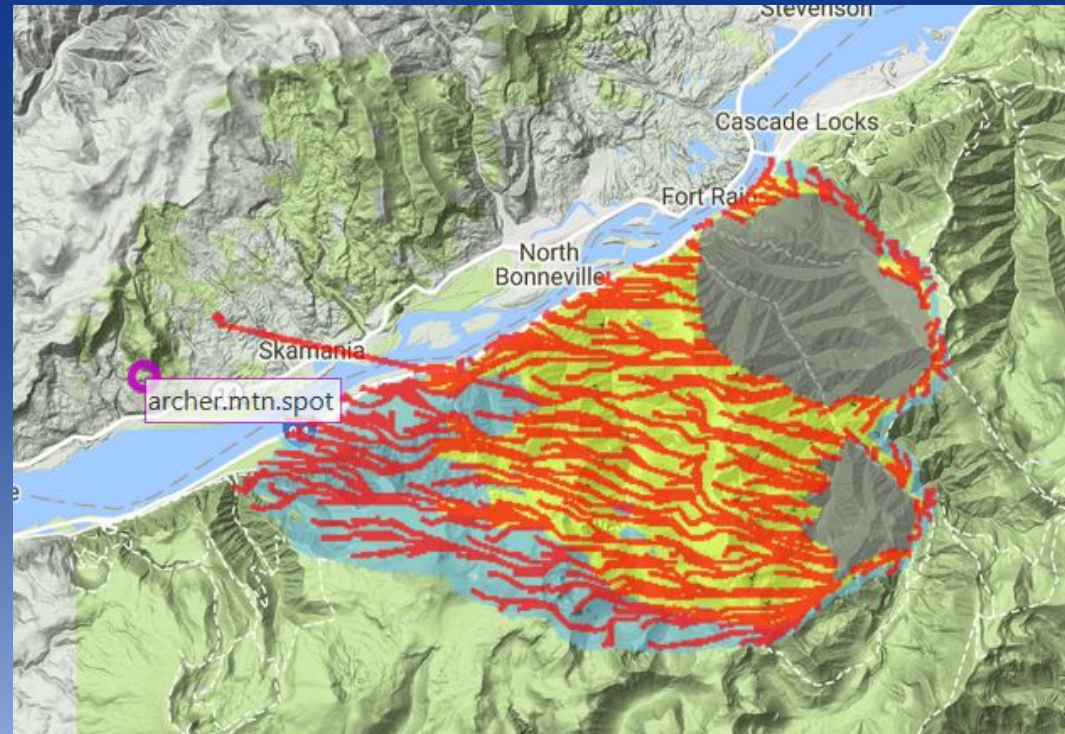
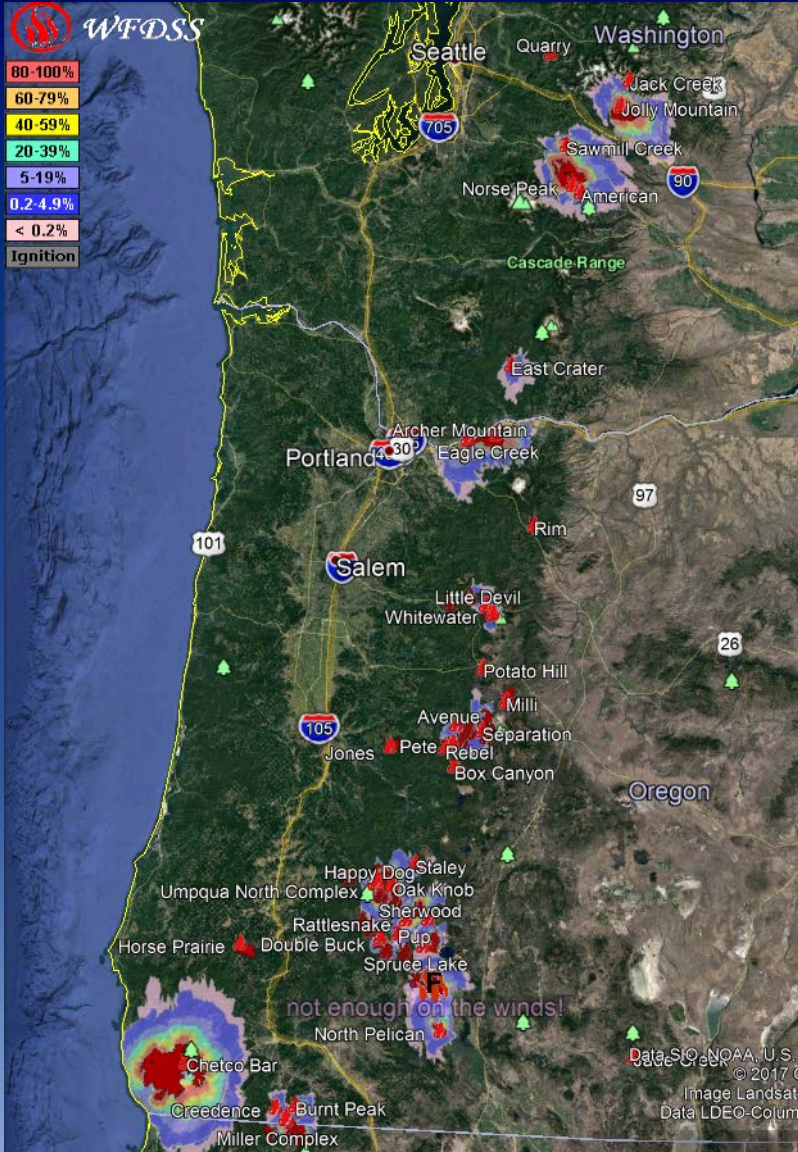


# The Use of Spatial Fire Modeling by Line and Fire Managers in Support of Fire Response

Rick Stratton | rdstratton@fs.fed.us





- Packers Cabin FLA (Chetco Bar Fire)
- Discussions about Diamond Creek & Jolly Mtn. (OWF)
- A hope to focus more on fire managers and line officers in the coming years (e.g., [M-581](#))
- The fires of tomorrow we are experiencing today; we must get better at infusing our fire management practices with fire analytics and new technology to help us make better risk-informed decisions.

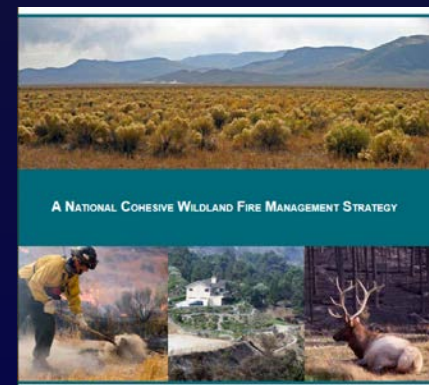
# Why use science and modeling in fire management?

- Forces you to zoom out; see large fires at the appropriate scale—a landscape phenomena
- Obtaining scope and visualizing the impact
- Perform multiple scenarios to game the landscape
- Validate our inherent suppositions
- Helps us answer and form new questions
- Common communication medium for discussions
- Helps document your decision and thinking
- Per policy and direction

# It is in our policy and consistently in leaders intent

“Sound risk management is a foundation for all fire management activities\*”

- 1995 FWFM & Program Review\*
- 2009 Wildland Fire Policy
- National Cohesive Strategy
- U.S Forest Service FSM 5100
- BLM Manual Section 9211
- 2017 Direction to Wildland Fire Leadership from Secretary of Agriculture & Interior to the 5 Federal Agencies:



We will also continue to integrate science and technology into all of our firefighting and to capitalize on other advancements to better inform and support our firefighting capabilities.

- USDA Strategic Goal #5 (2018-2022): “Strengthen the stewardship of private lands through technology and research.”
- Chief Tooke Oath of Office Address: “All of our actions will continue to be anchored in science and be based on good data...”

# FIRE EFFECTS TRADEOFF MODEL (FETM)

## LANDFIRE



### Wildland Fire Decision Support System

### SIMulating Patterns and Processes at Landscape scales

## FOFEM

## FARSITE

Fire Area Simulator



## FlamMap 5.0

## Wind Wizard

## FCCS

## WindNinja

## FUEL CALC

## Consume 3.0

## Fire Sciences Lab

## ArcFuels10 System Overview

Nicole M. Vaillant, Alan A. Ager, and John Anderson

WindWizard 1.0.0.3.0.4 SP-2007-06-06-17  
Copyright 2003-2007 Fluent Inc. All Rights Reserved.

## BehavePlus

fire modeling system

## InformS

## FMAPlus<sup>®</sup> Version 3

### Fuels Management Analyst



## NEXUS

## FireFamilyPlus 4.1



## FIRE TOOLS

## V-D-D-T

### Vegetation Dynamic Development Tool

## Fire Regime Condition Class



## TELSA

Tool for Exploratory Landscape Scenario

## LANDSCAPE TREATMENT DESIGNER

## Interagency Fuels Treatment Decision Support System

Version 2.0 Beta

## DIGITALFUSEE

- "Preparing for what might be"

It is not your job to know all of these models, but...

- Ask the right questions...of the products and the analysts.

# Questions to ask the about the **product**...

- What is the start and end date of the run?
- How much confidence do you have in the output?
- Was the run calibrated to recent fire spread?
- Is there fire movement we have not observed, but is possible?

# Questions to ask the **analyst**...

- How long have you been on the fire?
- Where are you from?
- How much experience do you have?
- Have you been in the field and/or who are your eyes on the ground?
- Have you spoken to he or she at the district?



# It is not your job to know all of these models, but...

- Ask the right questions...
- Know the difference between **spatial** (FSPro) and **non-spatial** models (Behave Plus)

# It is not your job to know all of these models, but...

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- Know the difference between spatial (FSPro) and non-spatial models (Behave Plus)
- Get to know the names and uses of the fire models in **WFDSS**.

## 4 primary fire modeling products in WFDSS:

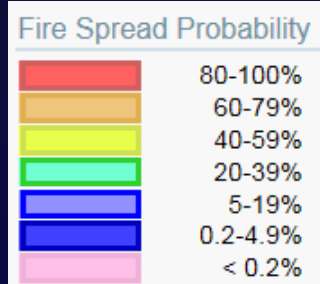
- **BASIC**: Think of it as a spatial Behave; all pixels burn—like FlamMap—yields a ROS, FL, FLI, etc.
- **STFB**: Ideal for modeling frontal passages, and stable weather and winds—gridded wind option; flow paths an output; 1 to 3 days
- **NTFB**: This is FARSITE in WFDSS; ideal for variable weather; 4 to 7 days
- **FSPro**: What is the probability of the fire being at a given location? A probability surface from **thousands** of weather and wind combinations that use historical and forecasted data; 7 days sweet spot, 10 to 14 ok, 21 pushing it; 30+ days a Hail Mary

# It is not your job to know all of these models, but...

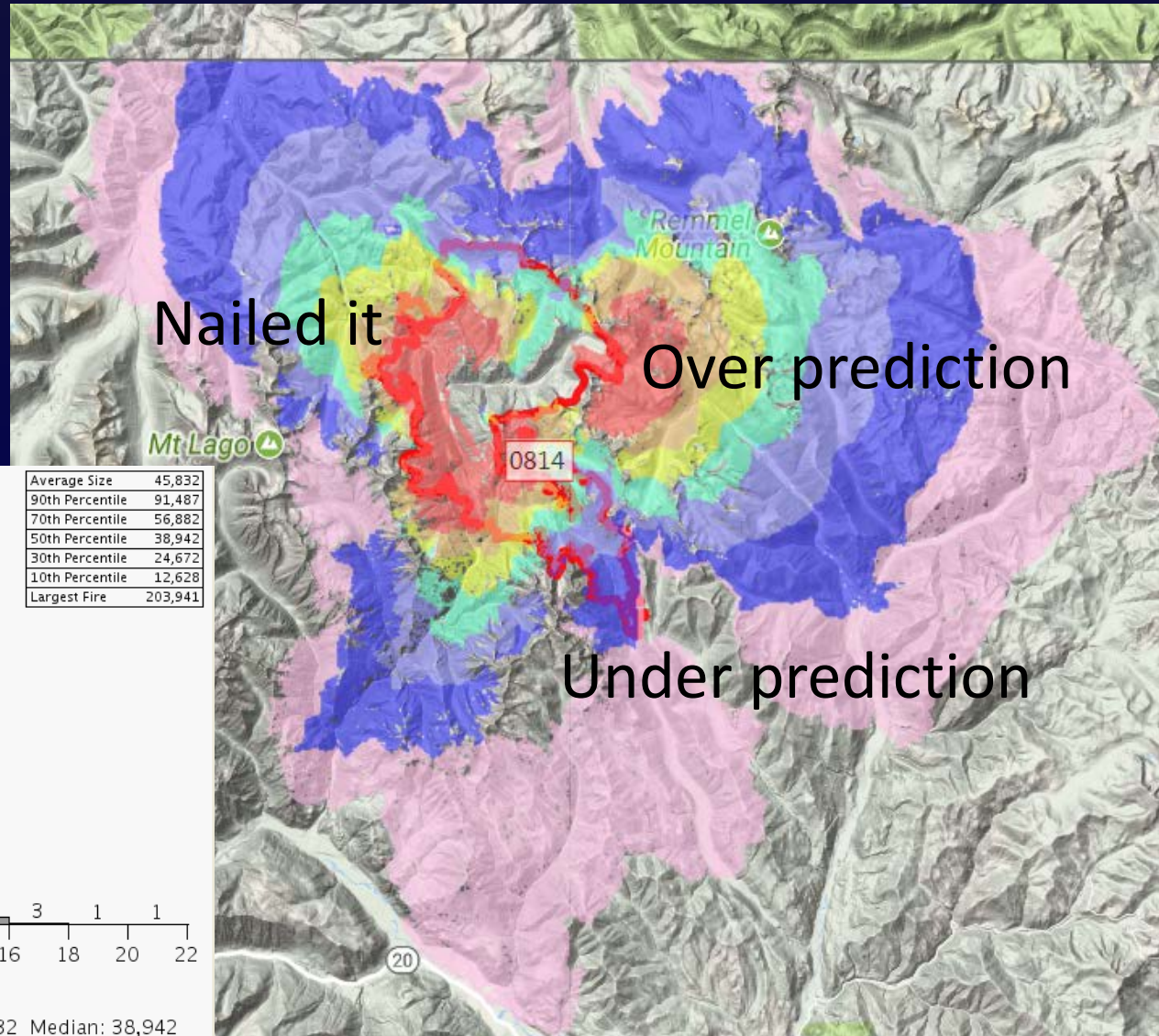
- Ask the right questions...
- Know the difference between spatial (FSPro) and non-spatial models (Behave Plus)
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- Learn how to interpret the output.

# You will usually see degrees of "rightness"

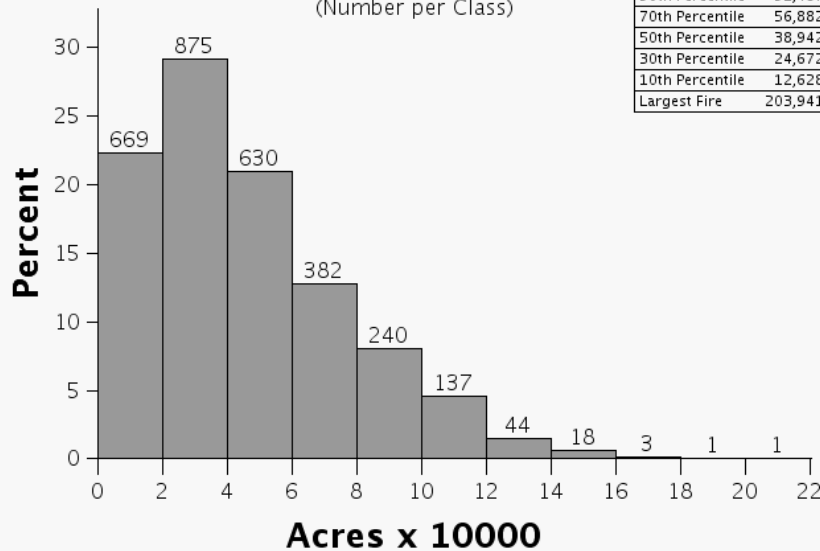
## 14-day Diamond Creek FSPro (7.31-8.13); retrospective look



Start: 6,725 ac  
End: 27,207 ac



**Final Fire Size**  
(Number per Class)



Average Size	45,832
90th Percentile	91,487
70th Percentile	56,882
50th Percentile	38,942
30th Percentile	24,672
10th Percentile	12,628
Largest Fire	203,941

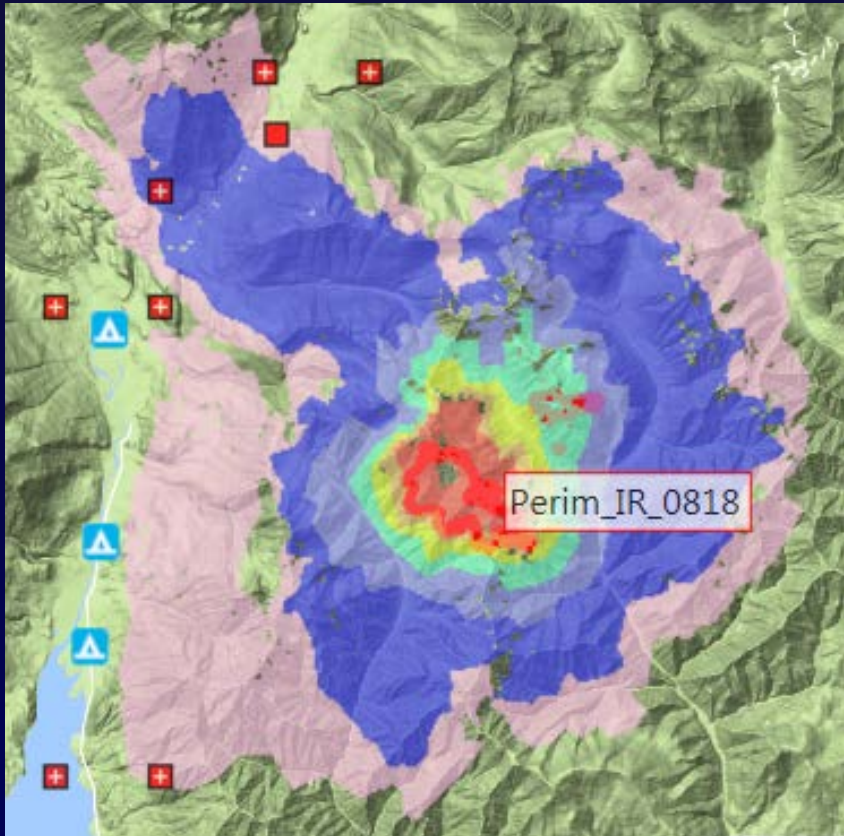
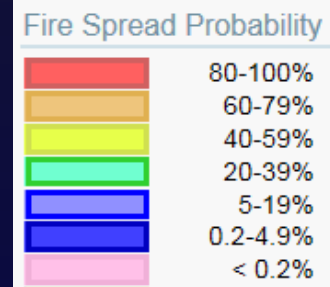
Number Fires: 3,000 Duration: 14 Days Avg Size: 45,832 Median: 38,942

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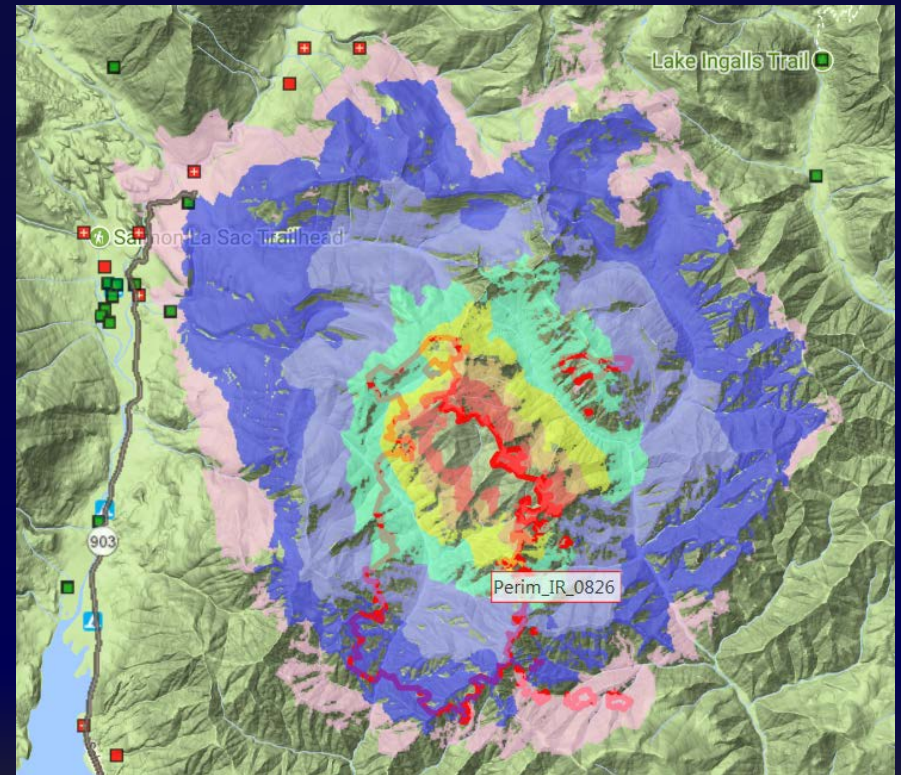
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- Learn how to interpret the output.
- Be cautious with the first runs on a fire and **initial** runs by analysts

# Initial runs and local vs. out of region assistance

## Jolly Mountain: Validation Perimeters Overlaid



7-day (Local Analyst)



14-day (Out of region)

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- Provide feedback both + and –
- Know model limitations (e.g., plume dominate fires, burnouts, and suppression)
- Have realistic expectations; do not expect perfection!

# Uncertainties, limitations, & a very dynamic environment



Sometimes, despite our best efforts, we just miss it or are unlucky.



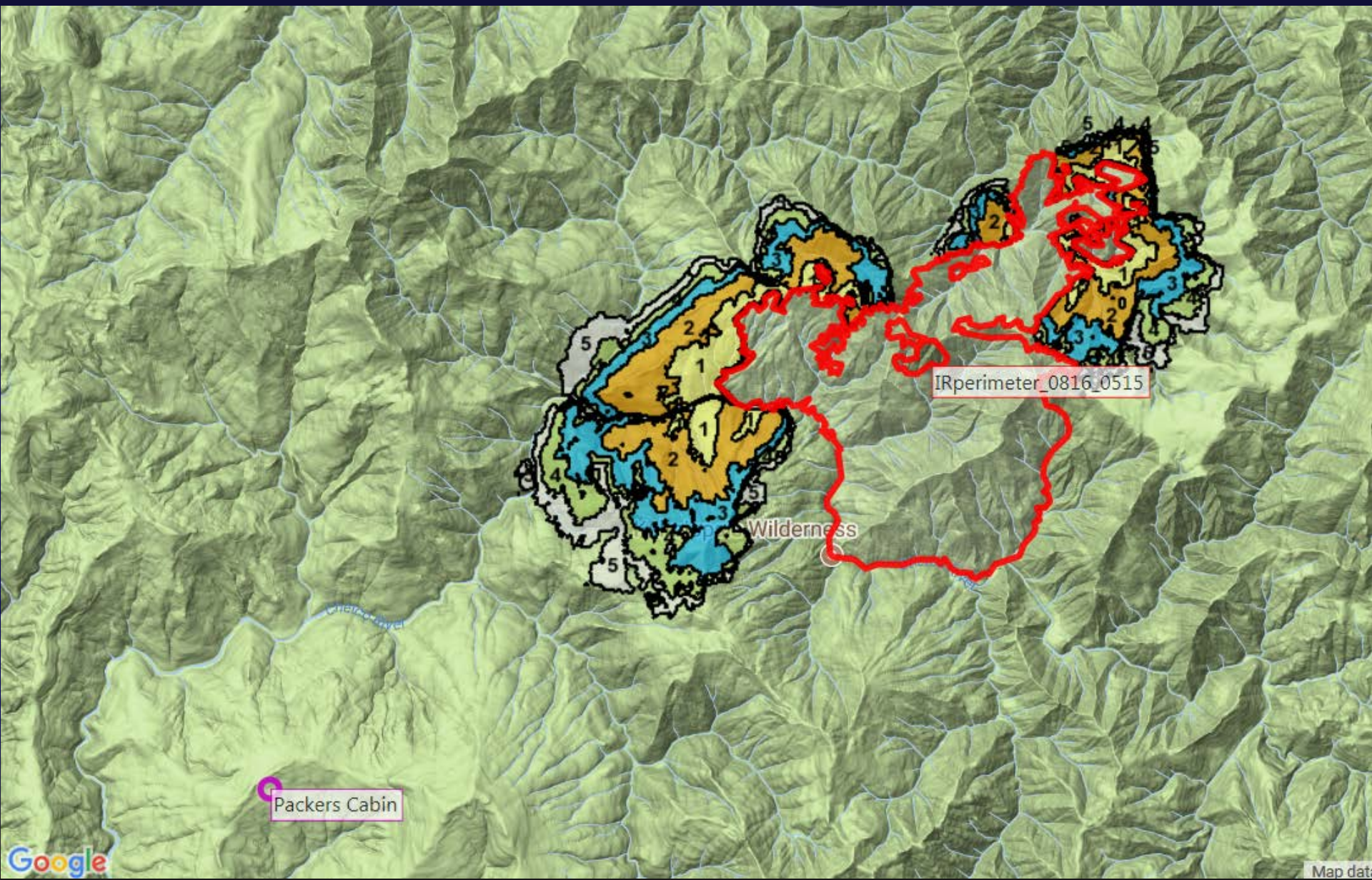
Model output can be **spooky right** and **dead wrong**, but...

- I would wager with (1) local fire behavior knowledge, (2) modeling expertise, (3) an accurate weather forecast, and (4) the right parameters/calibration, model output will be **good most of the time** and can lead to better risk-informed decisions. However, you MUST have that **NEXUS** or accuracy will be compromised. SO ask the **right questions** as a check!

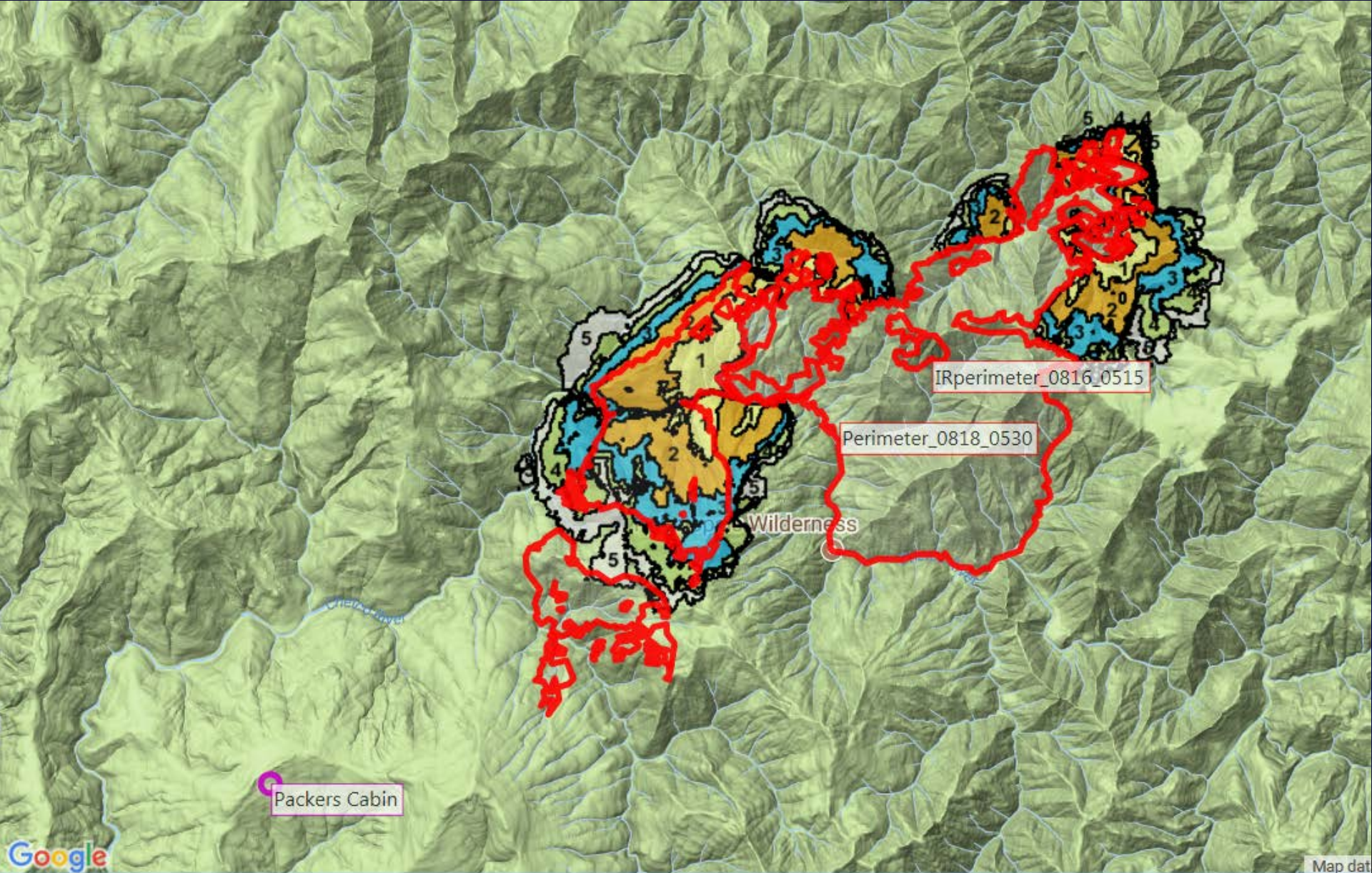
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- When there is a **miss (a bomb)**, it is a screaming **opportunity** and more often than not it is because of weather not in the forecast, a fire transition (e.g., active crown fire run), or user error.

# A Miss is an Opportunity/Calibration: 5-Day NTFB (8.16-20) Chetco Bar Fire, OR 2017



# 5-Day NTFB (8.16-20) Chetco Bar Fire, OR 2017

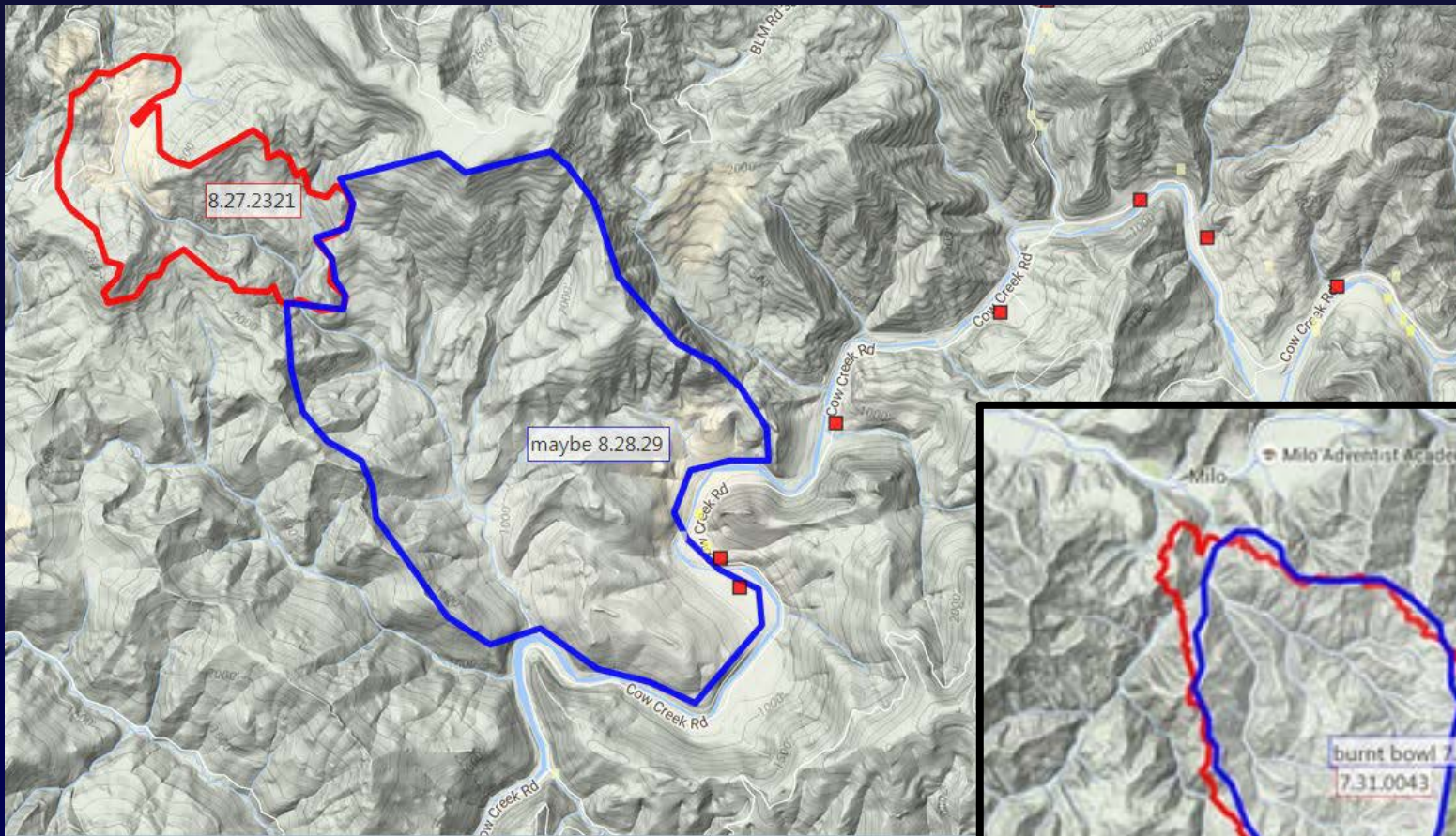




# 5-Day NTFB (8.18-22) Chetco Bar, OR 2017



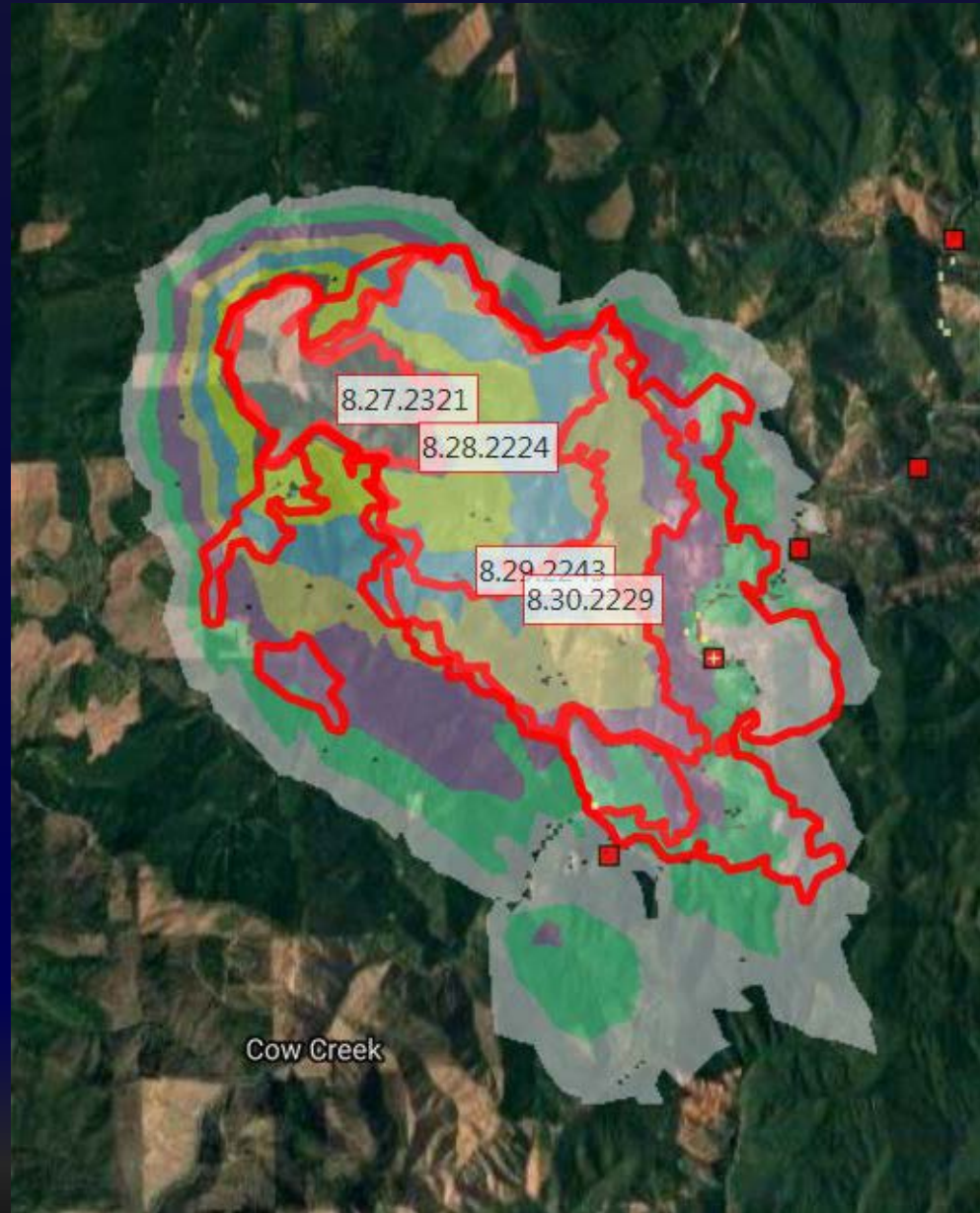
# Experience & Local Knowledge: 3-day STFB (8.28-30) Horse Prairie Fire, OR 2017



Stouts Ck. 2015

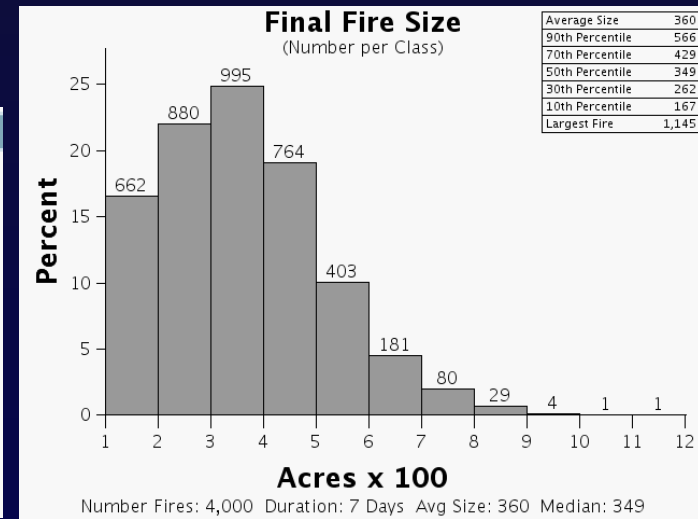
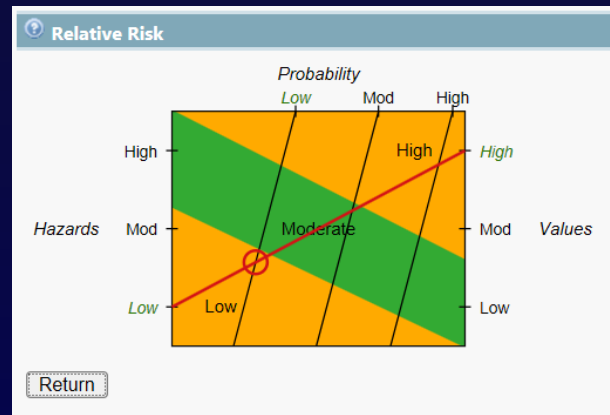


# 3-day STFB (8.28-30) Horse Prairie Fire, OR 2017



# And a few closing thoughts:

- Don't forget the other products like the relative risk, organizational needs assessment, and FSPro values-at-risk and fire size histogram.



## Values List

Category	80-100%	60-79%	40-59%	20-39%	5-19%	0.2-4.9%	<0.2%	Expected Value
Aqua Retardant Avoidance	265 acres	46 acres	159 acres	179 acres	1,081 acres	6,973 acres	8,568 acres	729 acres
Building Clusters: Kittitas, WA	0	21	46	209	765	749	115	215
Campgrounds	0	0	0	2	0	1	3	0.63
Class 1 Airsheds	0 acres	0 acres	0 acres	0 acres	0 acres	5,254 acres	11,338 acres	148 acres
Communication Towers	0	0	0	0	3	2	41	0.47
County: Kittitas, WA	7,869 acres	2,888 acres	3,644 acres	7,878 acres	24,988 acres	72,508 acres	74,564 acres	18,372 acres
Electric Power Plants	0	0	0	0	0	0	1	0.00
Electric Sub Stations	0	0	0	0	0	1	1	0.03
Electric Transmission Lines	0.0 miles	0.0 miles	0.0 miles	0.0 miles	0.0 miles	15.6 miles	22.8 miles	0.43 miles
Est Ground Evac Time: 1-2 Hrs	3,253 acres	1,923 acres	2,205 acres	3,422 acres	11,483 acres	26,671 acres	20,371 acres	8,552 acres
Est Ground Evac Time: 2-4 Hrs	2,569 acres	134 acres	145 acres	703 acres	3,037 acres	17,309 acres	18,802 acres	3,538 acres
Est Ground Evac Time: 4-6 Hrs	680 acres	1 acres	0 acres	0 acres	48 acres	5,071 acres	9,038 acres	760 acres
Est Ground Evac Time: 6+ Hrs	0 acres	0 acres	11 acres	15 acres	41 acres	1,379 acres	7,626 acres	58.6 acres
Estimated Population	7	14	36	27	256	749	106	93.8
Habitat: Bull Trout	1.1 miles	0.2 miles	0.6 miles	2.0 miles	6.9 miles	33.1 miles	23.6 miles	3.78 miles
Habitat: Northern spotted owl	3,383 acres	578 acres	787 acres	1,189 acres	5,177 acres	28,057 acres	37,262 acres	5,613 acres

# A few closing thoughts cont.:

- We need to **grow** fire analysts on our local unit to help us make better landscape decisions and to help us make more risk-informed decisions on wildfires.
- We need to be ok with monitor, confine, and point or zone protection as the **default strategy** (where consistent with L/RMP direction and values-at-risk)
- We need to **reconfigure** some of our teams for this new reality—long-duration fires. We need to match our fires with the right team. These newly retrofitted teams need to be on a different rotation.