## Understanding How Fuels Treatments
## Are Used in FPA  FL_026_WP

# Topic

Fire Planning Units (FPUs) plan and carry out fuels treatments as a way to manage hazardous fuels and influence fire behavior. This paper describes how the Fire Program Analysis (FPA) system enables fire planners to model the impact of fuels treatments (fuels options) to evaluate different fuels treatments' cost and effectiveness.

# Terms

**Fuel Prescriptions** – Descriptions of typical fuels treatments applied within the FPU. These prescriptions "train" the large fire module on how treatments change the behavior of large fire on the landscape.

**Fuels Treatments** – Manipulation or removal of hazardous fuels to:

- Reduce the risk of an ignition becoming a large fire and/or

- Reduce potential from damage and resistance to control (e.g., lopping, chipping, crushing, thinning, piling, and burning, etc.)

# Introduction

FPA models the effect of fuels treatments using two modules in the system:

- Initial Response Simulator (IRS) – Models the effect of treatments on initial response success.

- Large Fire Module (LFM) – Models the effect of treatments on the behavior and size of large fire.

These FPA modules need the FPU planner to provide two types of information about their fuels treatments before the system can model the effect of defined treatments on fire behavior:

1. Fuels prescriptions that describe the three or four most common fuels treatments used in the FPU. FPA uses these prescriptions in Stage 1 of the LFM to "train" the module to model the effect of treatments on fire behavior and predict fire size on the landscape.

2. Fuels options describe how an FPU's Fuels Program would modify on-the-ground fuels conditions in specific Fire Workload Areas (FWA) at different levels of investments in the FPU fuels program. IRS and Stage 2 of the LFM use these treatments.

This paper focuses on the second of the two FPU-provided fuels inputs. Other white papers describing how the FPA LFM uses fuels prescriptions are available from the See Also section of this paper.

# Background

FPU fire planners develop fuels options used by the Initial Response Simulator (IRS) and by the Large Fire Module (LFM) in FPA. Planners describe what fuels models and canopy characteristics currently exist (as identified in LANDFIRE) on the landscape, and what fuels models and canopy characteristics result post treatment. The FPU planner designs fuels options based on each planning year's interagency guidance. This guidance specifies the level of increase or decrease in funding for the FPU's Fuels Program.

# Discussion

## *How IRS Uses Fuels Treatment Information*

Using the IRS module results, FPU fire planners can analyze how fire behavior would change based on different investments in fuels treatments. As part of the modeling process, the FPA system changes the fuels model for the proportion of the FWA affected by the treatment, and then models fire behavior based on the new fuels model and canopy characteristics. IRS modeling outputs include the number of acres burned for modeled fires that are contained, and number of fires that exceed the simulation limits. The fire planner set simulation limits for each FWA by the fire size or time limit since the ignition was discovered. The number of acres burned and fires that exceed IRS simulation limits (ESL) will change based on the type of fuels treatments and the number of acres treated in each fuels option. These two measures, acres burned and number of ESLs enables the FPU planner to evaluate the modeled effectiveness of planned fuels treatment investments.

FPU planners have the most flexibility in representing fuels treatments by describing the treatments' "from" and "to" states using the 40 Scott and Burgan[1] fuels models instead of the more general 13 Anderson fuels models. The 40-fuels model is especially useful to planners as they describe the effect of changes in fire behavior resulting from maintenance treatments.

## *How the Large Fire Module (LFM) Uses Fuels Treatment Information*

The LFM runs as two stages. The FPA analysis team conducts the first stage before the planning season by statistically capturing the effect of fuels, weather, topography, and fuels treatments on fire behavior. This first stage "trains" the LFM in how fire behaves on the FPU's landscape.

FPU planners complete the second stage using the statistical representation of these relationships to evaluate different fuels treatment options' effect on fire behavior. It is important for a planner to keep in mind that the LFM responds to fuels treatment options in Stage 2 based on the fuels

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[1] http://www.firemodels.org/downloads/behaveplus/publications/Scott_and_Burgan_RMRS-GTR-153_2005.pdf

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prescriptions they provided to FPA to "train" the LFM in Stage 1. The second stage of the LFM enables the planner to model how different investments in fuels treatments (fuels options) will affect the final size and burn intensities of large fires.

Fuels treatments and their impact on rate of spread are the primary inputs that directly affect fire behavior in FPA's Large Fire Module. The fires modeled in LFM are those ignitions that exceeded the simulation limits used in IRS. IRS then passes the ESL fires to the LFM, so it can model how the fires will grow.

For more information on how the LFM is used, refer to the See Also section at the end of this paper.

### *How FPA Performance Measures are Affected by Fuels Treatments*

Fuels options created by the FPU planners affect all five FPA performance measures. Effective treatments along with an effective initial response organization will result in IRS modeling a larger number of fire ignitions as "contained." The number of modeled contained fires is the sole factor for calculating FPA Performance Measure # 5. See Understanding FPA and the Performance Metrics used in Analyzing Investment Alternatives_PM_021_WP for more information about FPA Performance Metrics.

Fuels treatments have a direct influence on the growth and intensity of fires modeled in the IRS and LFM, and consequently affectaffects the other four FPA performance measures. These measures compare how effective each investment alternative is in reducing the probability of:

- Large fires,

- Costly fires in the Wildland Urban Interface,

- Fires occurring outside an FPU's fire management objectives, and

- Fires that adversely affect highly valued resources.

For more information about performance measures and how they are calculated, see the references at the end of this paper.

## Future Direction

Fuels changes due to wildfires and other disturbances on the landscape are represented in each update of the LANDFIRE fuels data. FPA plans to use the most current version of LANDFIRE data available for each FPU. Refer to the LANDFIRE (http://www.landfire.gov) web site for schedule and details.

Before each FPA planning season, FPUs will have the opportunity to update the prescriptions they submitted for use in Stage I of the LFM if their fuels management strategies or fuels

landscape have changed substantially from the previous year. The new prescriptions will be used to "re-train" the LFM to recognize the impact of fuels treatments on fire behavior.

## See Also

- Option and Investment Alternative Development in FPA  AL_022_WP

- Understanding the Fire Program Analysis (FPA) Large Fire Module  LF_012_WP

- Building a Fuels Treatment Prescription for FPA Large Fire Module Simulation FL_002_TP

- Understanding How the Large Fire Module (LFM) Processes Fuels Treatment Prescriptions FLS_011_WP

- Understanding FPA and the Performance Metrics used in Analyzing Investment Alternatives PM_021_WP