FSPro Calibration on the Zitziana Fire (Interior Alaska)

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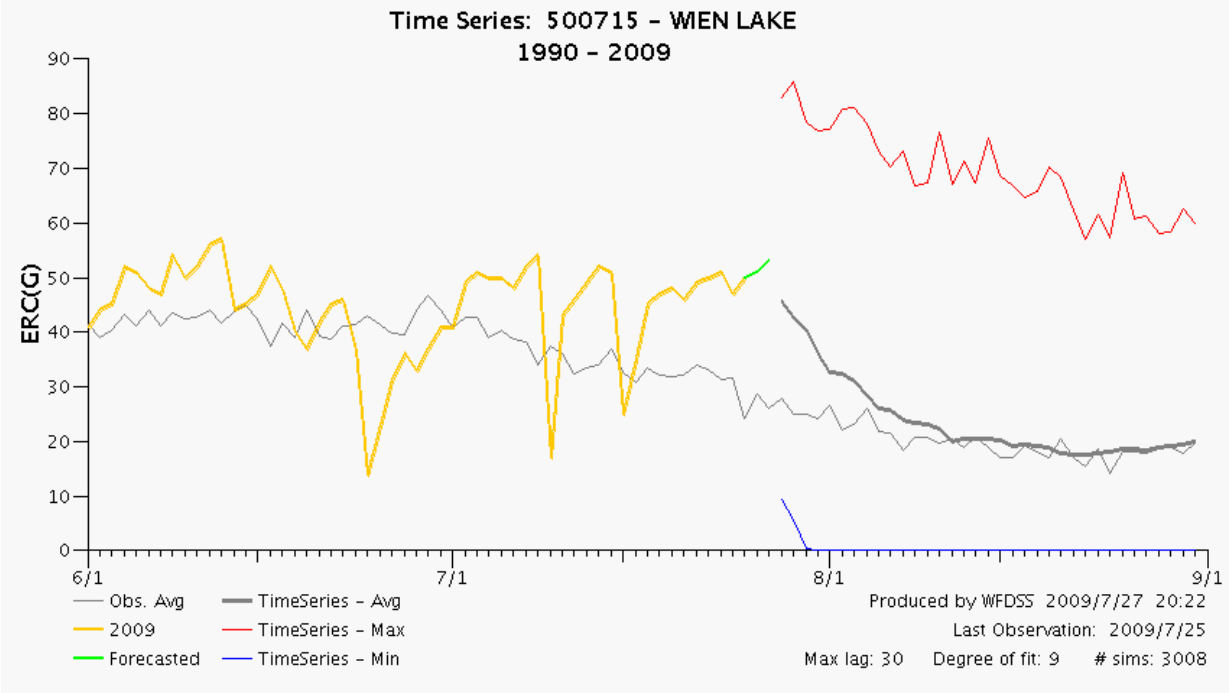
Purpose

The purpose of this paper is to document the calibration process on the Zitziana Fire (#284) so that future analysts can benefit from this procedure and findings.

Background

The Zitziana Fire was started by lightning on June 17th on State land. It is approximately 60 miles west of Nenana, AK. ERC was above average (light gray) (80th+ percentile).



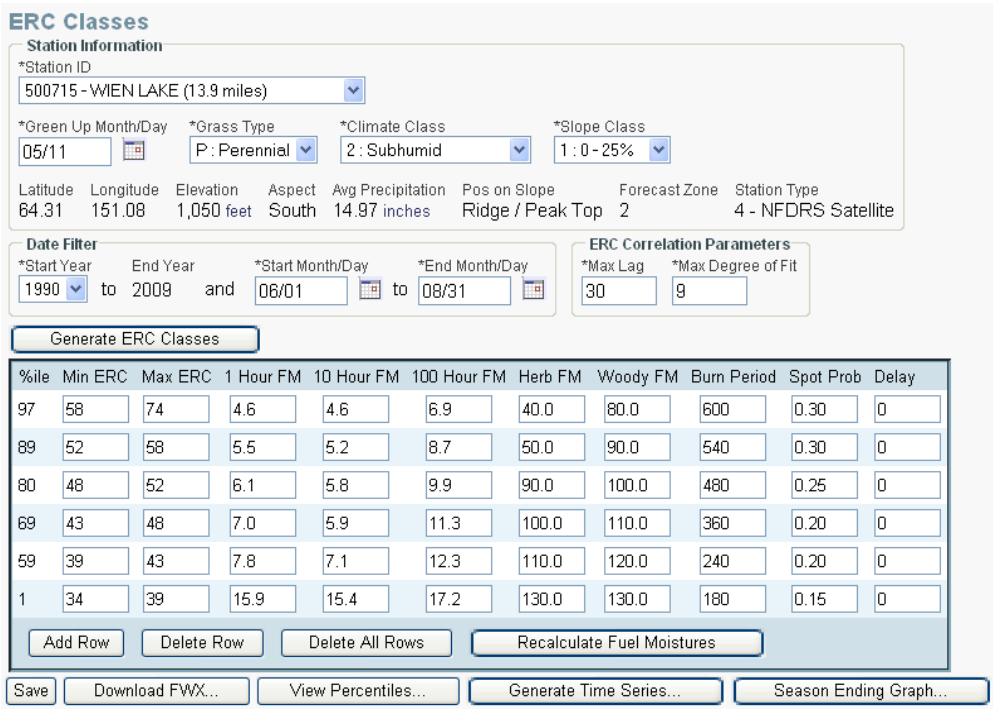
I calibrated two fires in the interior (Zitziana and Stevens Creek). I found the calibration process more challenging than past calibration exercises in the lower 48, particularly on Stevens Creek. There was several reason for this. (1) I could not find an adequate RAWS for winds (on Stevens Creek). It is critical that winds be representative of the fire area. If they are not, and you do not compensate for the misrepresentation, your FSPro simulation is practically worthless. So search diligently for a representative station even if it is not the closest station. After a thorough search, if you are unable to find a satisfactory station, you will need to manually modify the wind matrix to match weather observations and fire movement.

(2) Historical large fires were not accounted for in the existing fuel model layer. The LANDFIRE imagery that was cross-walked to the 40 fuel models was from 2000; so any fires during or after 2000 were likely not captured in the LCP.

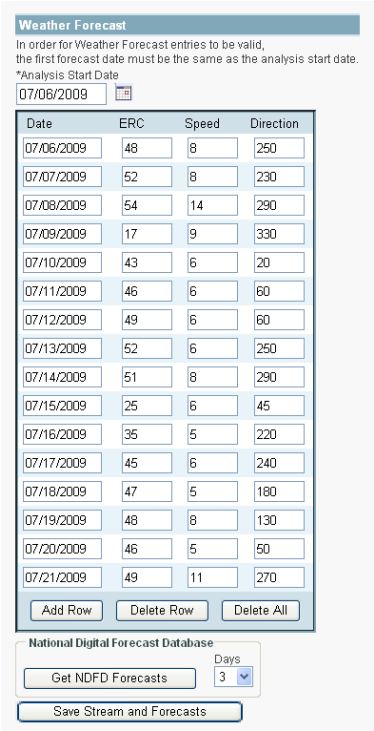
(3) Burn period and spotting were increased, even in the lower bins. Likewise, an additional bin (50th) was added for periods where the ERC dipped, resulting in marginal fire growth. Spotting was increased to simulate the group torching of black spruce.

Calibration - Inputs

- The July 6th **perimeter** was selected as the start with the 21st perimeter as the validation perimeter (16-day calibration).
- The WFDSS Alaska 2009 **fuels** data was used.
- The Wien **RAWS** (500715) was used for weather and winds.
- NFDRS calculated dead **fuel moistures** were adequate, but live herbaceous and woody fuel moisture were altered. Herbaceous fuels were increased considerably. Woody fuel moisture was increased moderately.
- **Burn period** was substantially increased from the default to account for the longer burn period.
- **Spotting** probability was increased from the default settings.



- The **weather forecast** contained 16 days and was populated with the *previously observed weather* obtained from WFDSS (ERC) [ERC Classes > "View Percentiles…" button]) and MesoWest via Roman (wind speed and direction) (http://raws.wrh.noaa.gov/roman/). DRI is also a great place to get this information (http://www.raws.dri.edu/index.html). Remember, with a typical FSPro run you would provide a forecast of a couple days. However, we are calibrating the model to known weather, hence the "forced" weather for the *entire* simulation period.



Weather Forecast

In order for Weather Forecast entries to be valid, the first forecast date must be the same as the analysis start date.

*Analysis Start Date: 07/06/2009

Date	ERC	Speed	Direction
07/06/2009	48	8	250
07/07/2009	52	8	230
07/08/2009	54	14	290
07/09/2009	17	9	330
07/10/2009	43	6	20
07/11/2009	46	6	60
07/12/2009	49	6	60
07/13/2009	52	6	250
07/14/2009	51	8	290
07/15/2009	25	6	45
07/16/2009	35	5	220
07/17/2009	45	6	240
07/18/2009	47	5	180
07/19/2009	48	8	130
07/20/2009	46	5	50
07/21/2009	49	11	270

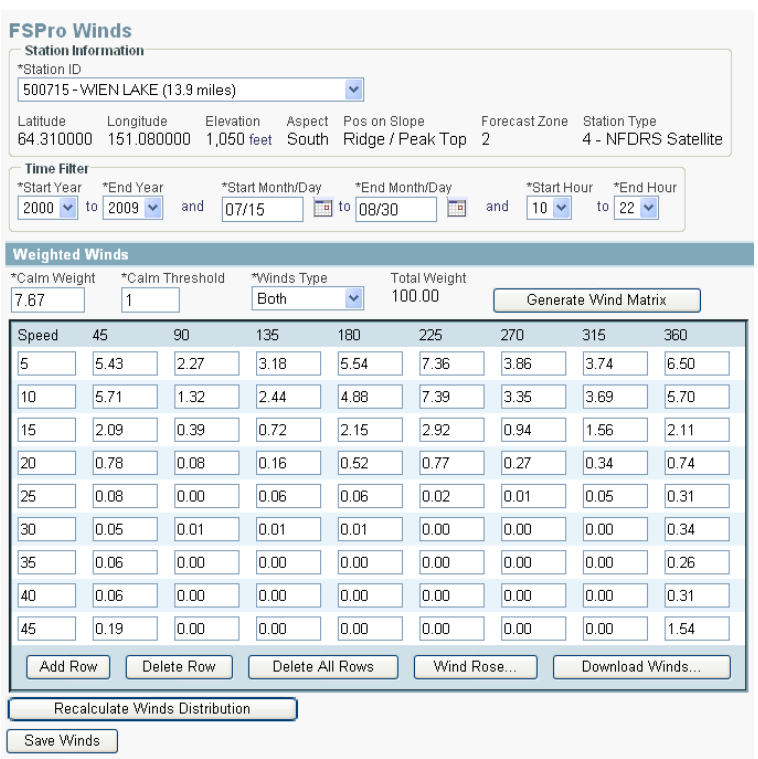
Add Row | Delete Row | Delete All

National Digital Forecast Database

Get NDFD Forecasts — Days: 3

Save Stream and Forecasts

- **Winds** were filtered by July 15 to August 30 for 1000 to 2200. Ten minute average winds and gusts were used by selecting “both.” In mild years, use the 10-minute average, otherwise use “both.” Because the wind speeds are so high when selecting “gusts,” this option is usually not recommended. If you are unsure which wind to select, run two separate scenarios, one with the 10-minute average and one with “both.” Because we have hard-wired FSPro the wind speed and direction via the forecast, it will not pull from the wind data, but saving this matrix is a required input.



FSPro Winds

Station Information

*Station ID: 500715 - WIEN LAKE (13.9 miles)

Latitude	Longitude	Elevation	Aspect	Pos on Slope	Forecast Zone	Station Type
64.310000	151.080000	1,050 feet	South	Ridge / Peak Top	2	4 - NFDRS Satellite

Time Filter

*Start Year: 2000 to *End Year: 2009 and *Start Month/Day: 07/15 to *End Month/Day: 08/30 and *Start Hour: 10 to *End Hour: 22

Weighted Winds

*Calm Weight: 7.67 *Calm Threshold: 1 *Winds Type: Both Total Weight: 100.00 Generate Wind Matrix

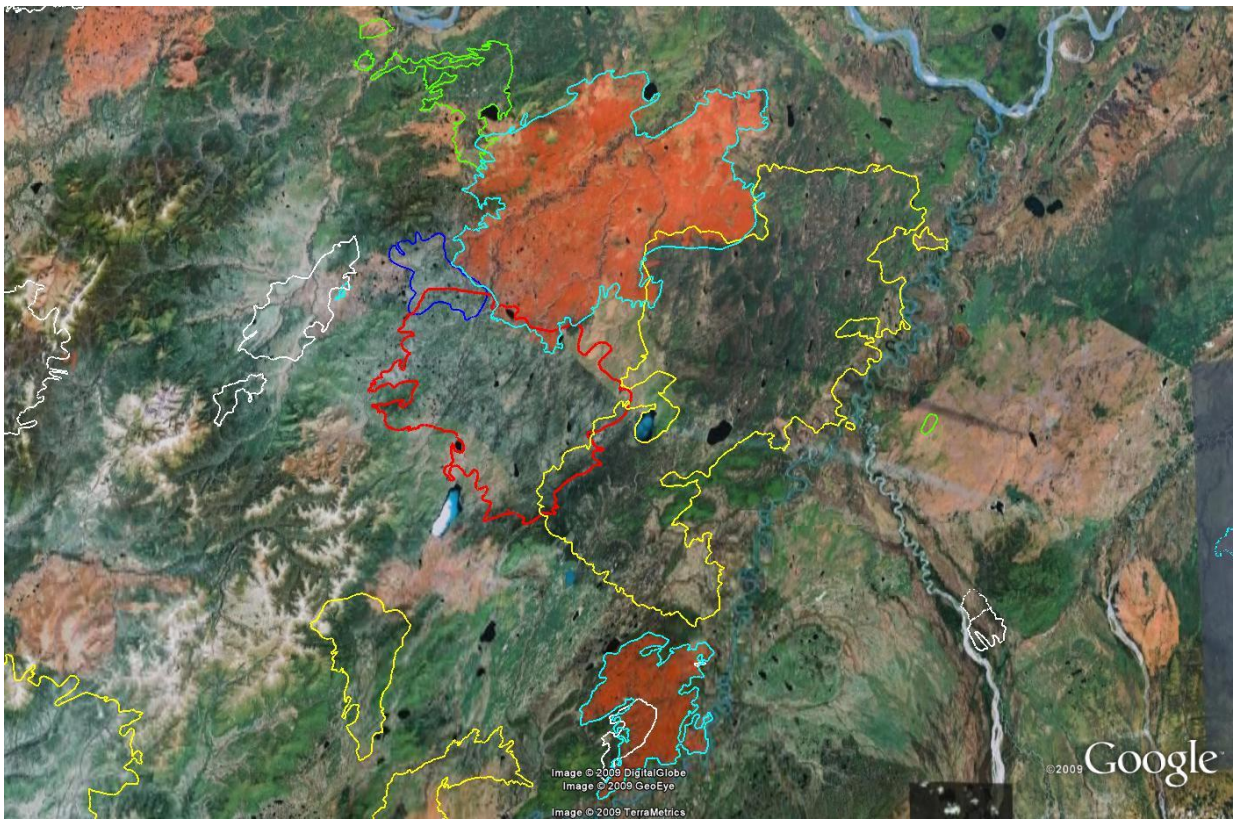
Speed	45	90	135	180	225	270	315	360
5	5.43	2.27	3.18	5.54	7.36	3.86	3.74	6.50
10	5.71	1.32	2.44	4.88	7.39	3.35	3.69	5.70
15	2.09	0.39	0.72	2.15	2.92	0.94	1.56	2.11
20	0.78	0.08	0.16	0.52	0.77	0.27	0.34	0.74
25	0.08	0.00	0.06	0.06	0.02	0.01	0.05	0.31
30	0.05	0.01	0.01	0.01	0.00	0.00	0.00	0.34
35	0.06	0.00	0.00	0.00	0.00	0.00	0.00	0.26
40	0.06	0.00	0.00	0.00	0.00	0.00	0.00	0.31
45	0.19	0.00	0.00	0.00	0.00	0.00	0.00	1.54

Add Row | Delete Row | Delete All Rows | Wind Rose... | Download Winds...

Recalculate Winds Distribution

Save Winds

- Several changes were made to the **landscape** using the WFDSS landscape editor. The most significant changes were to areas that had experienced recent fires. There were ten fires surrounding Zitziana (red line in the center). Each of these had to be imported as a mask and the fuel model was changed to either 161 (TU1) or 181 (TL1). In burned areas of black spruce 164 (TU4), the canopy cover (CC) was reduced to 10%. Crown base height (CBH) was also decreased to 0.1 m and canopy bulk density (CBD) was increased to 0.25 kg m^{-3} in fuel model 164. Below is the altered fuel layer; note the burns now attributed with the new fuel models (181 is light blue and 161 is lime green).

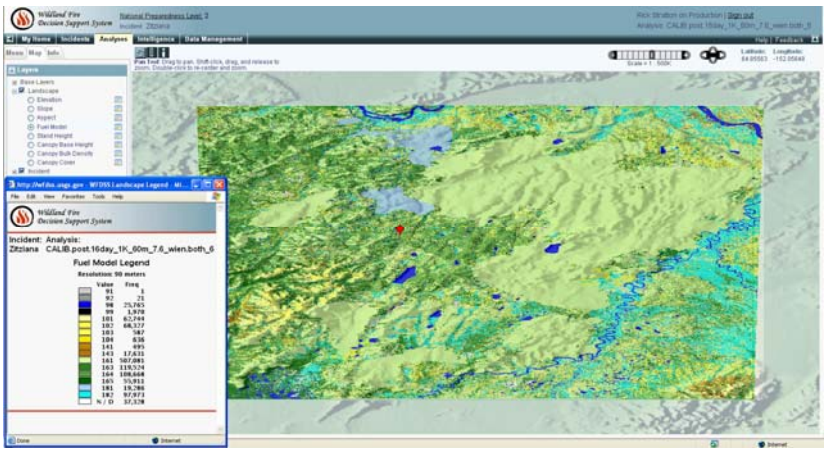


Landscape File Editor

Attribute	Rule Description
Fuel Model	If (LCP intersects 2008_Blind_Luck) Set Fuel Model to 181
Fuel Model	Else If (LCP intersects moooseheart_2007) Set Fuel Model to 181
Fuel Model	Else If (LCP intersects cosnariver_bitzshtini_bearpawmtn_2005) Set Fuel Model to 161
Fuel Model	Else If (LCP intersects johnhansen_lk_ck_gekakmina) Set Fuel Model to 161
Fuel Model	Else If (LCP intersects zitziana_bearpawmtn_2000) Set Fuel Model to 161
Canopy Base Height	If (Fuel Model is 164) Set Canopy Base Height to 0.1
Canopy Bulk Density	If (Fuel Model is 164) Set Canopy Bulk Density to 0.25
Canopy Cover	If (Canopy Cover is between 50 and 100) Multiply Canopy Cover by 0.75
Canopy Cover	Else If (Fuel Model is 164) AND (LCP intersects blind_luck; cosnariver_bitzshtini_bearpawmtn_2005; johnhansen_lk_ck_gekakmina; moooseheart_2007 OR zitziana_bearpawmtn_2000) Set Canopy Cover to 10

Add Edit Move Up Delete...

Import Rules



Calibration – Parameters & Process

- Set the **number of fires** to 1. Because a 32-processor machine at EROS does the calculations, this number will be converted to 32.
- Set the **number of days** based on the starting and ending perimeters used (16-days in this case). Set the **analysis start** date to the 1st burn period. Import the ignition file. Remember all shape files imported into WFDSS must be zipped and contain all the necessary files. When all the inputs are entered, the Run FSPro Status will state: "An FSPro Analysis can be run." Click "Run FSPro."

Note: Let the perimeter date and quality determine the calibration duration. I used 16 days because I had good perimeters for that longer time period. Usually FSPro calibration exercises are of a shorter duration (5 to 7 days). But if you have the time, longer duration calibration can yield better results because you are capturing more variability in fuels and weather. You can also calibrate using a fire run or runs (e.g., a single day event), but be sure that conditions and fuels going forward are consistent with the fire environment of the validation run. Also, when calibrating, remember to account for suppression and burn outs.

An alternative to a longer calibration run is calibrating a single day run using the same process outlined

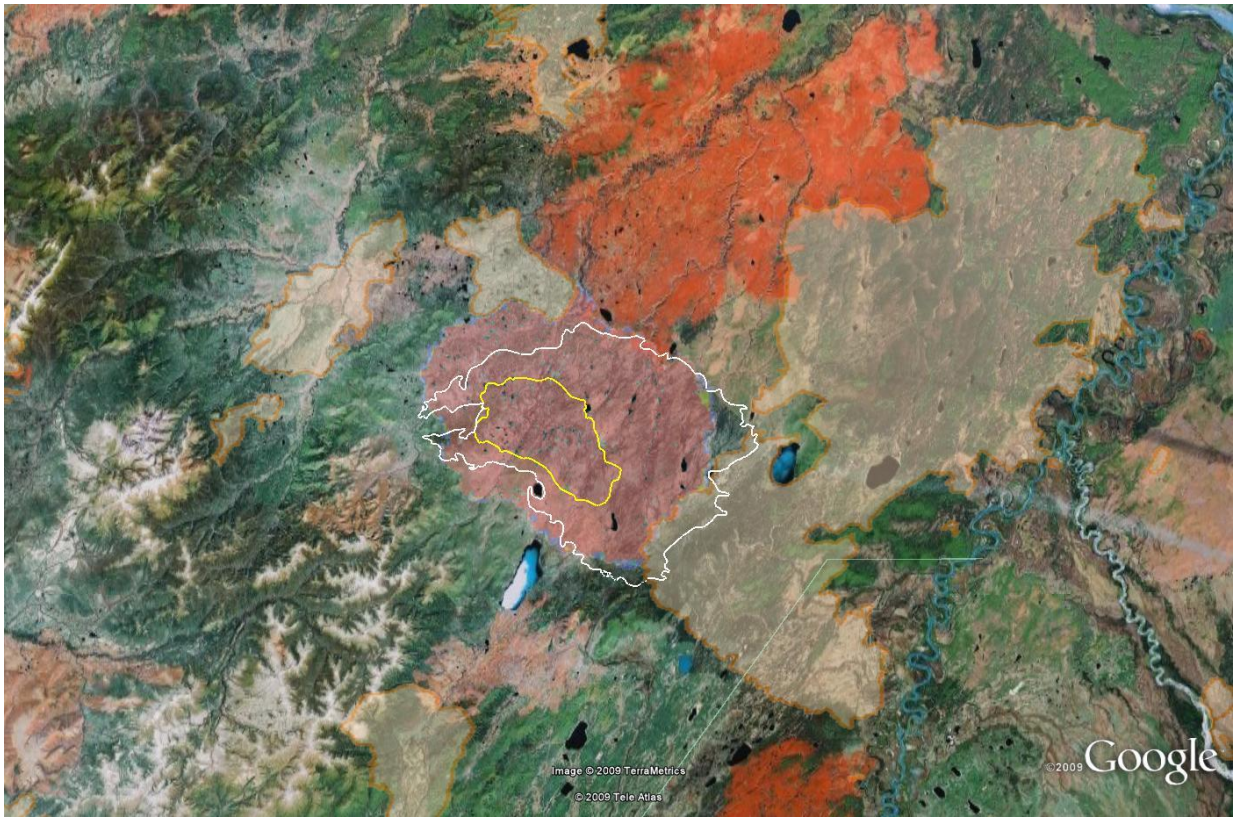
Calibration – Process

- Run 1: Usually on a first run I take the defaults, but because of prior earlier runs, I adjusted live fuel moisture, increased burn period and spotting, and modified the fuels to account for all past fires (both fuel model and canopy).

- Run 2 & 3: Decreased CC landscape-wide and CBH in fuel model 164; increased CBD in fuel model 164.

- Run 4: Looked again at the wind speed and direction. Because you have to capture all the variability in a single wind speed and direction in the forecast, this can be a very subjective process. Keep the progression of the fire in mind as you nail down the wind parameters. Look for frequency of the observations (the mode) rather than averaging values. I like input winds *between* the 10-minute average and the gusts. A paper by Crosby and Chandler (1966) can help (http://www.fs.fed.us/fire/fmt/fmt_pdfs/fmt64-1.pdf#getthemostfromyourwindspeedobservation).

- Run 5(Last; shown below): Increased spotting in the lowest bins.



NOTE: Output from the calibration runs will be mostly red due to the selection of only 32 fires. Essentially, you are viewing a MTT run where spotting was included. The yellow perimeter is the 6th and the white perimeter is the 21st. The red area is a probability of 80 to 100%—in this case 100%, so try and capture much of the perimeter, but remember it is just a model–an approximation of reality and this *crude and quick calibration technique has a lot of "moving parts" and subjectivity, so do not expect perfection*. For more information on calibration and making changes to an LCP refer to my guidebook (p. 32) on LANDFIRE fuels data manipulation (http://www.treesearch.fs.fed.us/pubs/31921).

Summary

Once your model is calibrated you will have more confidence in the output going forward. The initial days of an incident are the trickiest modeling due to unfamiliarity with the data, fire, terrain, and fire behavior. Simulations nearing a term event are also challenging. Incident FBANs, FMOs, fuel specialist, foresters, etc. need to be your eyes. Ask question and rely on them. With time, you will get to know the area, fire, and the data. The end result will be FSPro output that will lead to more informed decision making.