BehavePlus fire modeling system

Patricia L. Andrews[1], Collin D. Bevins[2], and Robert C. Seli[1]

[1]US Forest Service, Rocky Mountain Research Station, Fire Sciences Laboratory, Missoula MT
[2]Systems for Environmental Management, Missoula MT

## Fire Behavior Systems— Where does BehavePlus fit in

The following fire behavior systems are complementary and are based on essentially the same mathematical fire models.

A person should use BehavePlus to understand basic fire modeling concepts before moving to application of the spatial systems.

Sometimes BehavePlus is the appropriate tool for an application. Use of the spatial systems may be 'overkill'.

BehavePlus fire modeling system

•Calculations are for a set of uniform conditions… A 'point' system
•Rarely is a single calculation done
•The user looks at the effect of a range of values on the results
•Input is entered by the user. There are no data files or GIS layers.
•Results are in the form of tables, graphs, and simple diagrams

BehavePlus table of ROS, FL, area, perimeter for 4 fuel models
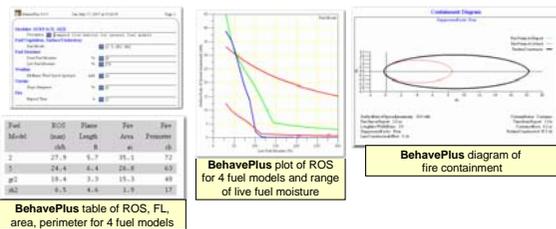
BehavePlus plot of ROS for 4 fuel models and range of live fuel moisture

BehavePlus diagram of fire containment

FlamMap fire mapping and analysis system

•Adds the spatial component
•Point calculations are done for each pixel
•Conditions are constant in time but vary in space
•Minimum travel time and other options are also available in FlamMap
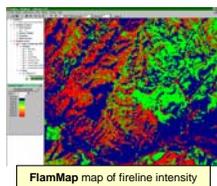
*FlamMap* map of fireline intensity

FARSITE fire area simulator

•Conditions vary in both space and time
•Fire growth simulation
•The fire behavior in a pixel depends on the adjoining pixels and the time it burned

FARSITE map of fire perimeters over fuel model

FSPro fire spread probability

•Probability of fire spread from a known perimeter or point
•Not a fire perimeter
•Not a projection of fire size
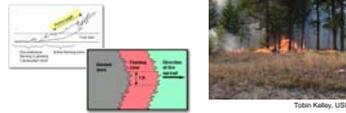•Based on thousands of *FARSITE* simulations for simulated weather sequences

Brins Fire, Coconino NF, June 2006
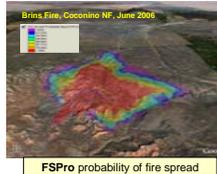
FSPro probability of fire spread

FlamMap, FARSITE, and FSPro use the same GIS data layers

BehavePlus fire modeling capabilities

SURFACE surface fire
•Rate of spread
•Flame length
•13+40 std fuel models
•Wind adjustment factor
•etc.

Tobin Kelley, USFS

CROWN crown fire
•Transition from surface to crown
•Rate of spread
•Fire type—surface, torching, conditional crown, crowning

Colin Hardy, USFS   Tobin Kelley, USFS

SAFETY safety zone size
•Area, perimeter, separation distance
•Based on flame length

Bret Butler, USFS

SIZE point source fire
•Area
•Perimeter
•Shape

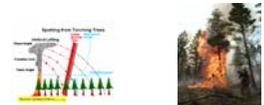From Wade and Lunsford (1989)   Eli Lehman, USFS

CONTAIN fire containment
•Containment success given line construction rate, resource duration, etc.
•Final size, fireline constructed

SPOT spotting distance
•Maximum spotting distance from Torching trees Burning piles Wind-driven surface fire

Tobin Kelley, USFS

SCORCH crown scorch
•Scorch height from surface fire flame length

Tobin Kelley, USFS   Mick Harrington, USFS

MORTALITY tree mortality
•Probability of mortality from bark thickness and crown scorch

Mick Harrington, USFS

IGNITE probability of ignition
•from firebrand
•from lightning

Mark Moak, Rocky Mountain College (2005)

Mick Harrington, USFS

Suggestions and Comments are welcome
pandrews@fs.fed.us

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Application of BehavePlus

BehavePlus can be used for any application that involves modeling fire behavior and effects. Following are examples:
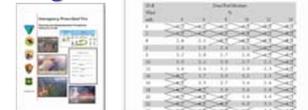
Predicting the behavior of an ongoing fire

The original application as described by Rothermel (1983)

Colin Hardy, USFS

Prescribed fire planning

Prescription development
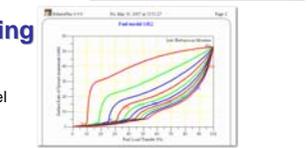Contingency planning
Table shading for acceptable fire conditions

Fuel hazard assessment

Effect of a change in surface and crown fuel on calculated fire behavior under various fuel moisture and wind conditions

Model understanding

Influence of input values on calculations
e.g. effect of curing and live fuel moisture on rate of spread

Training and Documentation

Ongoing JFSP project to develop training material
•Online overview presentation
•Workshop material for handoff
•Lessons for self-study or classroom

Users Guide – covers only program operation

In-program help windows
•Variable descriptions and guides

Fire modeling papers in preparation

Development is Continuing

Version 4.0, 2008
•Option to not impose wind limit
•Option to enter curing and LFM
•Intermediate output variables
•Changes to allowed value limits
•and more

B++
•Redesign in conjunction with FireFamily Plus and other fire behavior and fire danger systems to improve integration and to use a common user interface

For more information go to **FireModels.org**