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CPS-RX 2004

By: Doug Campbell

11 Years and 86 Rx Fires Later

Introduction

Many veteran fire technicians rely heavily upon "intuition" to accomplish prescription-burning operations. However, the intuition of experienced personnel is not a good teaching mechanism. In order to progress we need to discover and describe the knowledge contained in the intuition of the experienced fire officer. We can't teach others what the outcome of putting a torch to the land will be, without being more specific about the cause and effects of the variations in fire behavior. During the period from 1993 through 2003, Ventura County Fire's Wildland Fire Battalion conducted eighty-six prescribed burns. The author was assigned the Fire Behavior Analyst position for that period. We determined that there was a need to improve our procedures in the prescribed burning program. We identified five primary improvements that needed development.

A. How the perimeter could be located to reduce the risk of an escape.
B. How should the test fire be done and evaluated.
C. How to better understand the escape potential.
D. How the escape analysis document should be written to support the mitigation measures and define the area most likely for an escape.
E. How to determine the timing and sequence of firing.

In' tu i tion
1a. revelation by insight or innate

Improving our ability to identify the causes of fire behavior variables can add assurance that what is *planned* will be *accomplished.*

Questions to find solutions for:

A. How can the perimeter be located to reduce the risk of escape?
B. How will the escape analysis be displayed?
C. How will the escape analysis document support the mitigation measures and define the area most likely for an escape?
D. How will the test fire be evaluated?
E. How will the timing and sequence of firing be determined?
F. How will the knowledge gained be retained?

The findings and recommendations based on eleven-years experience and eighty-six prescribed burns in Ventura County.

The principle of perimeter location:

Locate the perimeter so that any escape goes out of alignment and becomes easier to control. Where the exposure is in alignment mitigation measures should be taken to offset the threat of an escape.

How to display the escape potential:

We have found that GIS technology is an important asset for displaying the locations of high escape potential. Placing the perimeter of the planned burn on either a contour map or a shaded terrain map constitutes the base map. Display the wind direction limits on the map using arrows. Locate the places where slope and wind align on exposure areas along the perimeter. These areas denote *in alignment exposures.* This is the trigger point where an escape is most likely. From that point place an arrow on the *in alignment area*, the tip of the arrow located where the alignment changes and the fire will go out of alignment. The fire will take this track. The display will give an idea of how much acreage an escape will consume. This also becomes a basis for mitigation measures and a contingency plan.

Writing an escape analysis:

A boilerplate document is written and included in the I.A.P. for the burn. Each time the burn is attempted the escape analysis is revised to fit the season and changing conditions.

How to evaluate the test fire:

The test burn is the ground truth. The fire signatures that the test burn creates are the intensity values that will be created during the burn in like alignments.

The air temperature, humidity and fuel moistures are important values however these do not relate to the variation in fire intensity. Fuel temperature variations between sunlit and shaded fuels are more important a relationship in that this does reveal the variation in fuel flammability that is useful in planning the timing and sequence.

Record the weather and fuel temperatures on the test burn form. We found that the fuel temperature should be 40 degrees f. above air temperature to insure time and aspects would have the desired effect. The hot aspects dry fuel quickly and the cool or shaded aspects retain fuel moisture.

The test fire should be lit on a hot aspect and allowed to burn until it establishes independent head, flanks and heel signatures. The FBA or Operations Section Chief should have pre-determined the required flame length and consumption for all three fire signatures and noted them on the test burn form.

The consumption objectives in the burn plan should be used to determine the test burn performance. If the burn fails to meet the objectives, the test burn indicates a no-go for the burn. If the test burn meets the objectives in the test burn form, the burn is a go. This is the last item on the go, no-go checklist.

We recorded the test fire and burn on video or by digital photographs and made an Rx burn log for each project.

<u>How to determine and display the timing and sequence of firing.</u>

The timing and sequence for firing the interior of the burn area should consider the following:

1. Determine the pyrotechnics to be used.
2. Time the beginning and end of firing sequence in relation to the fuel flammability curve and the alignment of slope and wind vectors.
3. The smoke shading the fuel in the path of the fire will reduce the intensity and fuel consumption.
4. Determine the fire signature desired to accomplish the

consumption and holding objectives.

The test fire will indicate which fire signature will accomplish the objectives in consumption of live and dead fuel.
The heel, *the out of alignment signature,* will be the least intense fire and will not accomplish much for burning the interior. This signature is desirable to create near any escape trigger point to reduce the intensity near those points on the perimeter.

Limiting the burn pattern to flanking signatures will provide wider firebreaks but flanking fire moves slow, takes more time and consumes less fuel.

For large areas we found it required that the ignition be placed in alignment with wind, slope and on solar preheated aspects. The elements in the prescription window can be lower than for any other alignment thus reducing the escape potential in areas that would be more *out of alignment*.
The greatest fire intensity potential, during low values in the Rx window, can be achieved by firing in alignment with the slope, wind and in solar preheated fuels.

Firing from the bottom of a slope has more potential for escape to the opposing aspect and requires more mitigation measures than ridge tops. We found that firing a short distance up the slope and placing ignition points well apart worked well. This lowered the intensity near the exposure. When more intensity was desired near the points of ignition they were placed closer together or in a line above the holding line.

The *line of fire intensity* can be increased by adding more depth to the fire. The more area on fire the more intensity is

created using the preheating factor of the fire.
The flame length from line of fire signature of the test fire may be 20- feet and can be increased to 50-feet in brush fuel type using ***area on fire.***

The firing timing and sequence plan can be shown in simple form on the escape analysis map. Refining the plan can be done at the daily briefing.

Training has been required for the burn bosses. This training covers the alignment of forces concept and the signature prediction methods. The training objective is to assure that the burn boss understands how to obtain the desired flame length and consumption through observation and prediction methods.

Retaining the lessons learned:
Beginning with the Broom Ranch burn of 1993 the Wildland Fire Battalion began video taping all test fires and prescribed burns. As time and technologies improved, digital photographs and Power Point, slide shows replaced the video records.
These records of the prescribed burning program have been retained and are a data source for future decision-making relating to the prescribed burning program.

Contact: Doug Campbell at: doug@dougsfire.com or by phone @ 805-646-7026