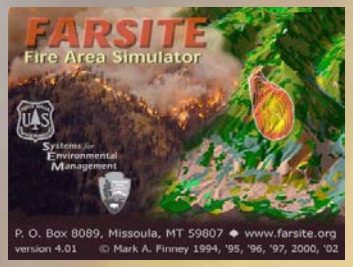
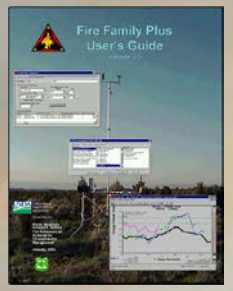
What is a Fire Model?

- A model is a set of mathematical equations to predict a phenomenon, in this case fire growth, behavior, or fuel moisture.

- A model is an approximation of reality; it does not explain all of reality (Burham & Anderson 1998).

- Some so-called fire models (FARSITE, BehavePlus) are actually fire modeling systems—they contain multiple models (surface spread, crown fire spread, spotting, fuel moisture, etc.).





Considerations When Using Models

- Why are you using a model? What is your management question?
- “All models are wrong, but some are useful.” (George Box, 1979)
- It is the task of the modeler to produce usable information; it is the land manager that ultimately determines its usefulness.
- Modeling is an art as well as a science; one’s field experience enables the art of the modeler; it also serves as a check of model outputs.
- All models have assumptions and limitations; know them.
- A model is a decision support tool, not a tool that makes decisions.
- Is the model output sensible? Ask why things are the way they are; remember, don’t be DUM (Data, user, model).

Why Use Models?

- Forces you to bring all the data together to do the analysis.

- “Game” the landscape—multiple runs, what if scenarios, explore hypotheses. In the real world, you make one decision at a time and observe the consequences.

- A landscape look at a landscape phenomenon.

- “Fire management plans and activities are based upon the best available science.” Many models are peer-reviewed.

- An alternative way to substantiate and document your decisions; helpful in public outreach, reviews, investigations, and litigation.

- Supports and facilitates the changing face of wildand fire management (i.e., suppress all fires to management actions consistent with land management plans.

Some Disadvantages of Models

- Spatial models are data intensive.

- Require a certain level of commitment, knowledge, and training.

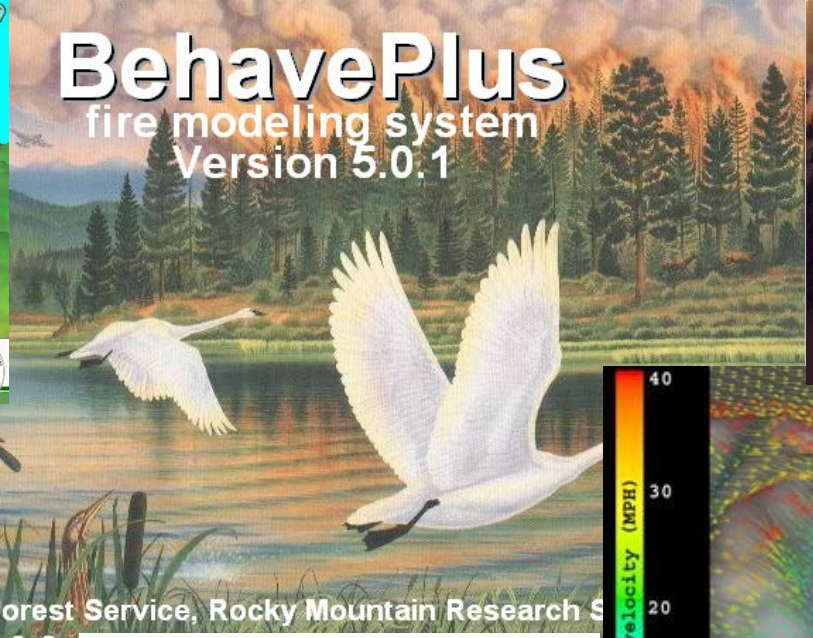
- Accuracy of model output is dependent on the quality of the data.

- Accuracy of model output often depends on the expertise of the modeler. There is a learning curve. There are differences in opinions. There are several ways to obtain a useful product.

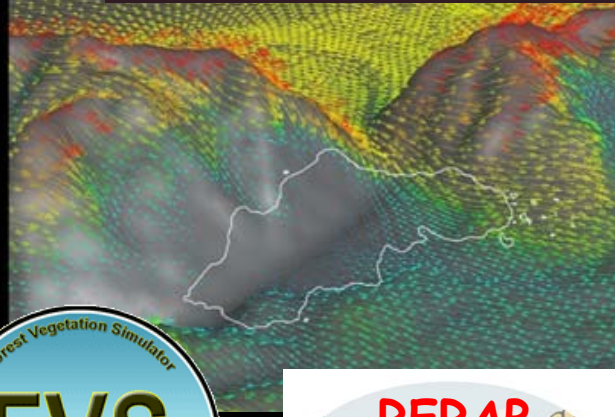
- Model results can take time to generate and sometimes even longer to display.

- Garbage in = gospel out (GIGO) (Especially with GIS).

- They can be “wrong” and the results can be misrepresented, misunderstood, and misused.



Fire Sciences Lab



LANDFIRE™

FPA

Forest Vegetation Simulator
FVS
USDA Forest Service

RERAP

Fire Family Plus
version 4.0

Innovation Discipline Execution FAM

Systems for Environmental Management

Forest Service U.S. Department of Agriculture

Wildland Fire
Decision Support System

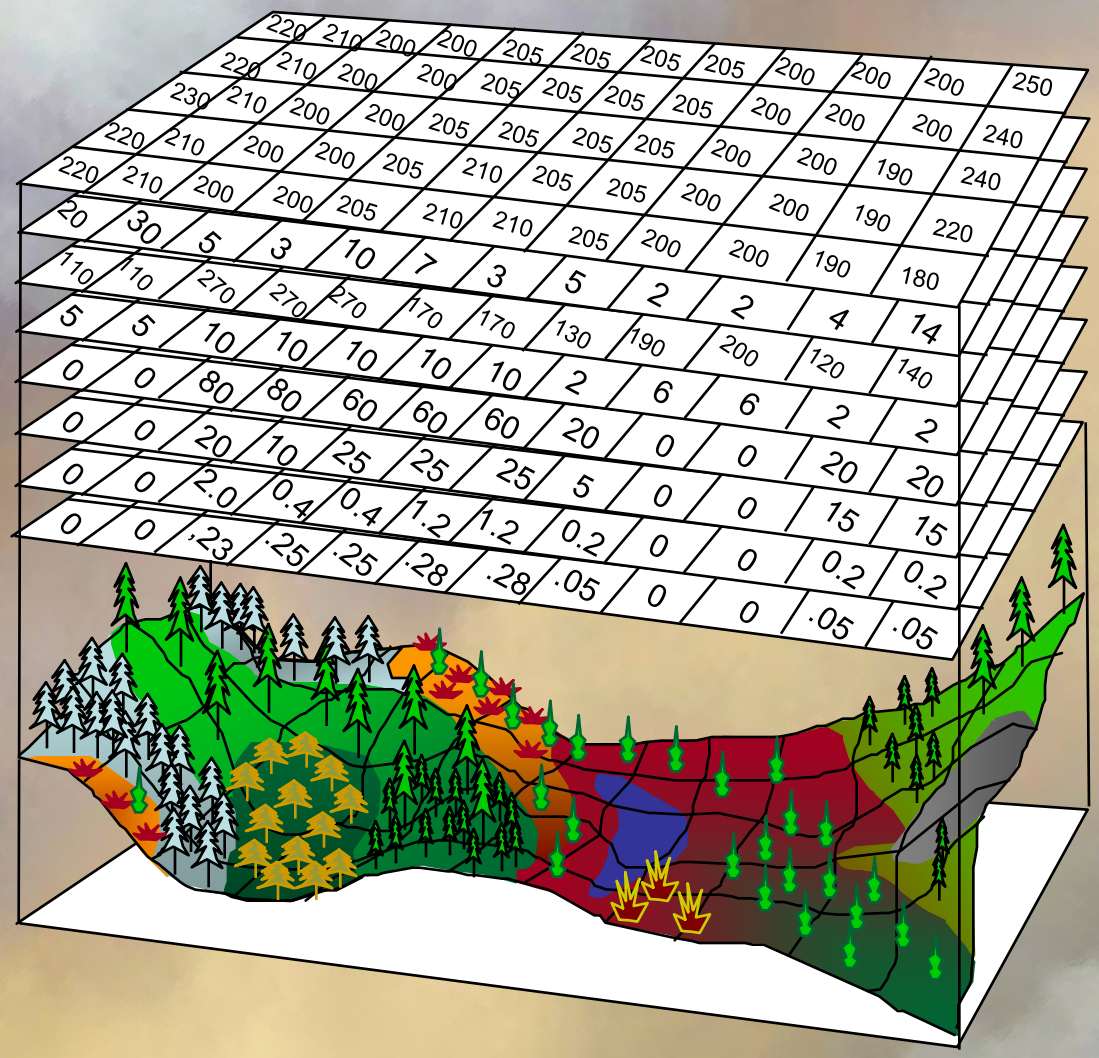
WFDSS

FFE-FVS

FMAPlus® Version 3
Fuels Management Analyst

NEXUS

FARSITE LCP (Landscape File) Themes

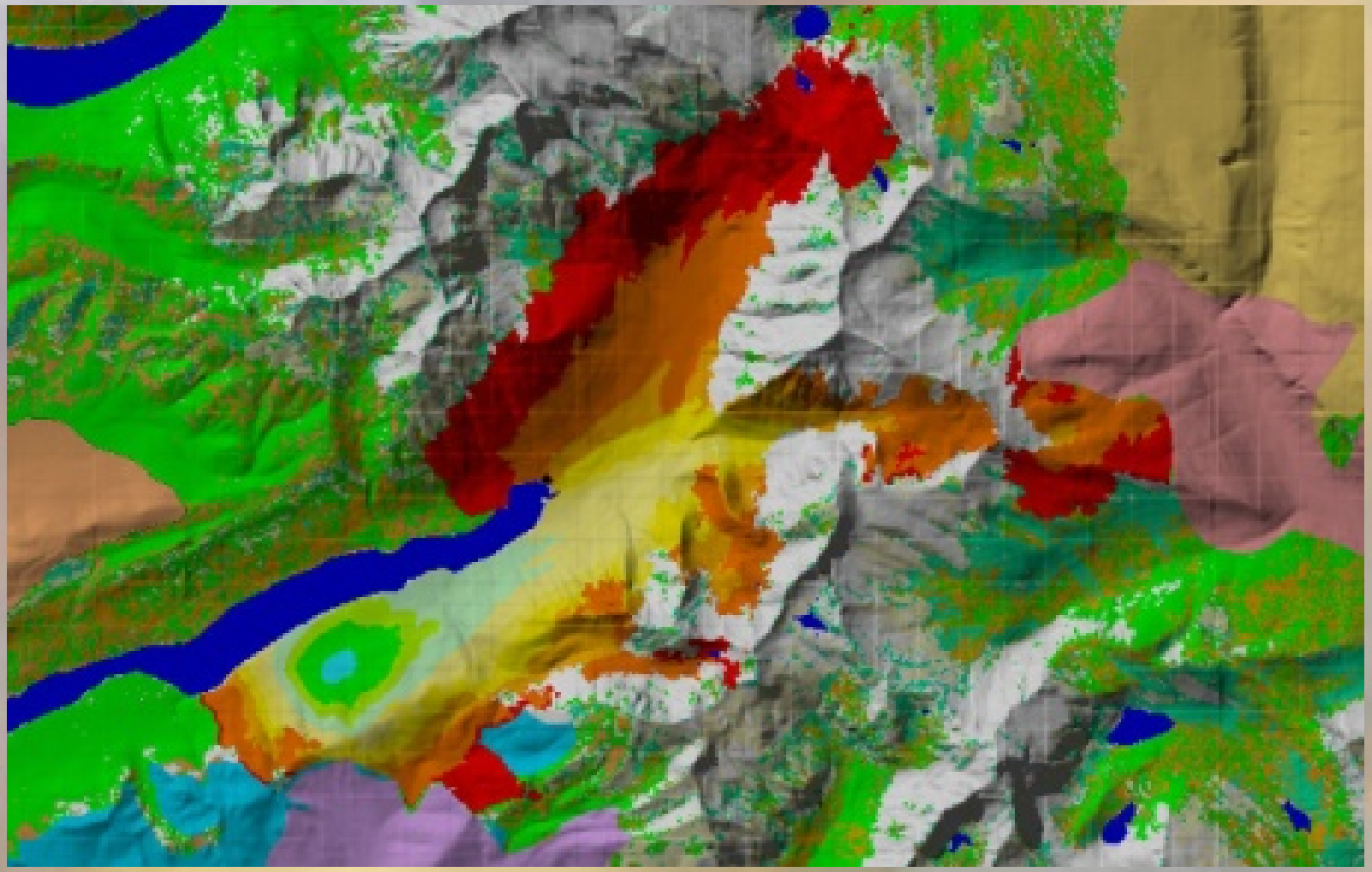


Elevation
Slope
Aspect
Fuel Model
Canopy Cover
Canopy Height
Canopy Base Height
Canopy Bulk Density

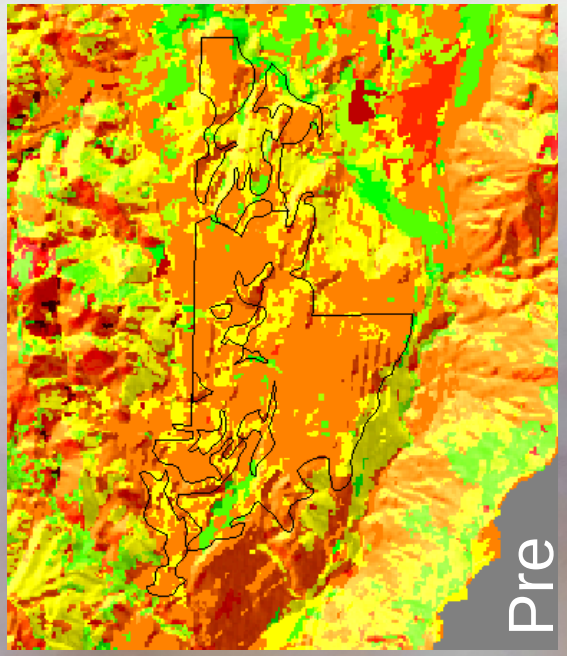
Four Model Comparison

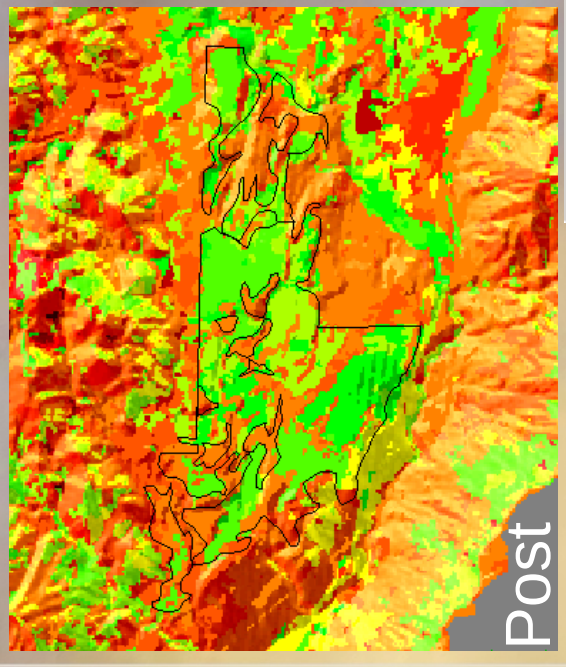
	1 Fire	All Fires
1 Weather Scenario	FARSITE	FlamMap
All Weather Scenarios	FSPro	FSIM (FPA)

FARSITE: Wolf Fire, Glacier NP 2003



Surface Flame Length

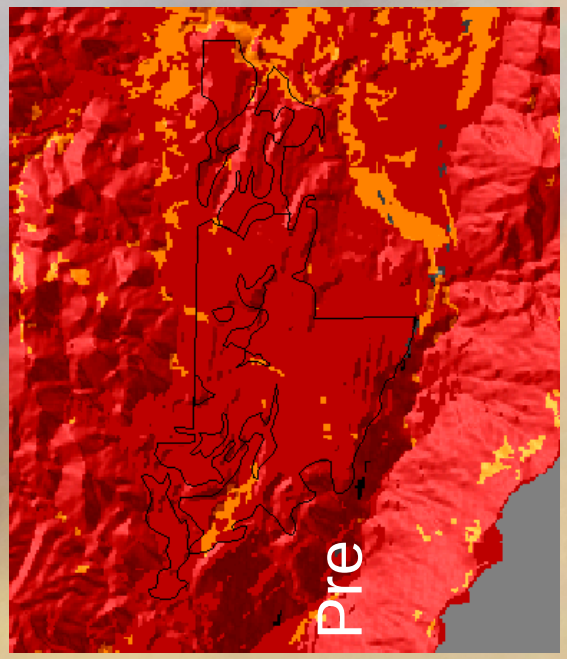


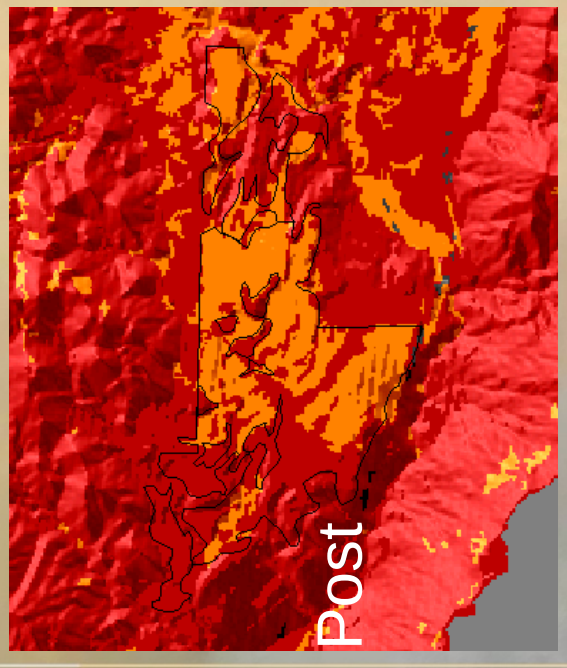


Flame Length
Feet

No Data	
3	
7	
10	
14	
17	
20	
24	
27	
30	
34	

Crown Fire Activity



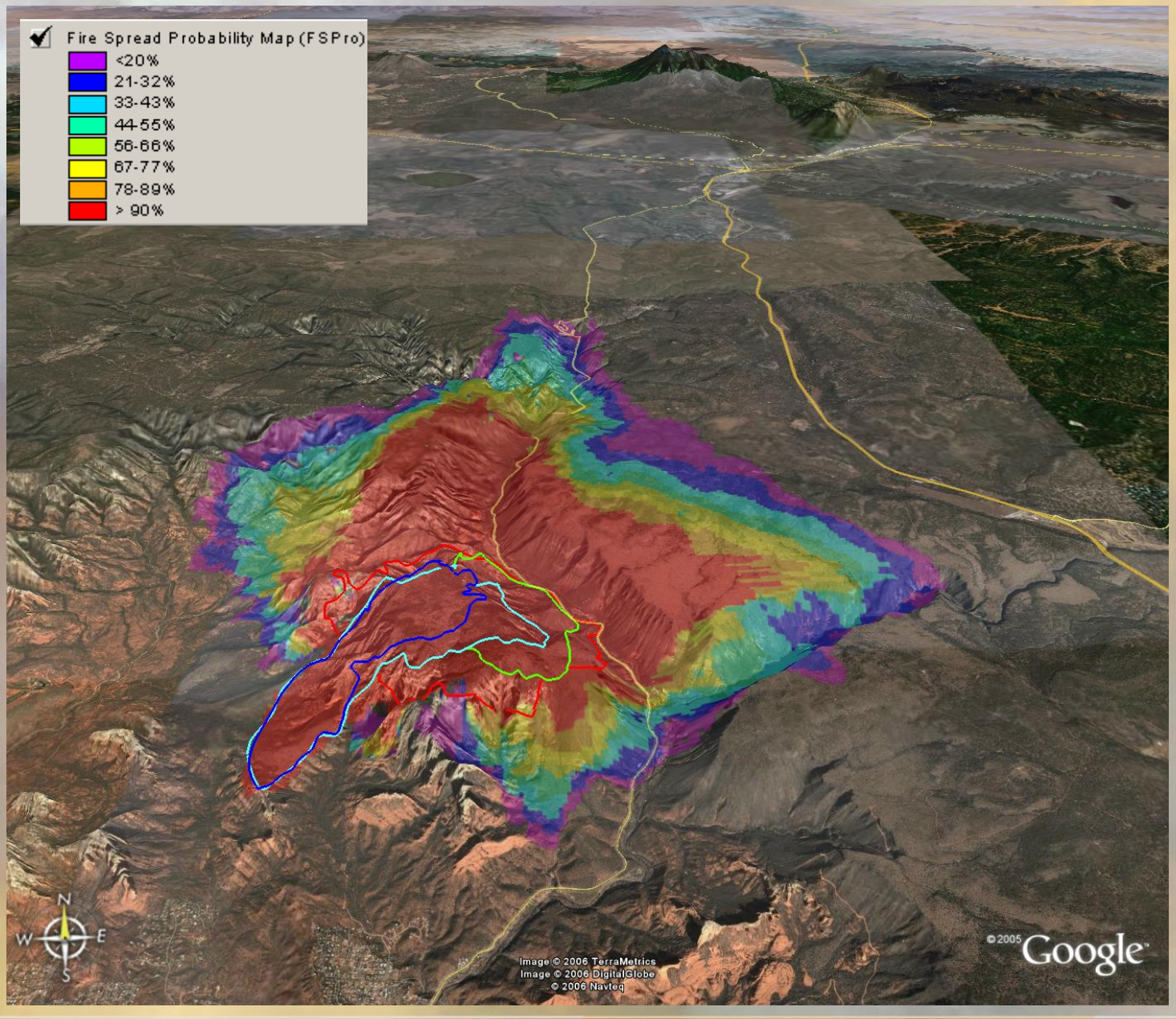


Crown Fire Activity
Class

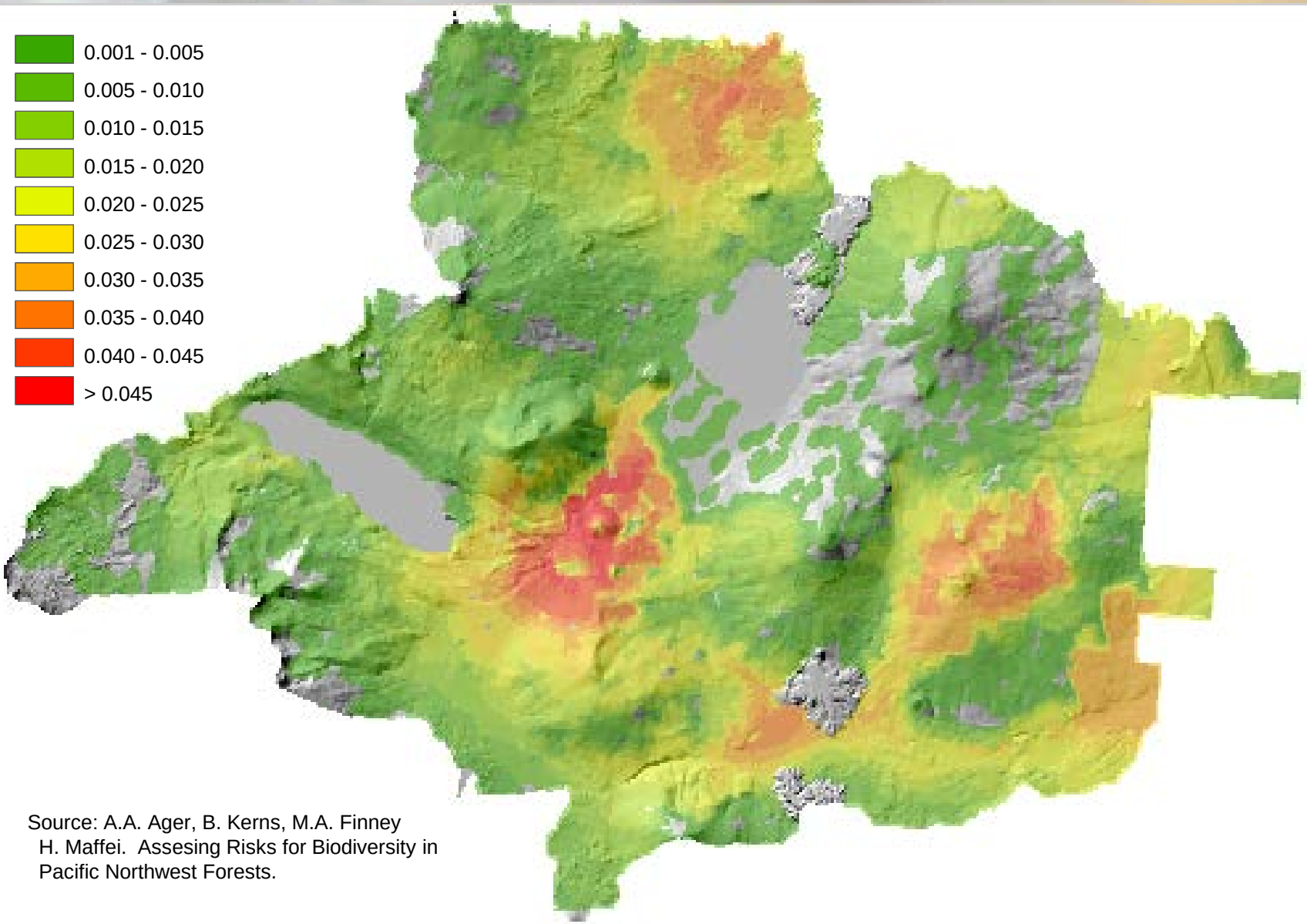
No Data	
Barren	
Surface Fire	
Crown Fire	

FlamMap

FSPRO: Brins Fire, AZ 2006 (10-day run)



FSIM (Fire Simulation System) (FPA)

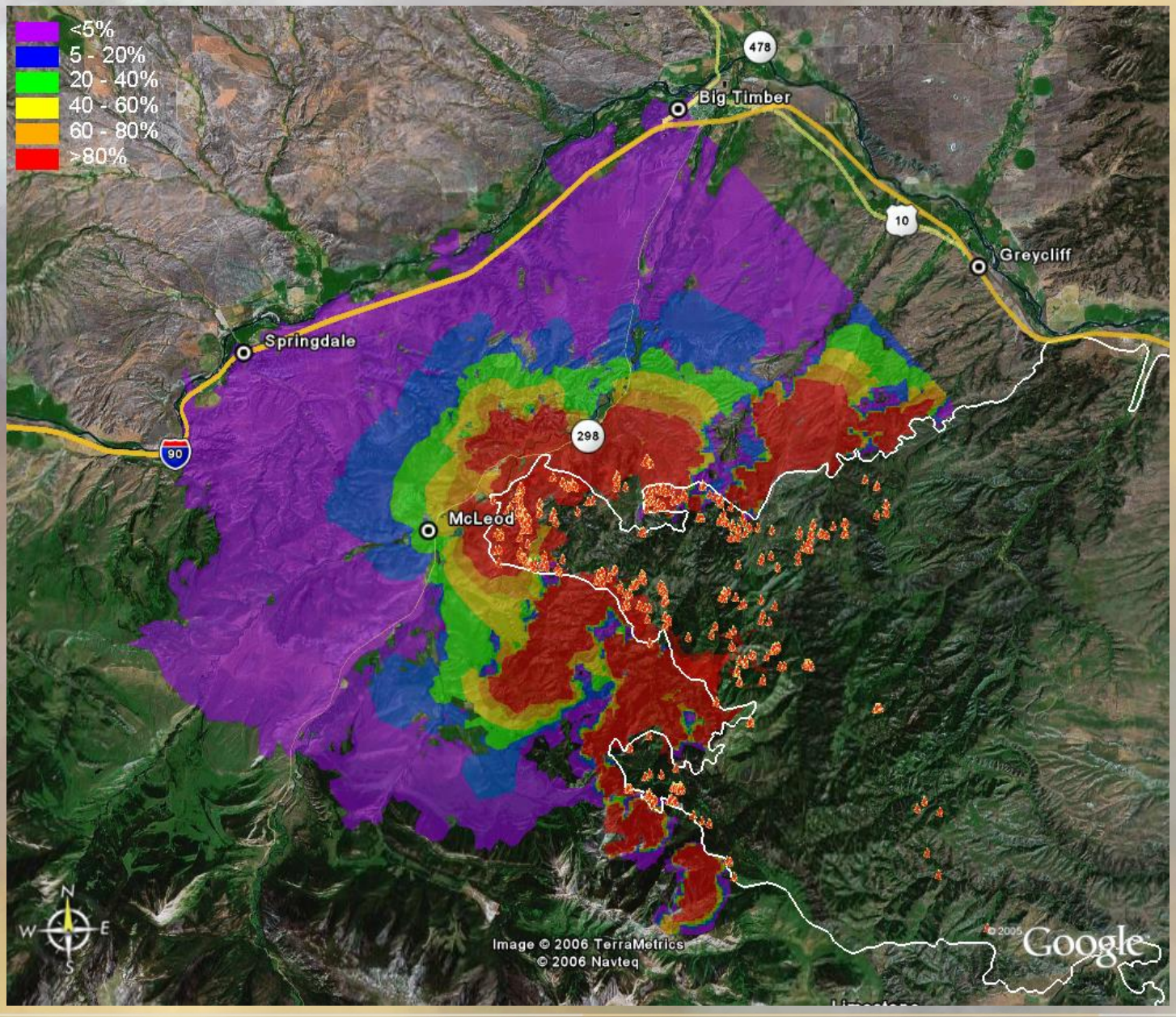


Source: A.A. Ager, B. Kerns, M.A. Finney
H. Maffei. Assesing Risks for Biodiversity in
Pacific Northwest Forests.

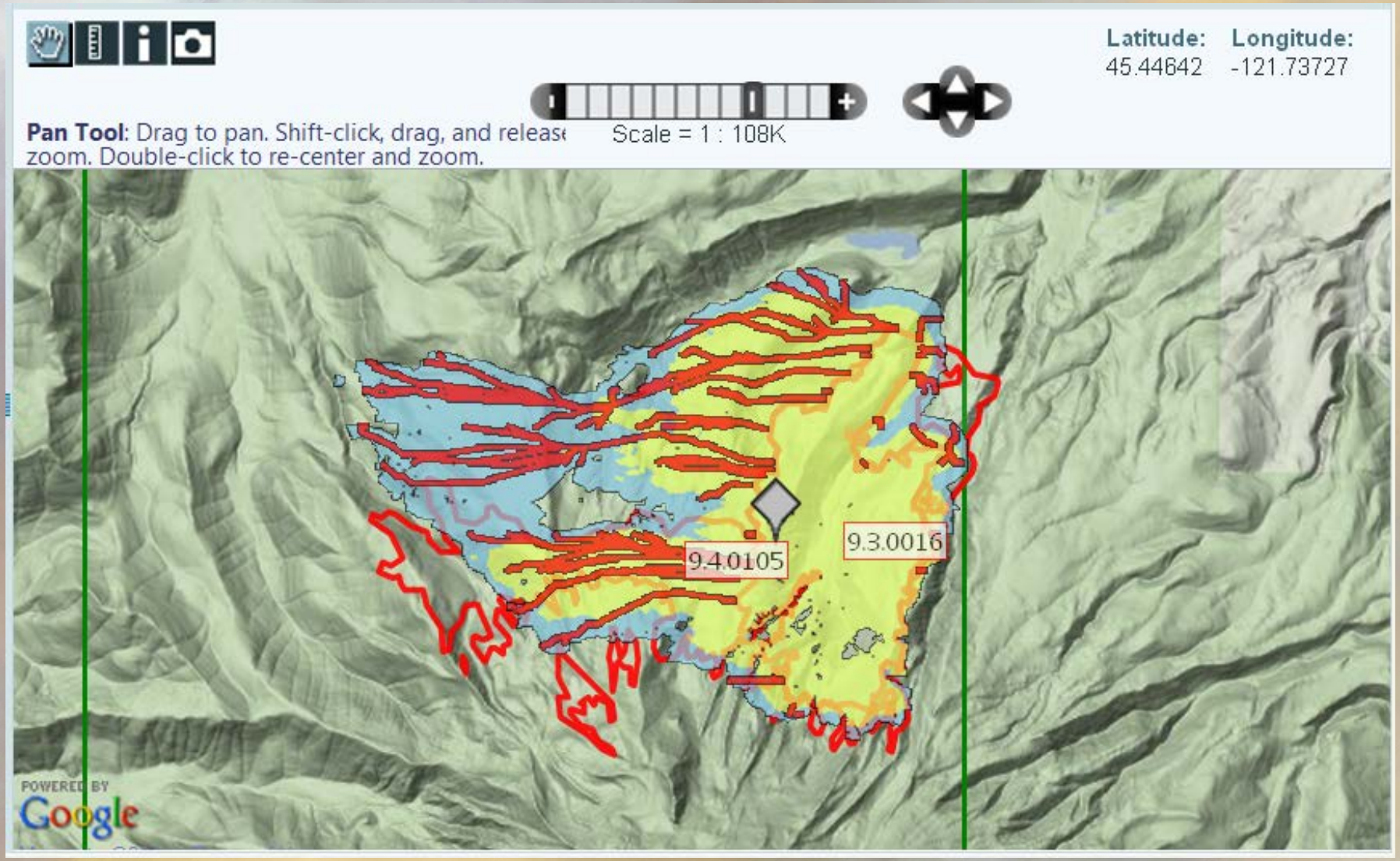
HANDOUT: Fire Growth Models in WFDSS

Fire Growth Models in WFDSS			
Tools	Short-Term Fire Behavior (**STFB**)	Near-Term Fire Behavior (**NTFB**)	Fire Spread Probability (**FSPro**)
"Model"	Minimum Travel Time (MTT) (Finney 2002)	FARSITE (Finney 1998)	Minimum Travel Time (MTT) (Finney 2002)
Duration	1 to 3 days	1 to 5 days	5 or 7 to 30 days
Weather	Daily, constant weather, wind, & fuel moisture*	Hourly, variable weather, wind, & fuel moisture	*plus ERC seasonal trend, auto-correlation, standard deviations & artificial time series
Gridded Wind	Yes (WindNinja)	No	No
Spotting	Yes (1 ember per node; start with .10% spotting probability)	Yes (16 embers per vertex; spotting probability value lower than STFB; start with .05%)	Yes (like STFB)
Principal Output(s)	Major flow paths; arrival times	Perimeter growth	Probability surface

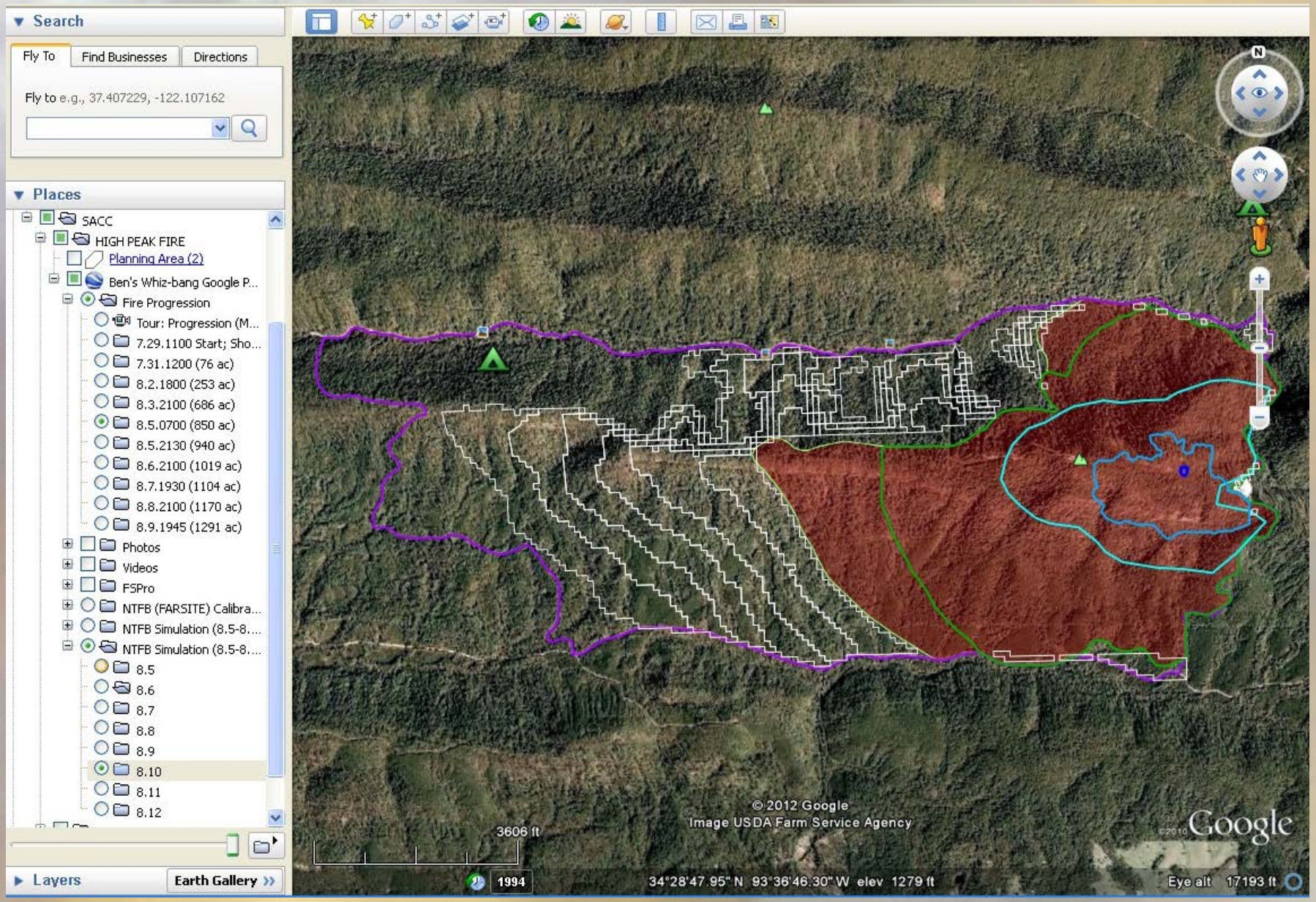
FSPro: Derby Fire, MT 2005 (7-day)



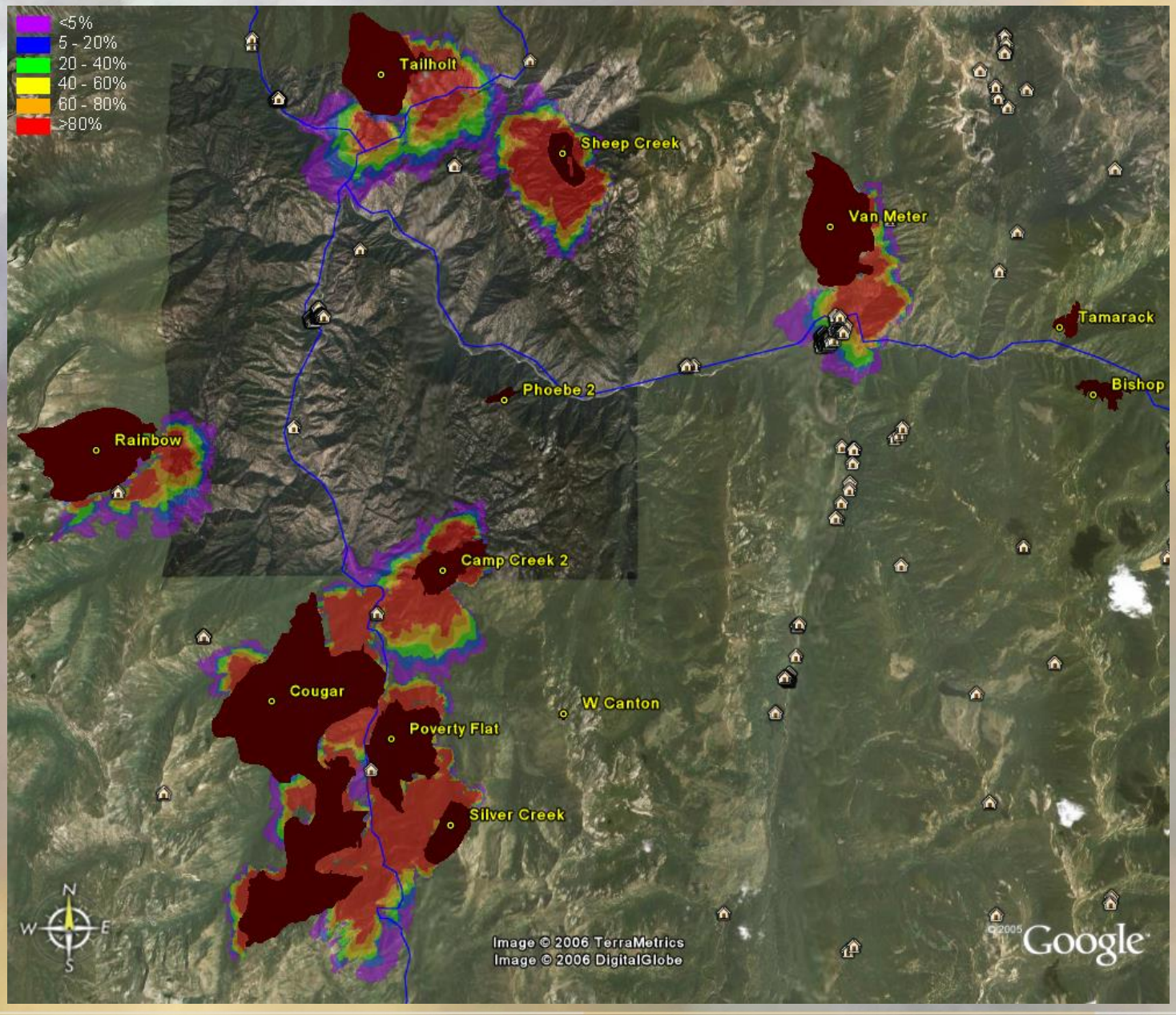
STFB: Dollar Lake Fire, OR 2011(7 hours)



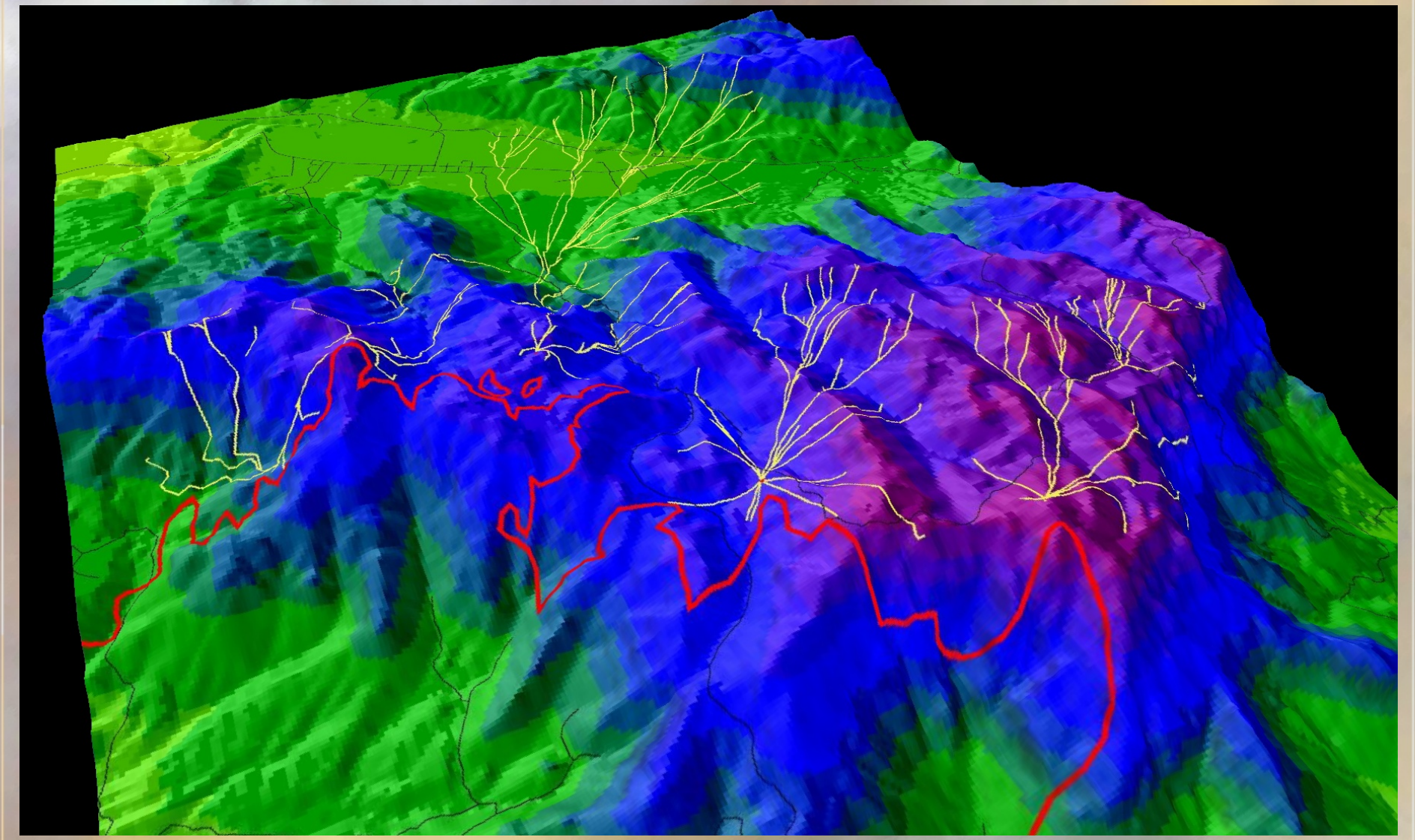
NTFB: High Creek Fire, AR 2011 (6 days)



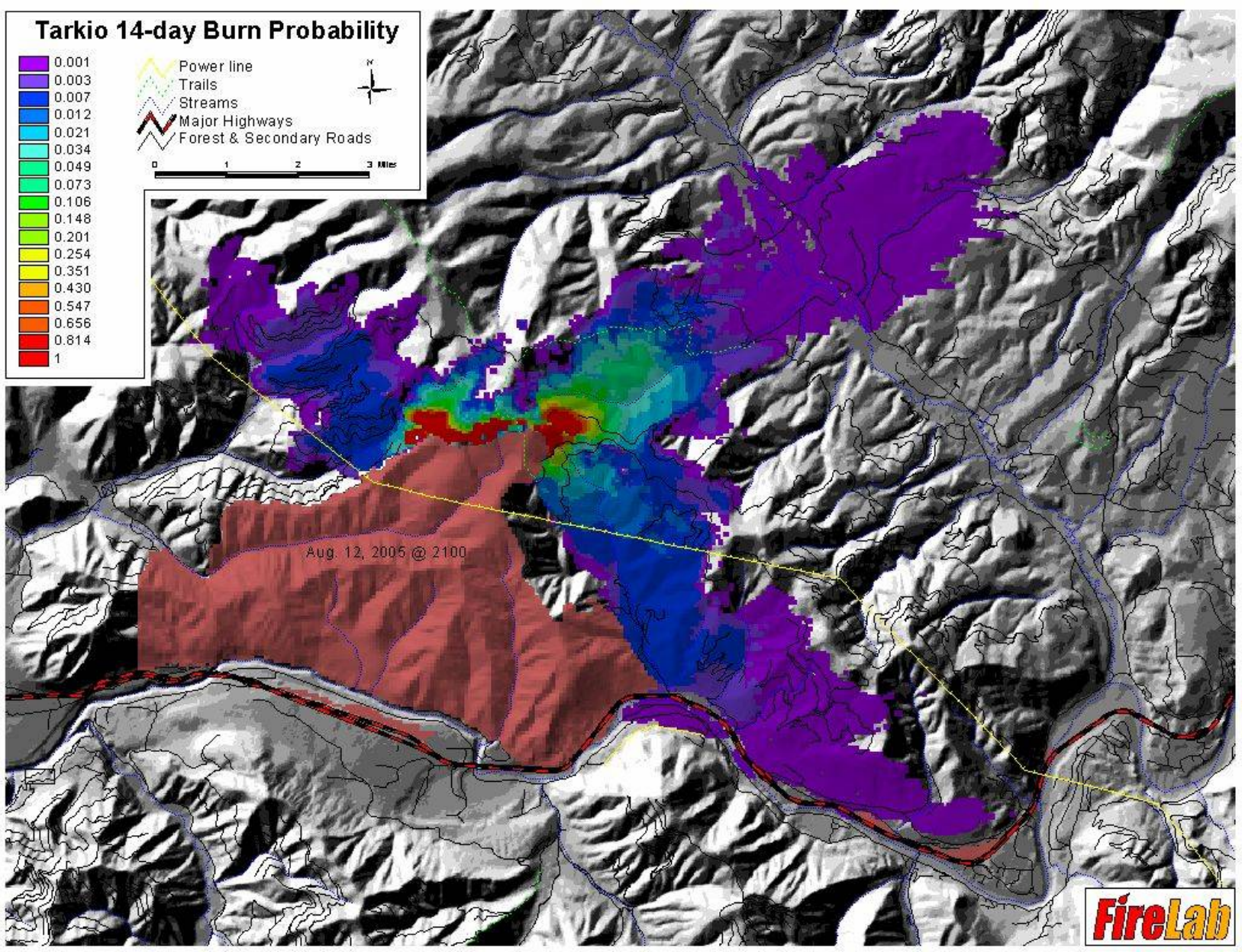
FSPro: Central ID, 2006 (7-day)



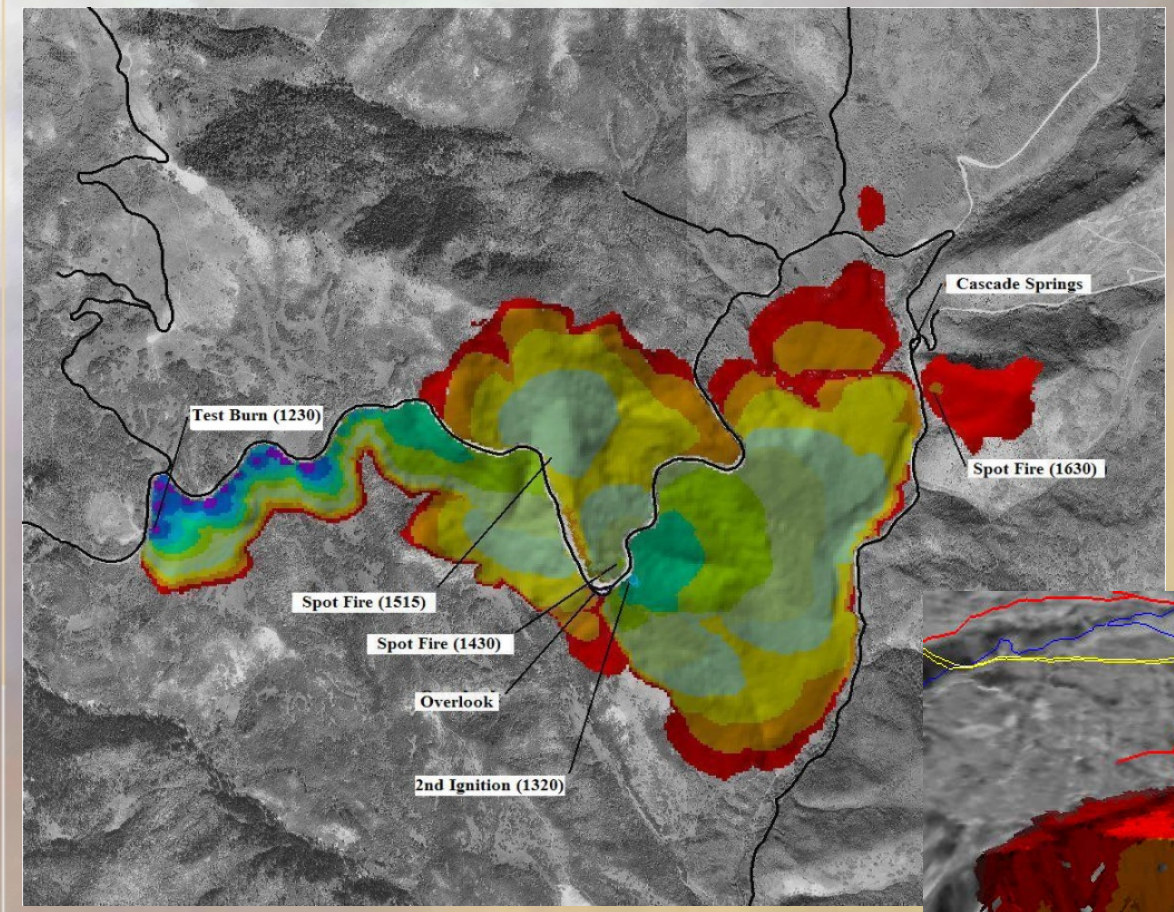
MTT (STFB): Dammeron Fire, UT 2005 (1-day)



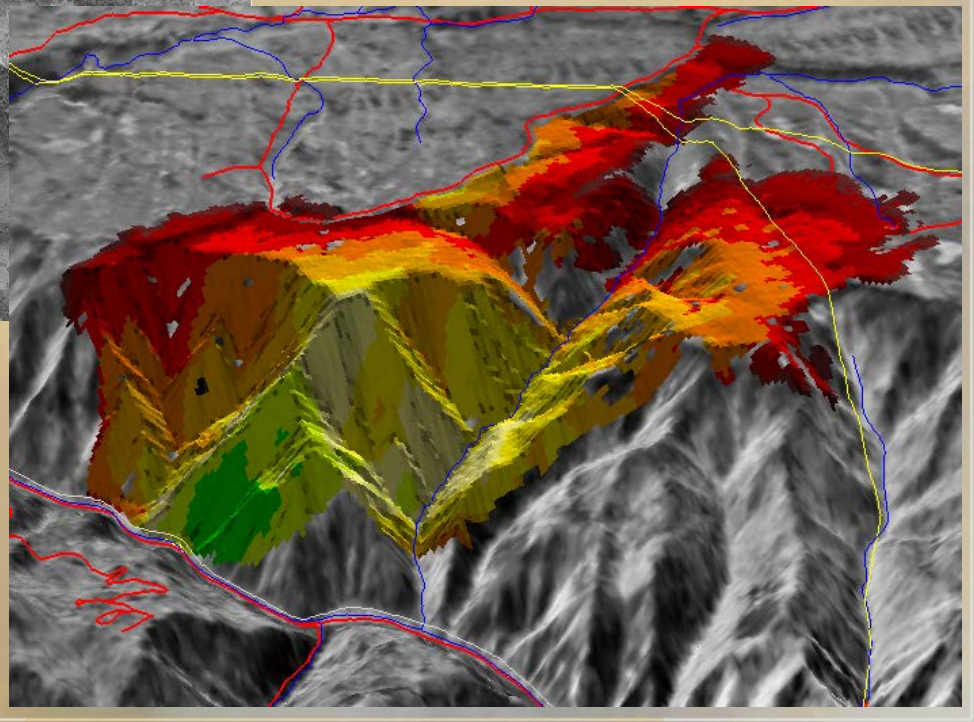
FSPro: Tarkio Fire, MT 2005 (14-day)



Cascade 2 PF Review, UT 2003 (5 hours)

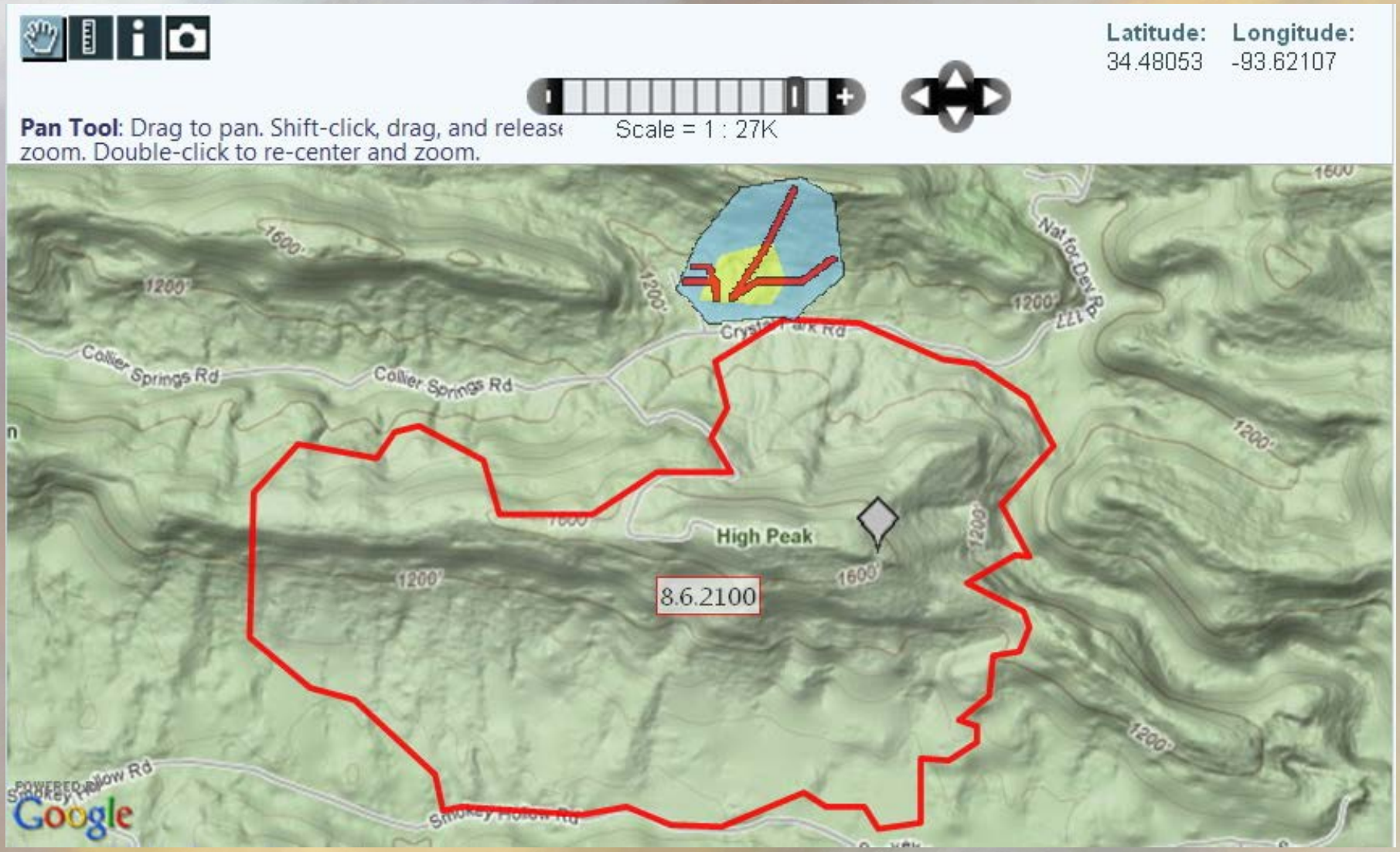


Price Canyon Fire, UT 2002 (8 hours)

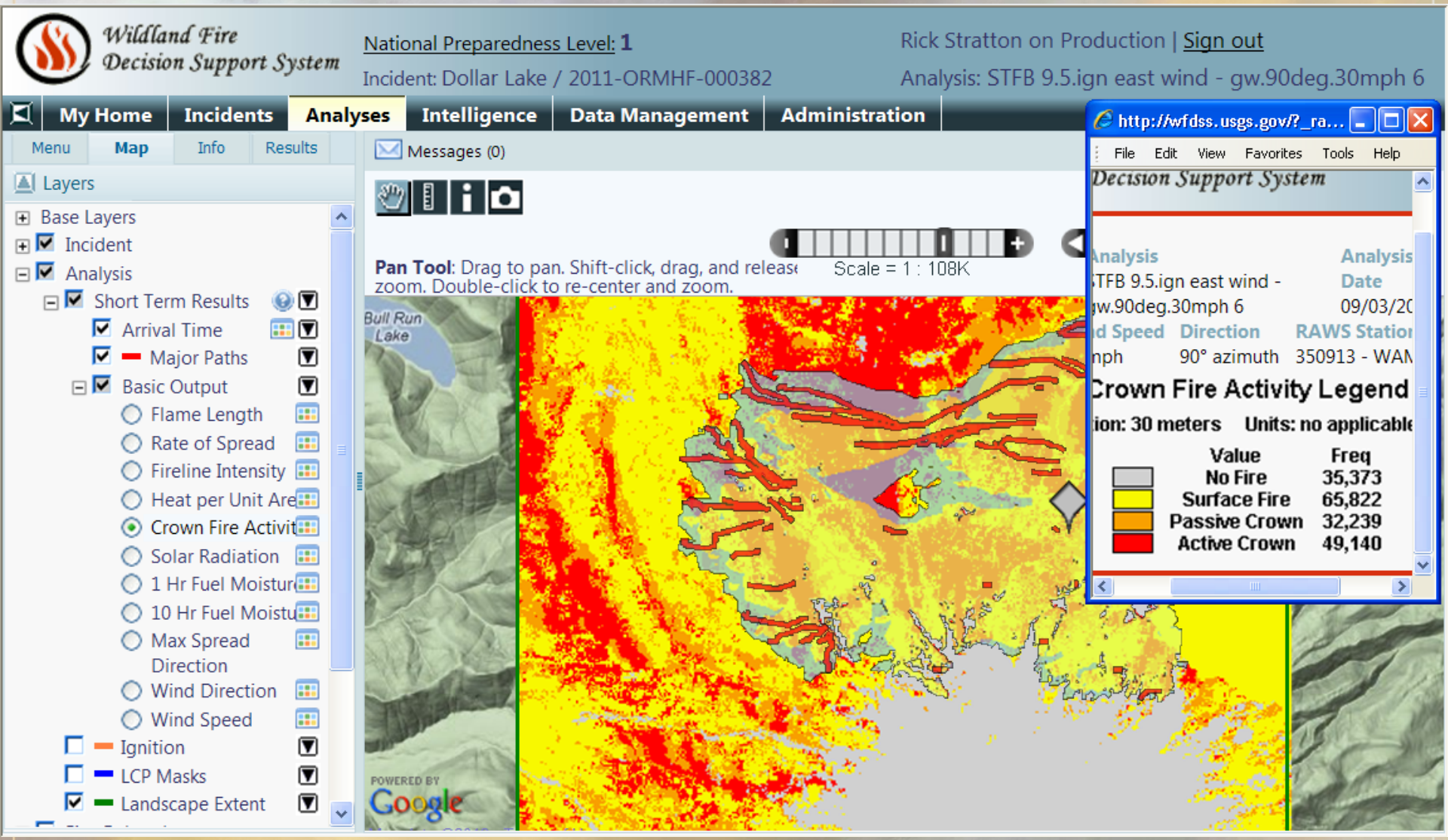


FARSITE (NTFB)

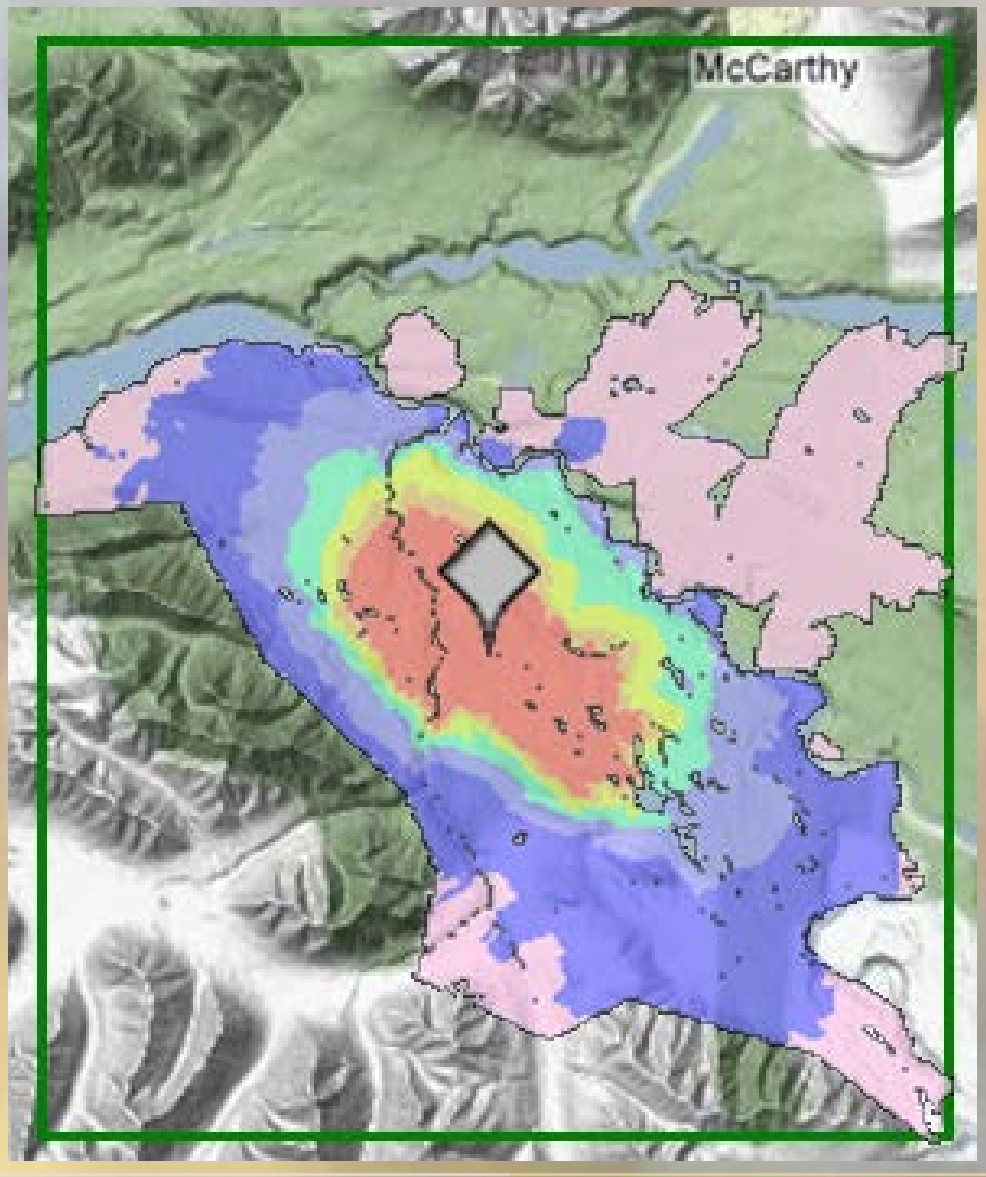
STFB: High Creek Fire, AR 2011 (60 ac [4 hours])



STFB Run (with Basic Output)



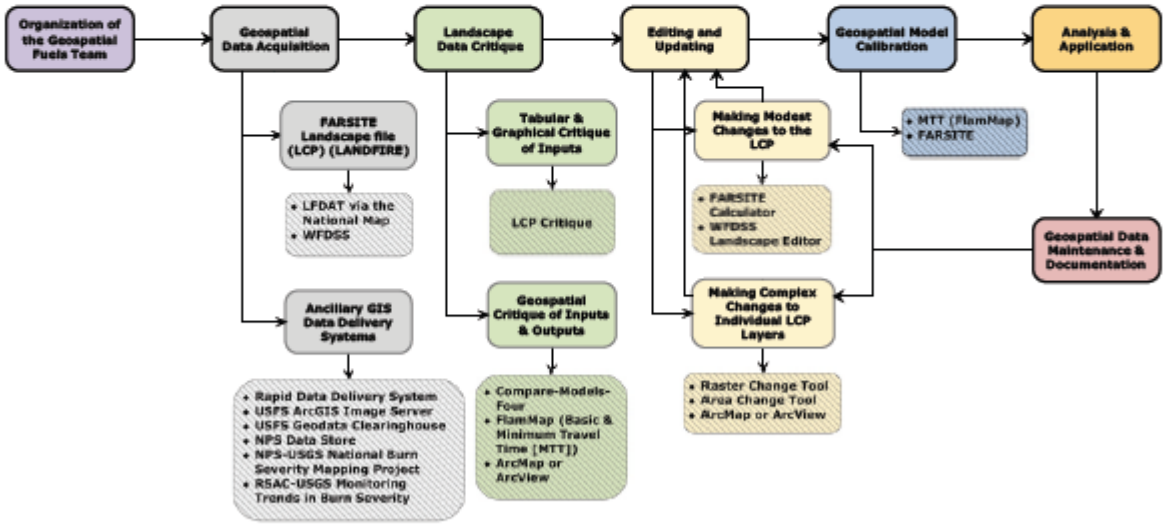
FSPro: Chakina (362) AK, 2009 (14-day)



Guidebook on

LANDFIRE Fuels Data Acquisition, Critique, Modification, Maintenance, and Model Calibration

Richard D. Stratton



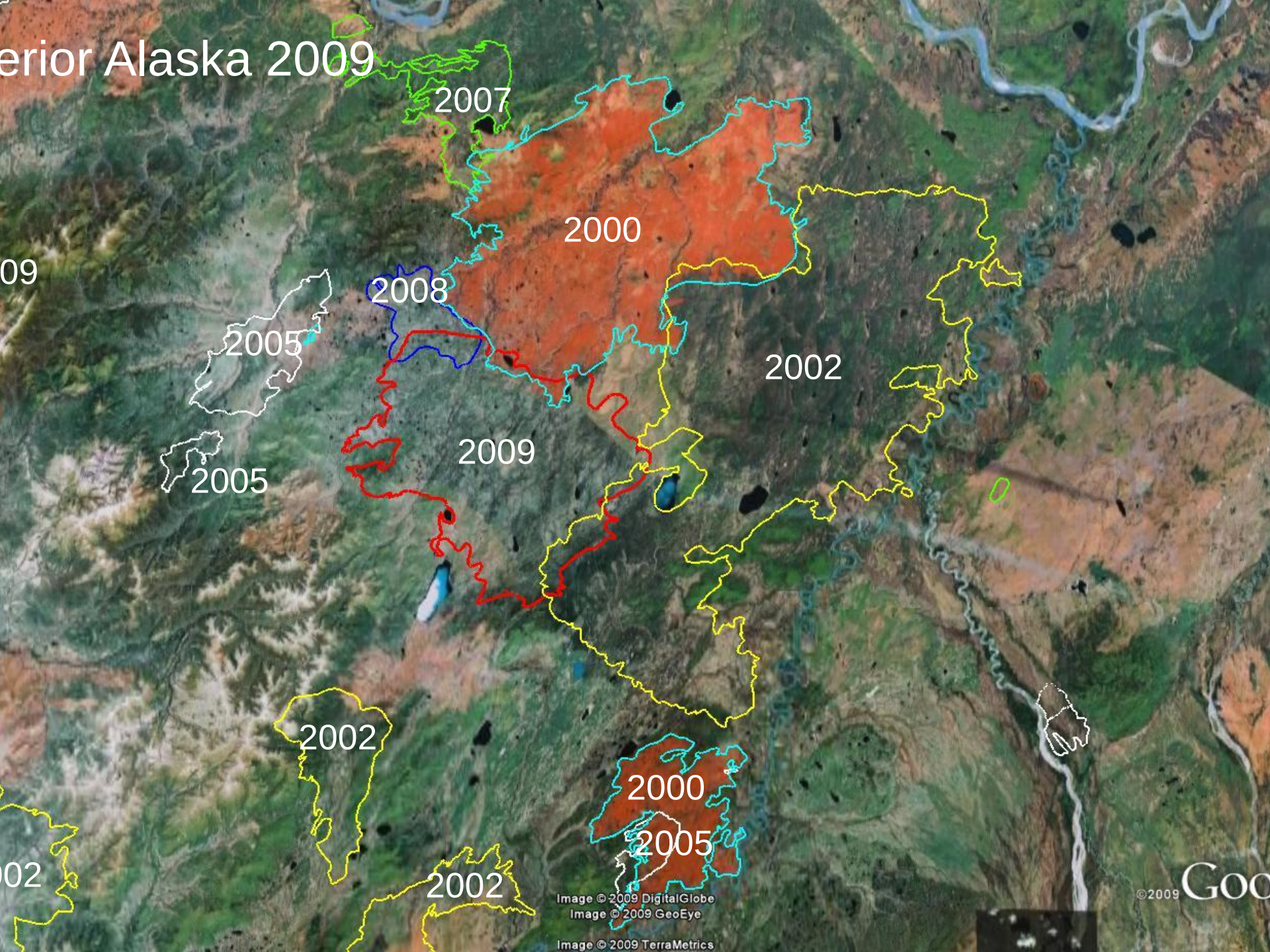
USDA United States Department of Agriculture

Forest Service

Rocky Mountain Research Station

General Technical Report RMRS-GTR-220

February 2009


erior Alaska 2009
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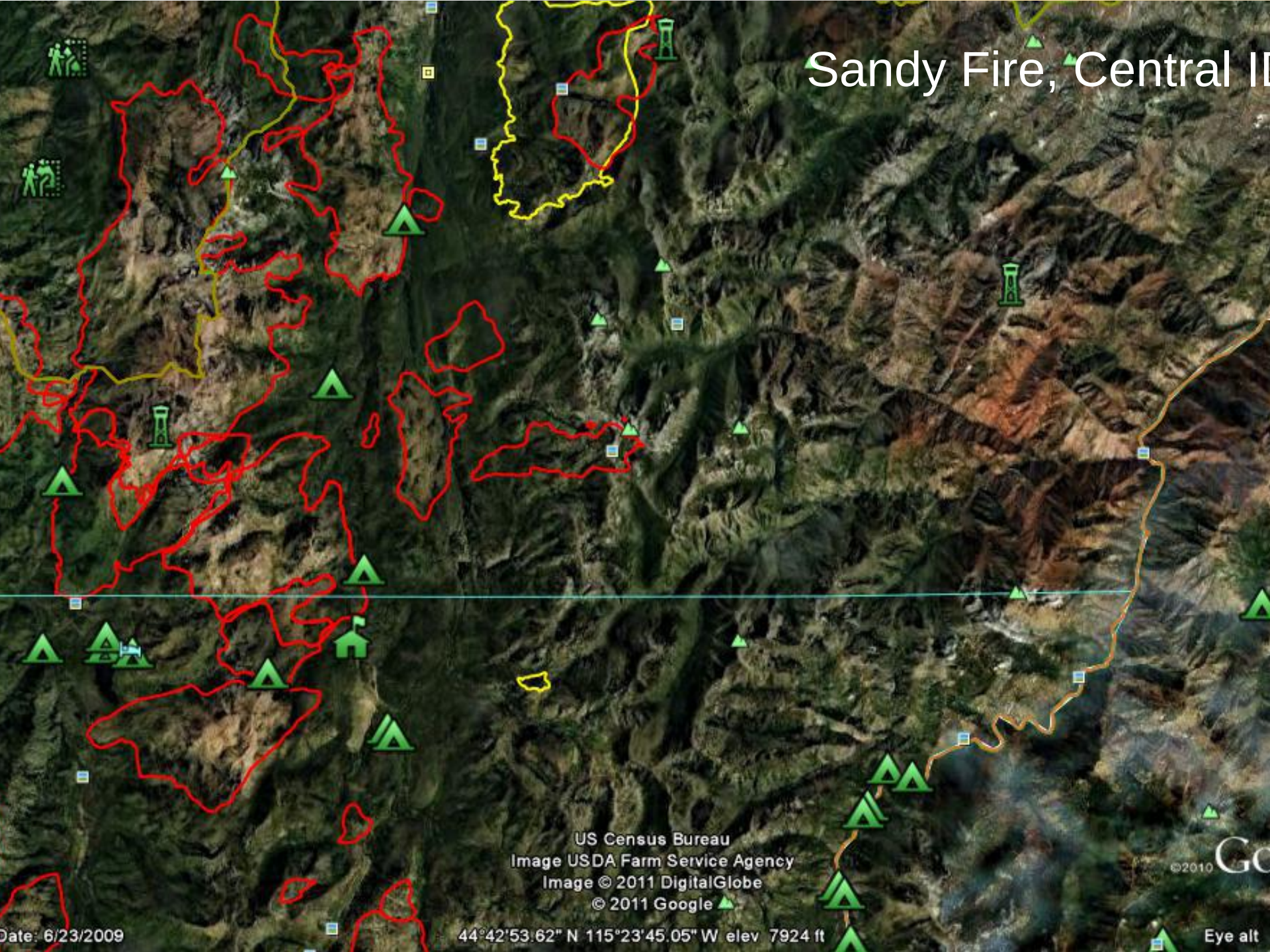
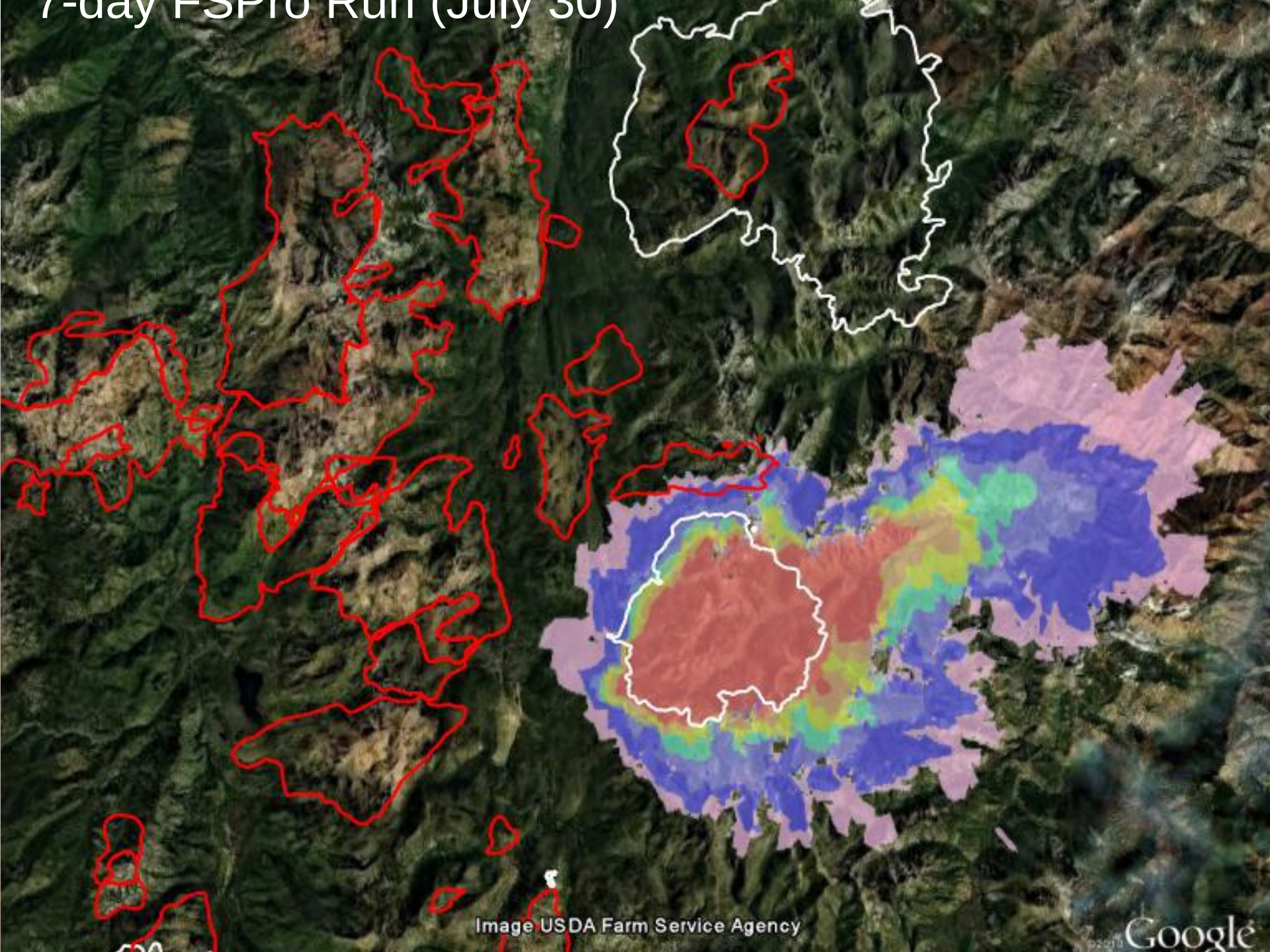
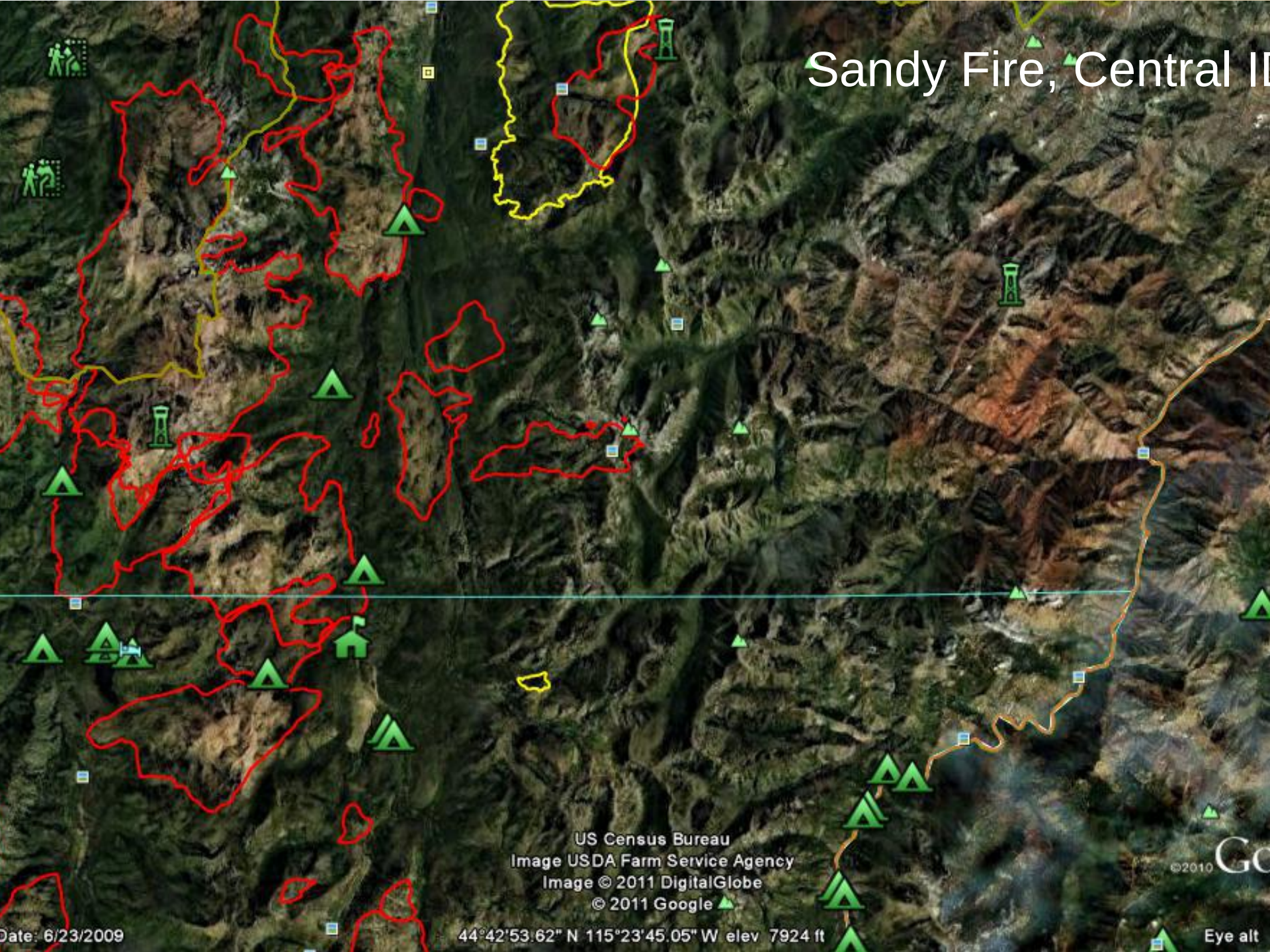

Sandy Fire, Central I
US Census Bureau
Image USDA Farm Service Agency
Image © 2011 DigitalGlobe
© 2011 Google
©2010
Date: 6/23/2009
44°42'53.62" N 115°23'45.05" W elev 7924 ft
Eye alt

7-day FSPro Run (July 30)




Sandy Fire, Central I
US Census Bureau
Image USDA Farm Service Agency
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Date: 6/23/2009
44°42'53.62" N 115°23'45.05" W elev 7924 ft
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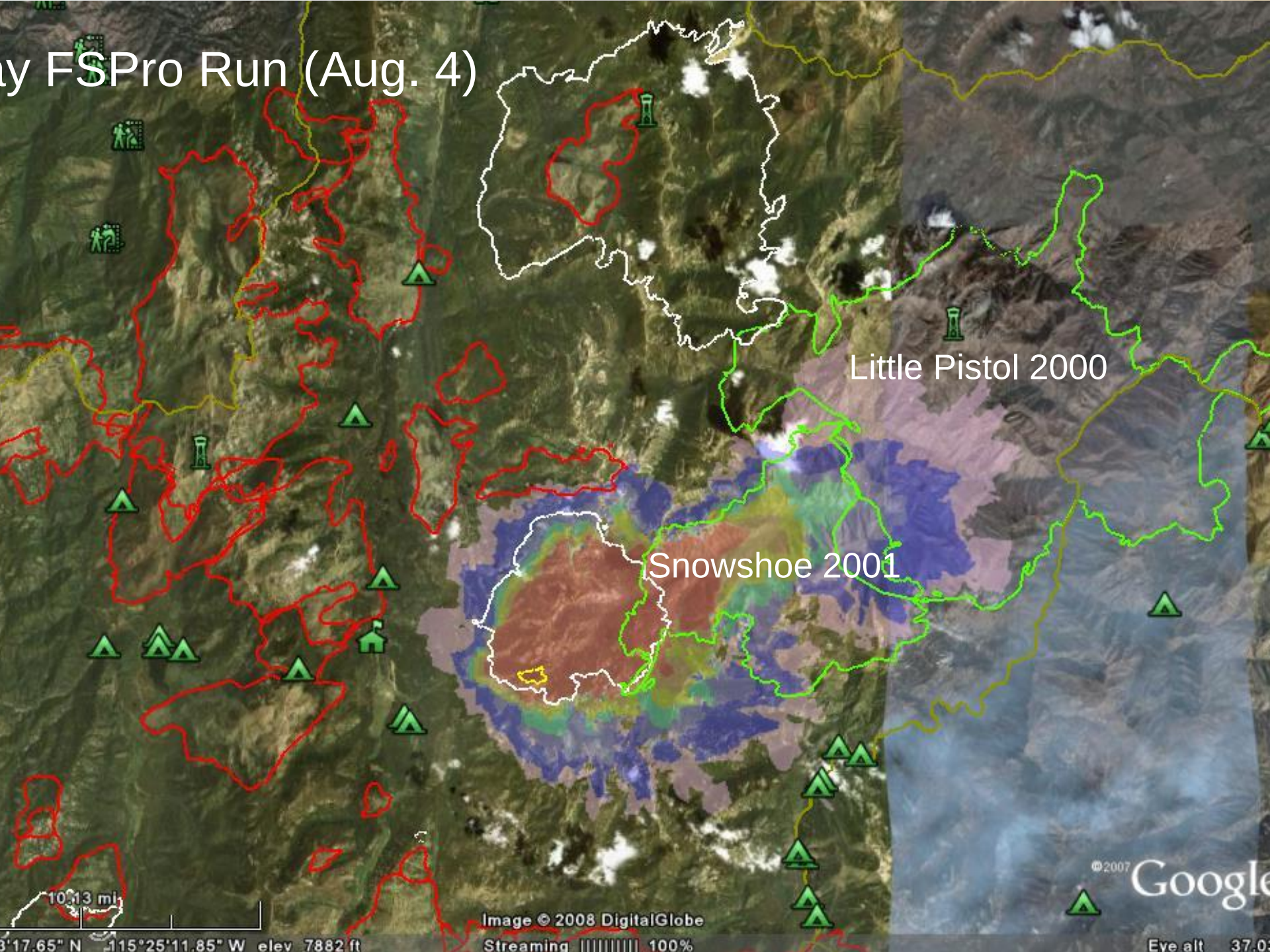
ay FSPro Run (Aug. 4)
Little Pistol 2000
Snowshoe 2001
10.13 mi
Image © 2008 DigitalGlobe
Streaming 100%
©2007 Google
3'17.65" N 115°25'11.85" W elev 7882 ft
Eye alt 37.0