidence or researched data) and judgment may be utilized to identify or calibrate prescriptions. Weaknesses in modeling can be overridden, but must be justified with empirical evidence and/or verified actual fire behavior."

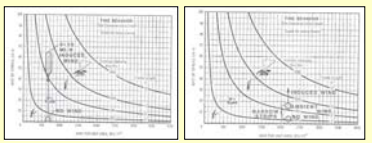
Fire behavior can be controlled by the pattern of ignition



from Wade and Lunsford (1989)

Bill Simpson, Florida DACS

from Wade and Lunsford (1989)



from Rothermel (1984) 'Fire Behavior Consideration of Aerial Ignition'

A fire characteristics chart tool is being developed to assist with this visual display of model results compared to fire behavior controlled by pattern of ignition

20 March 2007