

Current State of Operational Fire Modeling

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Wildland Fire in US

- ~80,000 fires per year
 - 4,000,000 – 10,000,000 acres per year (1.6-4 million ha/ year)
 - 95% burned area by 3% fires
 - Fire protection: Federal, State, County, City
-
- Who uses them? How do they use them?
What do they use them for?

Who: Manager/Modeler

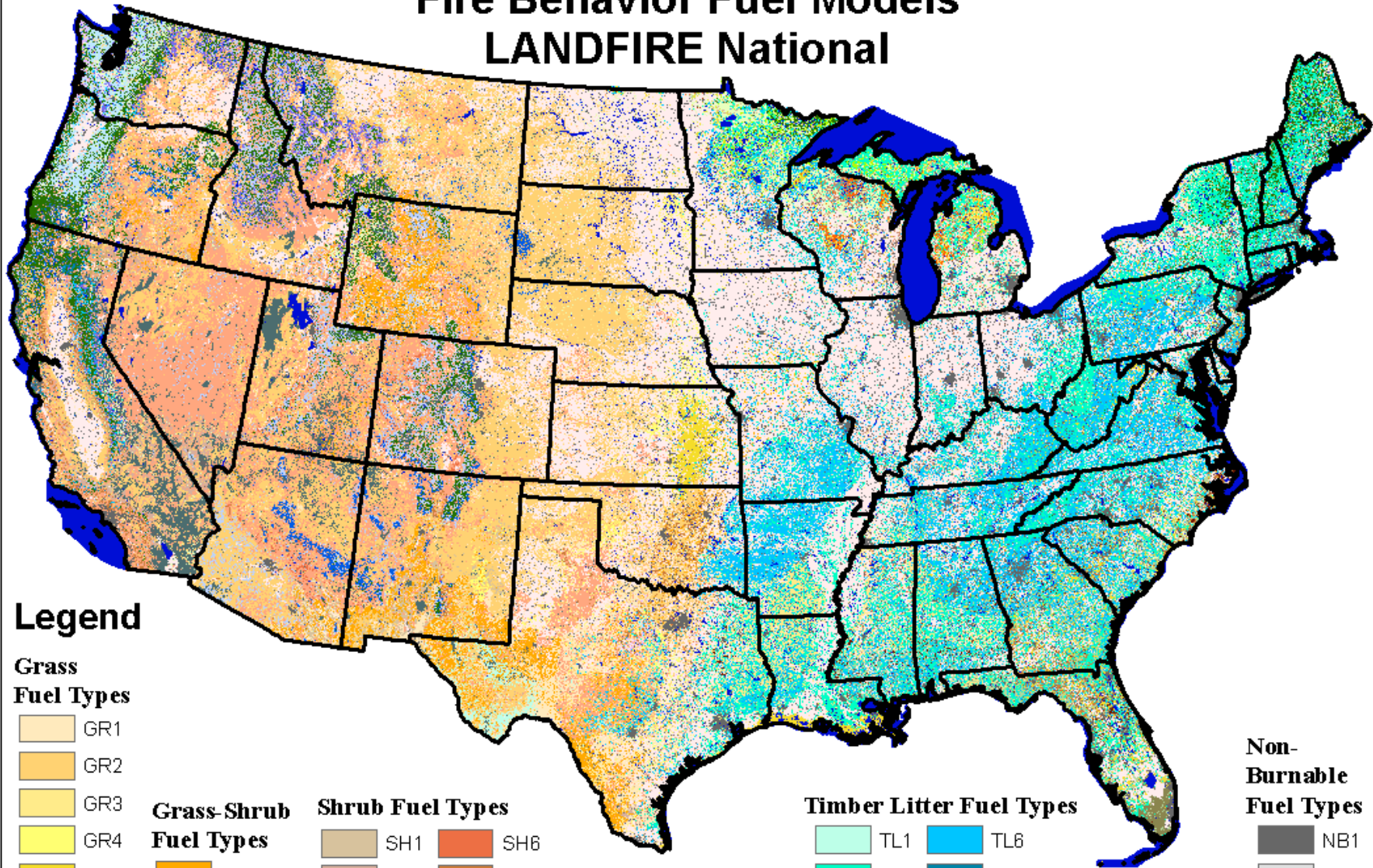
- Fire analysts do the modeling – fire/land management people
 - not modelers, meteorologists, physicists, engineers
- Variable expertise
 - Turnover in personnel (new people in and experienced people out)
 - Training limited (1 class per year, online material)
- Need common models/techniques/data etc. nationwide (for training, transportability to fires)

How: WFDSS

- Geospatial fuel data sources
 - LANDFIRE and regional sources
- MODIS fire locations & fire history
- Direct access to Nat. Weather Service weather stations
- Direct access to point and zone forecasts
- Values data – houses, infrastructure
- Wind modeling, WindNinja
- Fire Modeling servers

Fire Behavior Fuel Models

LANDFIRE National



Legend

Grass Fuel Types

- GR1
- GR2
- GR3
- GR4
- GR5
- GR6
- GR7
- GR8

Grass-Shrub Fuel Types

- GS1
- GS2
- GS3
- GS4

Shrub Fuel Types

- SH1
- SH2
- SH3
- SH4
- SH5
- SH6
- SH7
- SH8
- SH9

Timber Understory Fuel Types

- TU1
- TU2
- TU3
- TU5

Timber Litter Fuel Types

- TL1
- TL2
- TL3
- TL4
- TL5
- TL6
- TL7
- TL8
- TL9

Slash-Blowdown Fuel Types

- SB1
- SB2

Non-Burnable Fuel Types

- NB1
- NB2
- NB3
- NB8
- NB9

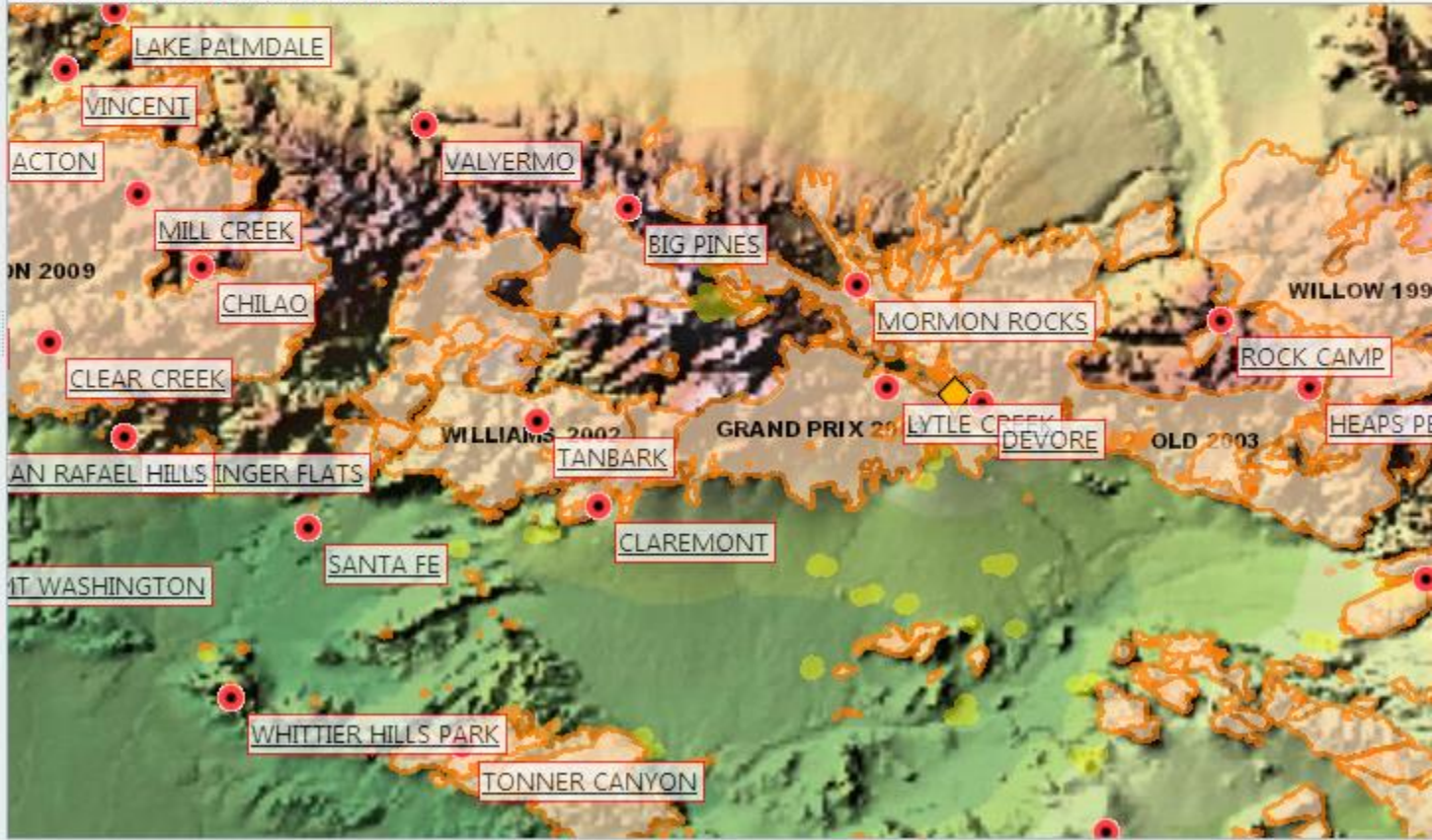
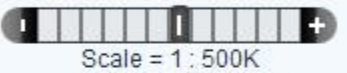
Layers

- * Fire Perimeters
- * Mgmt Action Points
- * Objective Shapes
- * Points of Interest
- Point of Origin
- Analysis
- Fire Environment and Safety
 - Incidents
 - Active Planning Area
 - Active MODIS 6
 - Active MODIS 12
 - Active MODIS 24
 - MODIS YTD
 - Est Ground Evac T
 - Retardant Avoidan
 - Aquatic Ret Avoidanc
- Disturbance History
 - WFDSS Fires Since 1/1/2013
 - Historical Wildfires
 - 2012
 - 2010-2011
 - 2000-2009
 - 1990-1999

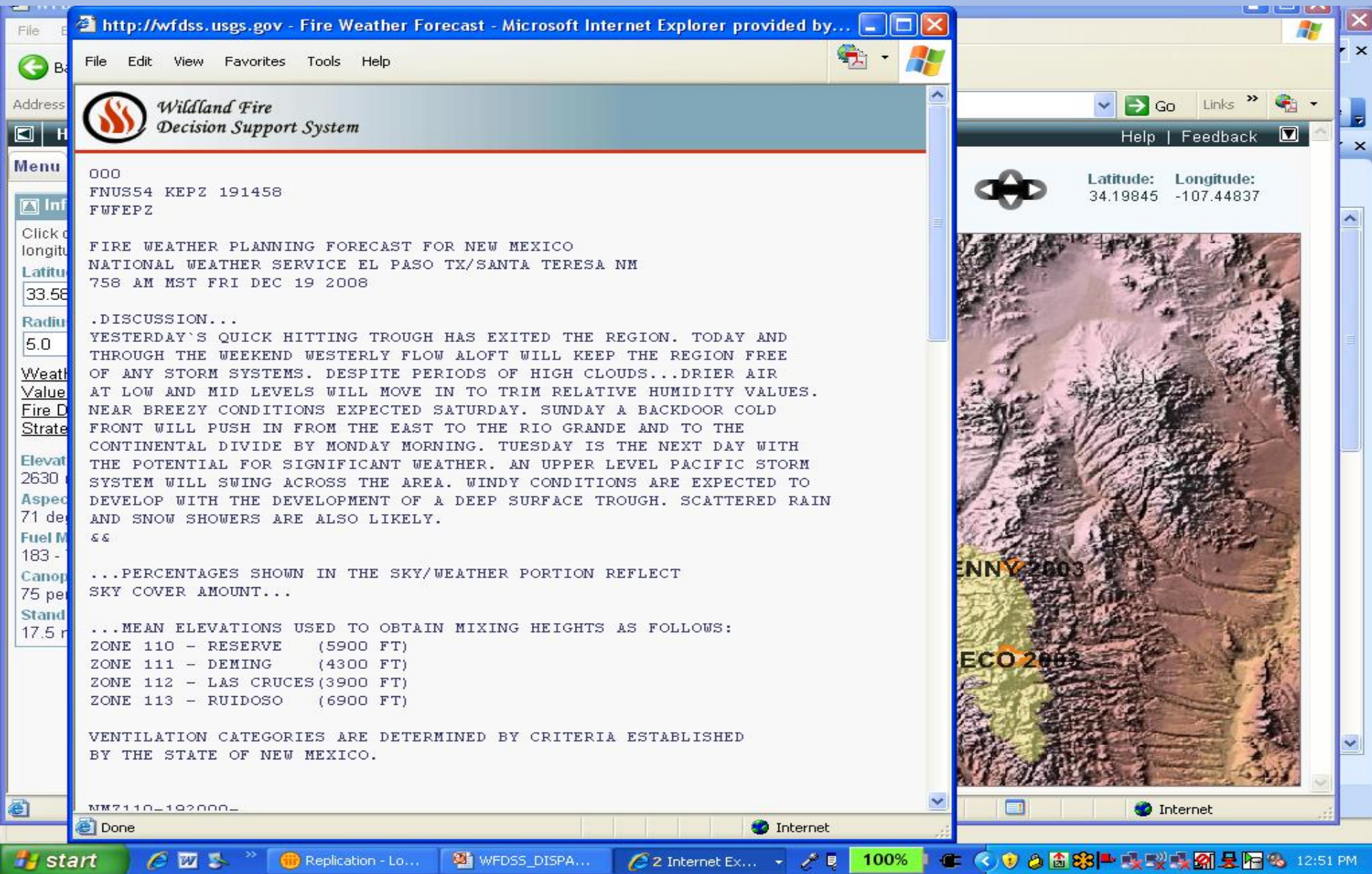
Bookmarks Messages (0)



Pan Tool: Drag to pan. Shift-click, drag, and release to zoom. Double-click to re-center and zoom.



Zone Fire Weather Forecasts



http://wfdss.usgs.gov - Fire Weather Forecast - Microsoft Internet Explorer provided by...

File Edit View Favorites Tools Help

Wildland Fire
Decision Support System

000
FNUS54 KEPZ 191458
FWFEPZ

FIRE WEATHER PLANNING FORECAST FOR NEW MEXICO
NATIONAL WEATHER SERVICE EL PASO TX/SANTA TERESA NM
758 AM MST FRI DEC 19 2008

.DISCUSSION...
YESTERDAY'S QUICK HITTING TROUGH HAS EXITED THE REGION. TODAY AND THROUGH THE WEEKEND WESTERLY FLOW ALOFT WILL KEEP THE REGION FREE OF ANY STORM SYSTEMS. DESPITE PERIODS OF HIGH CLOUDS...DRIER AIR AT LOW AND MID LEVELS WILL MOVE IN TO TRIM RELATIVE HUMIDITY VALUES. NEAR BREEZY CONDITIONS EXPECTED SATURDAY. SUNDAY A BACKDOOR COLD FRONT WILL PUSH IN FROM THE EAST TO THE RIO GRANDE AND TO THE CONTINENTAL DIVIDE BY MONDAY MORNING. TUESDAY IS THE NEXT DAY WITH THE POTENTIAL FOR SIGNIFICANT WEATHER. AN UPPER LEVEL PACIFIC STORM SYSTEM WILL SWING ACROSS THE AREA. WINDY CONDITIONS ARE EXPECTED TO DEVELOP WITH THE DEVELOPMENT OF A DEEP SURFACE TROUGH. SCATTERED RAIN AND SNOW SHOWERS ARE ALSO LIKELY.
&&

...PERCENTAGES SHOWN IN THE SKY/WEATHER PORTION REFLECT SKY COVER AMOUNT...

...MEAN ELEVATIONS USED TO OBTAIN MIXING HEIGHTS AS FOLLOWS:
ZONE 110 - RESERVE (5900 FT)
ZONE 111 - DEMING (4300 FT)
ZONE 112 - LAS CRUCES (3900 FT)
ZONE 113 - RUIDOSO (6900 FT)

VENTILATION CATEGORIES ARE DETERMINED BY CRITERIA ESTABLISHED BY THE STATE OF NEW MEXICO.

NM7110-192000-

Latitude: 34.19845 Longitude: -107.44837

ENNY 2003
ECO 2003

start | 100% | 12:51 PM

Values Inventory

http://wfdss.usgs.gov - WFDSS Values Inventory - Microsoft Internet Explorer provided by USDA Forest Service

Wildland Fire
Decision Support System

Values Inventory Information

Latitude: 33.58889 Longitude: 108.30238 W Radius: 5.0 miles

Asset	Value	Data Source	Currency	Coverage
Census Housing Values	\$0	U.S. Census Bureau	Jan 01, 2000	National coverage
Habitat: Mexican Spotted Owl	2,343 acres	Gila National Forest	Mar 01, 2008	Habitat restricted to Gila National Forest
Jurisdiction: USFS	25,579 acres	Various		AZ, CA, CO, ID, MT, NM, NV, OR, UT, WA, WY
Jurisdiction: BLM	9,359 acres	Various		AZ, CA, CO, ID, MT, NM, NV, OR, UT, WA, WY
Jurisdiction: Private	14,721 acres	Various		AZ, CA, CO, ID, MT, NM, NV, OR, UT, WA, WY
Jurisdiction: State	807 acres	Various		AZ, CA, CO, ID, MT, NM, NV, OR, UT, WA, WY

Done Internet

Fire Modeling Systems

	One Fire	Many Fires
One Weather Scenario	<ul style="list-style-type: none">• ShortTerm• NearTerm (FARSITE/MTT)	<ul style="list-style-type: none">• Basic (FlamMap)
Many Weather Scenarios (risk assessment)	FSPPro	FSim/ General Risk

Layers

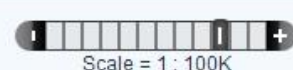
- Base Layers
- Incident
 - * Fire Perimeters
 - * Mgmt Action Points
 - * Objective Shapes
 - * Points of Interest
 - Point of Origin
- Analysis
 - * Near Term Results
 - Arrival Time
 - 1 hour interval
 - 2 hour interval
 - 3 hour interval
 - 4 hour interval
 - 6 hour interval
 - 12 hour interval
 - Burn Periods
 - Other Characteristics
 - Ignition
 - Landscape Extent
 - Fire Environment and Safety
 - Disturbance History
 - WFDSS Fires Since 1/1/2013
 - Historical Wildfires
 - 2012
 - 2010-2011
 - 2000-2009
 - 1990-1999
 - 1980-1989
 - 1979 & earlier
 - Fire Weather and Danger
 - Boundaries
 - Designated Areas
 - Infrastructure
 - Natural and Cultural Resources
 - * Unit Fire Planning

Notes

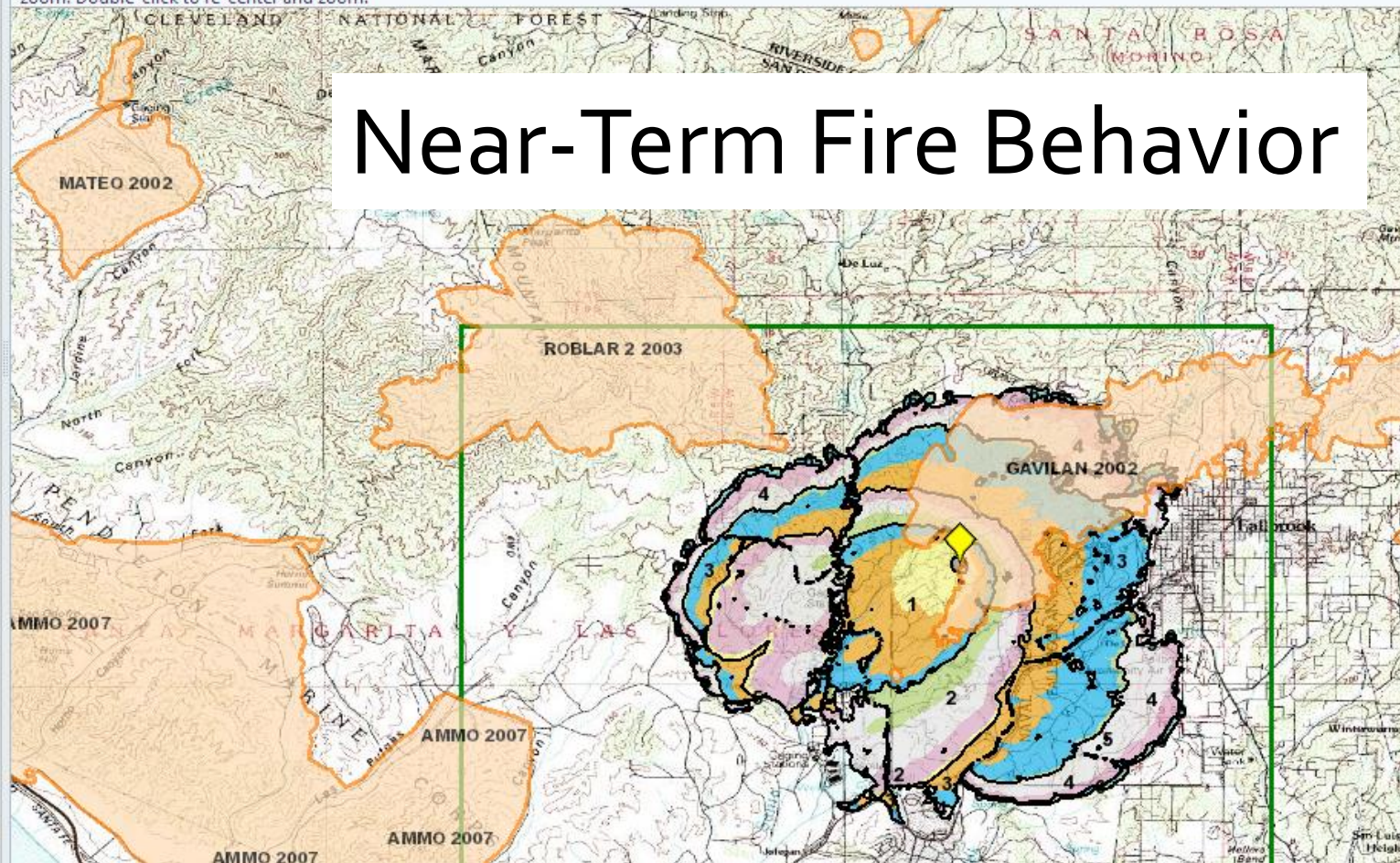
Time (CDT)	User	Note
10/08/2013 15:07	Elenz, Lisa	Analysis was completed utilizing the Wildland Fire Decision Support System for 10/5 to 10/8 with no barriers to fire spread. Calibration (LTAN) with input from Drew Smith (FBAN) for the incident. The fire perimeter shown is for the fire on 10/7. The projection utilized wind while the remainder of the days and forecasted days primarily were a SW wind.



Pan Tool: Drag to pan. Shift-click, drag, and release to zoom. Double-click to re-center and zoom.



Near-Term Fire Behavior





Pan Tool: Drag to pan. Shift-click, drag, and release to zoom. Double-click to re-center and zoom.

Basic Fire Behavior

- Layers**
- Base Layers
 - Incident
 - * Fire Perimeters
 - * Mgmt Action Points
 - * Objective Shapes
 - * Points of Interest
 - Point of Origin
 - Analysis
 - Basic Results
 - Flame Length
 - Rate of Spread
 - Fireline Intensity
 - Heat per Unit Area
 - Crown Fire Activity
 - Solar Radiation
 - 1 Hr Fuel Moisture
 - 10 Hr Fuel Moisture
 - Max Spread Direction
 - Wind Direction
 - Wind Speed
 - Landscape Extent
 - Fire Environment and Safety
 - Disturbance History
 - Fire Weather and Danger
 - Boundaries

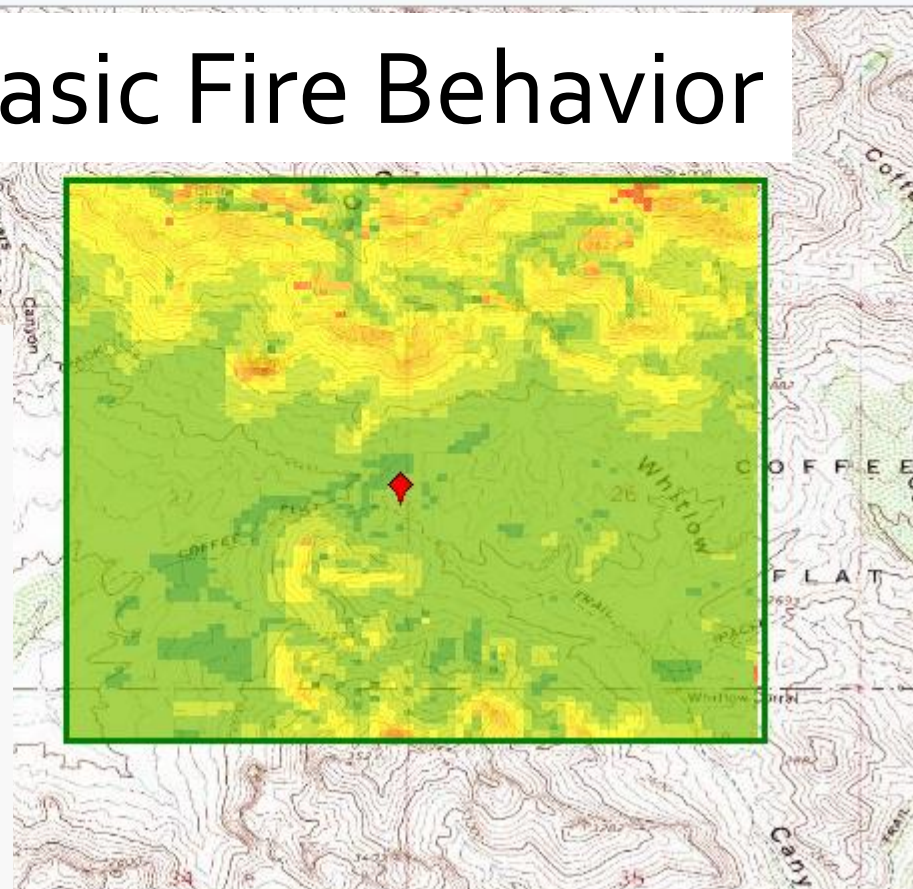


Incident	Analysis	Analysis Date	Time
Coffee	10-20-13	10/20/2013	10:00
Wind Speed	Direction	RAWS Station	
2 mph	180° azimuth	20606 - TONTO BASIN	

Flame Length Legend

Resolution: 30 meters Units: meters

Value	Freq
0.33 - 0.67	303
0.67 - 1.00	3,418
1.00 - 1.33	1,201
1.33 - 1.67	843
1.67 - 2.00	440
2.00 - 2.33	163
2.33 - 2.67	52
2.67 - 3.00	27
3.00 - 3.50	15
3.50 - 4.00	5
4.00 - 5.00	7
5.00 - 6.00	4



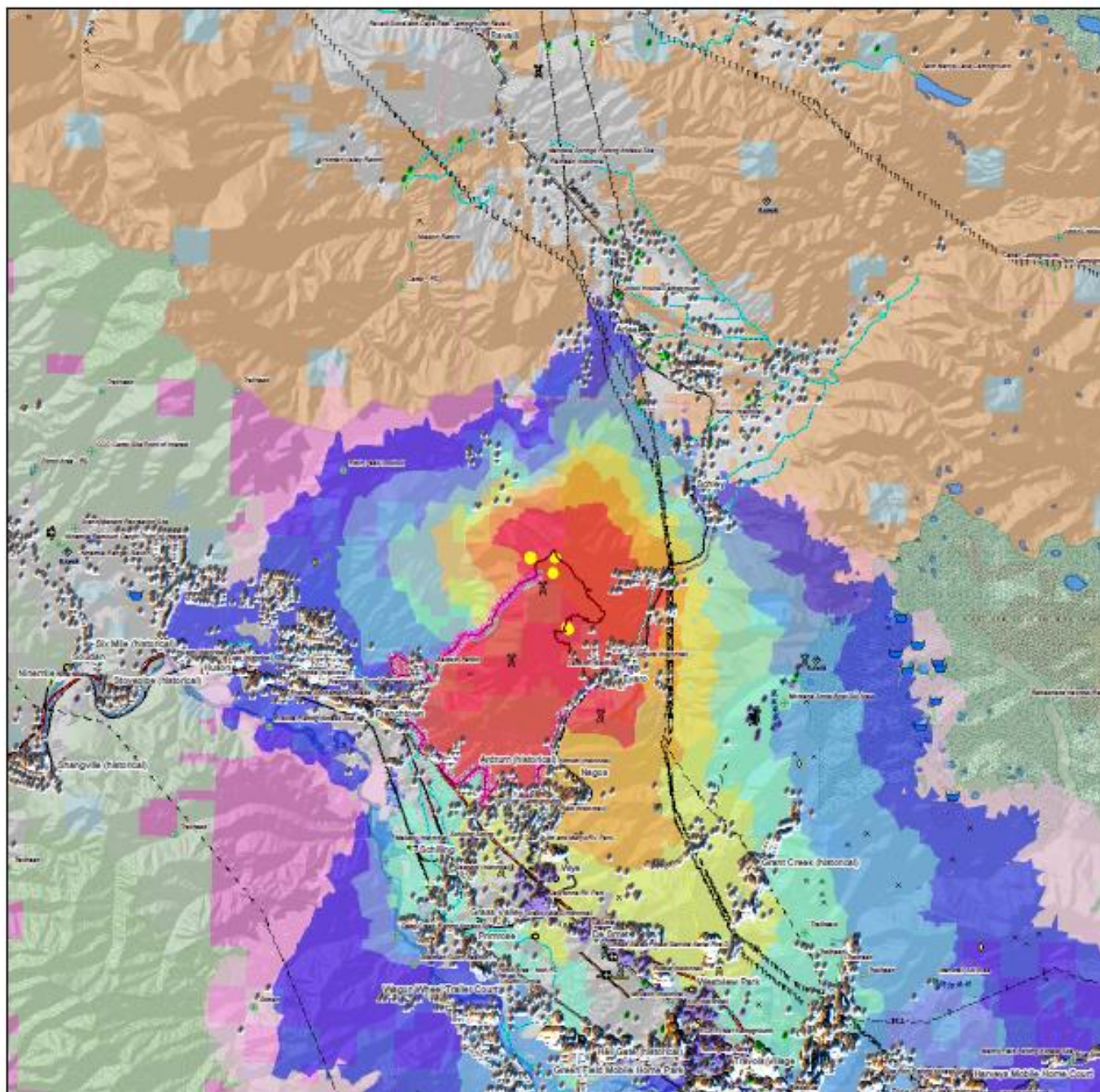


Black Cat, MT

T1_B_070827-1_jk 27 August 2007

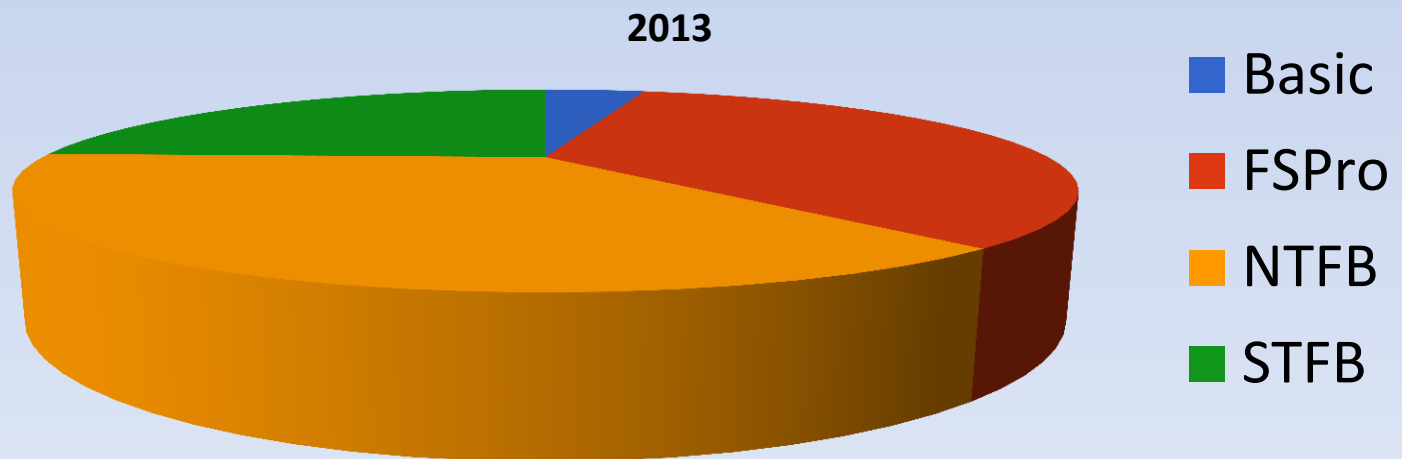
Major Values-at-Risk per
FSPro Fire Spread Probabilities:
30 days as of 26 August 2007

- FSPro Fire Perimeter: 25 Aug 0000h
- MODIS Points: 27 Aug 1200h
- 27 August 2007
- 26 August 2007
- Prior 5 Days
- Past Fires 2000-2005
- FSPro Fire Spread Barriers: 24 Aug 0000h
- FSPro Fire Spread Probabilities**
- > 80 %
- 60 - 80 %
- 40 - 60 %
- 20 - 40 %
- 5 - 20 %
- 1 - 5 %
- < 1 %
- RAVS Stations
- Building Clusters: Montana**
- Residential
- Commercial
- Exempt
- Water: Dams > 100cf
- Water Supply: Intakes
- Water Treatment Plants
- Water Pipeline - Aqueduct - Canal
- Powerlines
- Industrial Plant
- Power Pylon
- Power or Pumping Substation
- Communication Towers
- Oil & Gas Transmission Lines
- Airports
- Airport Runways
- Ski Resort Cables
- Hospitals
- Schools
- HAZMAT: Mines
- HAZMAT: Superfund Sites
- HAZMAT: Hazardous Waste
- HAZMAT: Landfill
- Other Landmarks
- Interstates
- Major Roads
- Railways



WFDSS, Number of Analyses, 2013

• Basic	FlamMap/Behave Runs	243
• Short Term	1-3 Day MTT	1,414
• Near Term	1-7 Day, FARSITE	2,133
• FSPro	7-30 Day ensemble	1,999

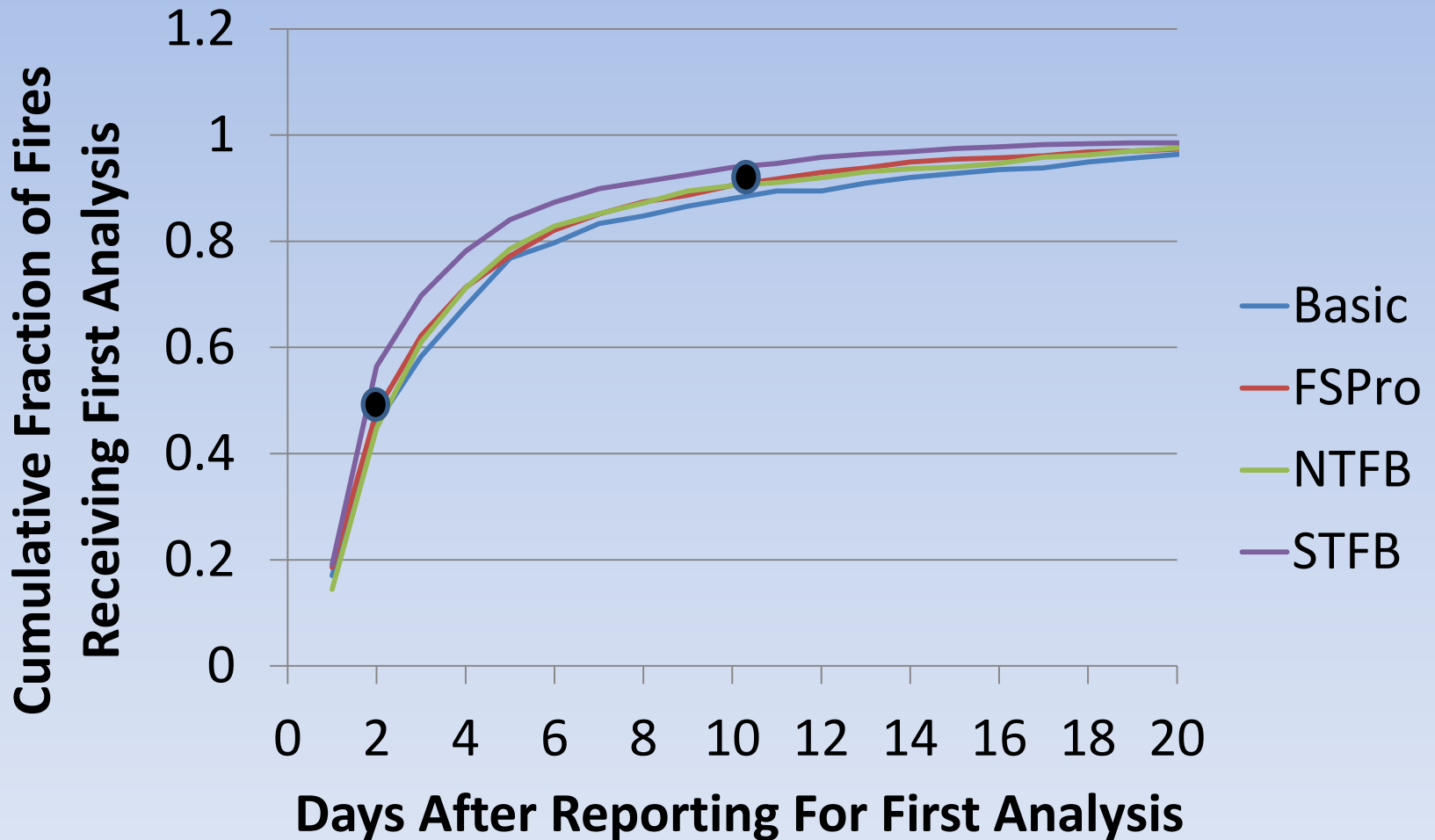


WFDSS – Fire Modeling, 2009-2013

- Number of Analyses: 24,419
- Fires with Analyses: 2,077
- Total Fires: WFDSS 60,803 (Federal)
- Total Fires: NIFC 330,782 (Fed+Non)

- Percentage of WFDSS Fires: 3.4% (2077/60803)
- Percentage of NIFC Fires: 0.6% (2077/330782)

WFDSS: Days to Run First Analysis



Interpretations of WFDSS Usage

- Most fires (>99%) have no modeling
- Most Federal fires (>96%) have no modeling
- Fires with analysis:
 - 50% by day 2
 - 90% by day 10

Fire Model

- Rothermel Spread Equation – basis for all systems
- Why?, not because it's right, but because it's useful
 - Reasonable results, ordinate fire responses to inputs
 - General, flexible for planning and operations
 - Practical fuel and weather inputs that are meaningful
 - Uncertainty dominates all inputs – and observations
- Poor understanding of real fires means that improvements aren't different enough to be appreciated.

What: Model Uses

	Operations	Planning
Objective	Safety, Strategy	Strategy, fuel mgt
Scenarios of Interest		
Weather/Wind		
Fuels		
Fire Location		
Suppression		
Time Critical		

What: Model Uses

	Operations	Planning
Objective	Safety, Strategy	Strategy, fuels
Scenarios of Interest	Predictions /Worst Case/Potential Scenarios, Risk	Worst Cases, Expectations, Risk
Weather/Wind		
Fuels		
Fire Location		
Suppression		
Time Critical		

What: Model Uses

	Operations	Planning
Objective	Safety, Strategy	Strategy, fuels
Scenarios of Interest	Predictions/Worst Case/Pot. Scenarios, Risk	Worst Cases, Expectations, Risk
Weather/Wind	Forecast/Observed/ Limited for large fires - Climatology	Assumed, very general, Climatology
Fuels		
Fire Location		
Suppression		
Time Critical		

What: Model Uses

	Operations	Planning
Objective	Safety, Strategy	Strategy, fuels
Scenarios of Interest	Predictions/Worst Case/Pot. Scenarios, Risk	Worst Cases, Expectations, Risk
Weather/Wind	Forecast/Observed/Limited for large fires	Assumed, very general
Fuels	Maps – may not be current	Maps, updated, Modified
Fire Location		
Suppression		
Time Critical		

What: Model Uses

	Operations	Planning
Objective	Safety, Strategy	Strategy, fuels
Scenarios of Interest	Predictions/Worst Case/Pot. Scenarios, Risk	Worst Cases, Expectations, Risk
Weather/Wind	Forecast/Observed/Limited for large fires	Assumed, very general Climatology
Fuels	Maps – may not be current	Maps, updated
Fire Location	Mapped /Uncertain	Assumed, Calibrated, Monte Carlo
Suppression		
Time Critical		

What: Model Uses

	Operations	Planning
Objective	Safety, Strategy	Strategy, fuels
Scenarios of Interest	Predictions/Worst Case/Pot. Scenarios, Risk	Worst Cases, Expectations, Risk
Weather/Wind	Forecast/Observed/Limited for large fires	Assumed, very general
Fuels	Maps – may not be current	Maps, updated
Fire Location	Uncertain	Assumed, Calibrated, Monte Carlo
Suppression	Highly Variable	Assumed/Ignored
Time Critical		

What: Model Uses

	Operations	Planning
Objective	Safety, Strategy	Strategy, fuels
Scenarios of Interest	Predictions/Worst Case/Potential Scenarios, Risk	Worst Cases, Expectations, Risk
Weather/Wind	Forecast/Observed/Limited for large fires	Assumed, very general
Fuels	Maps – may not be current	Maps, updated
Fire Location	Uncertain	Assumed
Suppression	Highly Variable	Assumed/Ignored
Time Critical	Hours	Months/Years

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