# Draft WFDSS/FSPro Walk-Through Guide for Alaska

July 22, 2008

## A. Running an FSPro Analysis

1. FSPro Information

After you accept or copy an analysis, go to FSPro Information. First give the analysis an appropriate name. Next, change the number of fires to 100 (or less). Generally, don't do more than 100 fires on the initial run. In addition, you should take the time period down to seven days on the initial run. If an ignition file exists, select it, otherwise, you will need to upload one or digitize one later in the process.

Hit the Save button and then select ERC Classes from the Menu on the left.

2. ERC Classes

First choose what weather station you want. In theory, the weather stations that are listed have 10 years of weather observations. However, this is not necessarily true in the case of Alaska. Once you have selected a weather station, take a look at the Green Up Month/Day to insure that it is accurate. Change the Green Up Month/Day if it defaults to 01/01. Next, consider changing the Start Year in the date filter. Most areas in North America began to experience warmer summer climate patterns sometime after 1985 – 1995. If you want to take this into consideration, then the Start Year should generally be when this shift occurred. On the other hand, you way want to use a Start Year that captures a longer Time Filter for weather inputs. The Start Month/Day and End Month/Day should roughly correspond to the dates of the fire season. Depending on the location of the fire, in Alaska the Start Month/Day will often be somewhere between 5/1 and 6/1 and the End Month/Day will be somewhere between 8/1 and 9/1. Note, the ERC Start Month/Day will need to be at least 31 days before the start of the analysis.

Next click Generate ERC Classes. By default, FSPro sets the lowest ERC percentile class at 60%. Within FSPro, there is no fire spread on days in which the ERC value is less than the lowest percentile class listed. If you want to allow fire spread below the 60$^{th}$ percentile, click on the Add Row button. A new row will be added with a default Min ERC value of zero. To pick an appropriate Min ERC value for the new ERC Class, click on the View Percentiles button. You may want this new ERC Class to go down to the 50$^{th}$ percentile. If so, pick the ERC value next to the 50$^{th}$ percentile and enter it in as the Min ERC value for the new row. Next, click on the Recalculate Fuel Moistures button to populate the fuel moisture values in the new row. Additional rows can be added by clicking on the Add Row button again.

The Herbaceous and Woody fuel moistures will likely be too low by default and should be changed. These are very important inputs and will likely adversely affect your analysis if the default values are used. The only time you would probably want to stick with the default values would be if you were doing the analysis during pre-green-up. In the absence of local/expert information, the following are likely to be better numbers to start with than the default entries for Herbaceous and Woody fuel moistures:

| %ile | Herb FM | Woody FM |
|---|---|---|
| 97 | 30 | 50 |
| 90 | 60 | 55 |
| 80 | 90 | 70 |
| 70 | 110 | 100 |
| 60 | 115 | 110 |
| 50 (if added) | 120 | 120 |

Note, per conversations with Skip Theisen woody fuel moisture values may need to be significantly lower since Alaska brush species have volatile chemicals that can cause them to burn actively even when the calculated live fuel moistures are not very low.

Next, look at the Burn Period values. These are in units of minutes. Because of the long daylight hours in Alaska, we would probably want to increase the length of the burn period, especially on the highest burning days. The default burn period for the 97$^{th}$ percentile is 360 minutes, thus 6 hours. For Alaska, Skip Theisen suggested increasing the burn period to 10 hours for both the 97$^{th}$ and 90th percentiles, 8 hours for the 80$^{th}$ percentile, 6 hours for the 70$^{th}$, 4 hours for the 60th and 2 hours for the 50th percentile classes.

Next, look at the Spotting Probability values. These values correspond to the Ignition Frequency in FARSITE according to Rob Seli. The FARSITE Help Menu describes Ignition Frequency as “the percentage of live embers that cause ignitions. This setting is NOT equivalent to a calculated Probability of Ignition.” Since black spruce spots prolifically, Rob Seli suggests using a value of 2% (0.02) even at the 60$^{th}$ percentile. Based on preliminary testing by Pat Stephen the following are given as suggested starting values:

| %ile | Spotting Probability |
|---|---|
| 97 | 20% (0.2) |
| 90 | 20% (0.2) |
| 80 | 15% (0.15) |
| 70 | 10% (0.1) |
| 60 | 2% (0.02) |
| 50 (if added) | 2% (0.02) |

Once you are satisfied with the ERC Class inputs, hit the Save button.

3. ERC Stream

FSPro automatically moves to the ERC Stream page after you hit Save on the ERC Classes page. Under ERC Stream, FSPro enters in the Current ERC values up to the most recent observation. If you want to add a weather forecast, click on the Add Row button beneath the Weather Forecast heading. The first forecast date will need to be the same as the burn start date. Enter in an appropriate ERC value and wind speed/direction for the forecast. The forecast that is input will be used for all runs in the analysis and so it is very important that the inputs (especially the wind directions) are correct. If you have confidence in the weather forecast, add more rows and enter in a longer weather forecast. The number of days used in the Weather Forecast (generally 1 – 5, but no more than about 30% of your analysis duration) should be based on your confidence in the quality of the forecast. If you don't have confidence in the forecast beyond day 3, don't include it. (Note that the Get NDFD Forecasts option is not currently available in Alaska.) When you are satisfied with whatever forecast you enter, click on the Save Stream and Forecasts button. Then select Winds from the Menu on the left.

4. Winds

First select a station to draw wind observations from those listed in the drop-down list. In theory, the stations listed here have at least 5 years of hourly wind observations. However, this does not necessarily appear to be the case in Alaska. Under the Time Filter, first select a Start Year and an End Year. Next select the Start Month/Day and End Month/Day. For Winds, the Start Month/Day and End Month/Day should be windowed down closer to the analysis period. Window down the winds to approximately two weeks before and two weeks after the analysis period. This contrasts with the ERC Time Filter in which the Start Month/Day and End Month/Day are set up to capture the entire fire season. Next select a Start Hour and an End Hour. The Start Hour and End Hour should more or less coincide with the burn period at the 97$^{th}$ percentile. If you entered a 10 hour burn period at the 97$^{th}$ percentile, then select a Start Hour and End Hour that cover a 10 hour period. A typical Alaskan Start Hour would be 11 and End Hour would be 21. But since all the weather station observation times are based on Alaska Standard Time, the Start Hour/End Hours will likely change depending on whether the fire is in eastern Alaska or western Alaska (per Skip Theisen).

Next select a Winds Type. The current recommendation is to use "Both" under most conditions. "Both" is an equally weighted combination of the Ten Minute Average and Gusts. If the fire for which you are running FSPro has been experiencing extreme fire behavior/spread, you should consider using Gusts instead of Both. After you have selected a Winds Type, click on the Generate Wind Matrix button.

On the wind distribution table, you should consider adding rows until you get the right amount of winds. By default, the maximum wind may be 20 or 25 mph. If

the probabilities are greater than (0.25), it would probably be good to add other rows to allow for the potential of 30 or perhaps as high as 50 mile an hour winds, depending on the winds that your fire is experiencing. After you add more records, click on the Recalculate Wind Distribution button. Click on the Wind Rose button to view a Wind Rose for the weather station. It is highly recommended that you study this wind rose to determine if the winds that will be used in the FSPro analysis are reasonable for the fire you are trying to model. When you are satisfied with the wind distributions, click on the Save Winds button.

5. Landscape

If this is the first analysis for an incident, you will need to create a Landscape File (.lcp). By default, the Landscape extent values will be 0. These values must be populated in order for FSPro to generate a .lcp file. To populate the extent values, click on Draw Extent in the Menu.

6. Draw Extent

FSPro will default to an area around the fire ignition location with a USGS topo background which gives a very distorted view of the world for Alaska and other northern latitudes. Click on the Map tab in the upper left side of the screen. Select Google Maps under the Base Layer. To draw a new landscape extent, click on the  button on the upper tool bar. Left click, hold down the left button and drag until you have made a box the size you want. If you do not get the desired size the first time, use the “eraser” button on the toolbar.

The extent values of the bounding box will appear under Analysis Extent. Click on the Save button to use these extents. Next Click on the Menu tab and then Landscape.

7. Landscape

The Landscape extent values are now populated with those from the bounding box. The resolution will default to 90 meters. Keep the resolution at 90 meters for your FSPro analyses. The Landscape Data Source should be AK Tanana Zone. Click on the Save button to save these inputs. If you want to use the AK Tanana Zone .lcp in its original format, then click on the Create LCP File button. If you want to apply rules to improve the AK Tanana Zone .lcp file, then you will need to apply rules in the Landscape Editor before “creating” the .lcp file. However, before going to Landscape Editor, go to Shape Upload.

8. Shape Upload

Shape Upload gives you the ability to upload a fire perimeter shapefile, a fire barrier shapefile or a landscape mask. If you have a fire perimeter shapefile that you want to use as the ignition source for an analysis, upload it here. The shapefile (and all associated files, including the .prj) will need to be zipped before uploading. Upload the .zip file. If you do not have a fire perimeter shapefile to

use as the ignition source, you will need to digitize one under the Draw Extent screen.

You can also upload Landscape Masks on the Upload Shapefile screen. Landscape masks are useful for uploading shapefiles for recently burned areas so that changes can be made to the .lcp file. Currently, we are recommending the following (coarse scale) changes be made to the .lcp file to areas that have burned since 1990.

| Fire Years | Fuel Model |
|---|---|
| 2005 - 2007 | TL1, 181 |
| 2003 – 2004 | TU1, 161 |
| 1990 – 2002 | SH2, 142 |

These changes require further testing. Skip Thiesen would advocate using a barrier for burns up to 30 years old. To implement these changes, make three separate shapefiles of fires within the area of the fire for the three periods and upload the zipped files as Landscape Masks. Once you've uploaded any Landscape Masks that you want to use, go the Landscape Editor.

9. Landscape Editor

Currently, we are recommending that the following rules be made in the Landscape Editor:

| | | |
|---|---|---|
| Fuel Model | If (Elevation is between 780 and 3000) Set Fuel Model to 99 | |
| | Fuel Model | Else If (LCP intersects 2005-2007 TL1) Set Fuel Model to 181 |
| | Fuel Model | Else If (LCP intersects 2003-2004 TU1) Set Fuel Model to 161 |
| | Fuel Model | Else If (LCP intersects 1990-2002 SH2) Set Fuel Model to 142 |
| | Fuel Model | Else If (Fuel Model is 142) Set Fuel Model to 164 |
| | Stand Height | If (Fuel Model is 164) Set Stand Height to 6.0 |
| | 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 0.20 |

| | | |
|---|---|---|
| | Canopy Cover | If (LCP intersects 2005-2007 TL1) Set Canopy Cover to 0 |
| | Canopy Cover | Else If (LCP intersects 2003-2004 TU1) Set Canopy Cover to 0 |
| | Canopy Cover | Else If (LCP intersects 1990-2002 SH2) Set Canopy Cover to 0 |
| | Canopy Cover | Else If (Fuel Model is 164) Set Canopy Cover to 35 |

10. Landscape

Once you have the Landscape Editor rules in place, click on Landscape in the Menu and click on Create LCP File. After the Landscape File has been created, go to View Landscape. Look at the fuel models layer as well as the canopy cover layer and legends to verify that the changes you made show up in the layer. The order of the rulesets used in Landscape Editor are important.

When you are satisfied that your landscape is what you want, go to FSPro Information.

11. Draw Extent

To digitize a fire perimeter, first zoom into the area of interest. Next click on the  button. Move the mouse cursor onto the screen and begin digitizing the perimeter. Double-click to finish the digitized sketch. Enter in a Shape Description and then select Fire Perimeter as the Shape Type.

12. FSPro Information

If you have not yet selected your ignition file, be sure to do so now. Then click on the Save button. Next, double and triple check that you have the desired number of fires and days, re-save. Click on the Run FSPro button to run an FSPro analysis.

## B. Calibrating an FSPro Run

Although it is difficult and time-consuming, doing “calibration” runs is important to validate your FSPro inputs: ERCs, winds, live fuel moistures, as well as the landscape files. To set up an FSPro calibration you will need a GOOD location of the fire origin as well as a fire perimeter after the fire has grown at least a few hundred acres. Trying to calibrate on a small fire is not recommended.

You can use the fire’s origin (either hand-digitized or an uploaded shapefile) as your ignition. Upload a fire perimeter that you wish to calibrate to… again, it

needs to be at least a few hundred acres and shouldn't be more than a few days. When you upload this perimeter, choose shapefile type as "Final Fire Perimeter" (even though in reality it is not the final one.)

Work through the FSPro screens as described above. On the Information page, set your number of fires to 1. The "number of days" will depend on the time between your origin and the fire perimeter you are calibrating against. For instance, if your fire started on July 6th and the first good perimeter you have is for July 10th, choose 5 days for the fire duration. This would be a good time to do a Shape Upload to load the perimeter you want to use as the "Final Fire Perimeter".

Make sure that you have "generated ERC classes", edited the woody and herbaceous fuel moistures, burn period and spotting (as described above) and saved this screen before proceeding to the ERC Stream screen. The ERC Stream screen should give you the most recent ERCs. On the ERC Stream page under Weather Forecast you will need to set the Burn Start Date. This should be the date of your fire origin (or the first fire perimeter you are using for calibration).

Then click on "Add Row" for each of the days of forecasted weather needed. This will be the number of days you used on the Information screen, which is the number of days between the fire origin (or an earlier perimeter) and the fire perimeter you are using to calibrate against (uploaded as a Final Fire Size). Enter the ERCs (from weather stream) for each day as well as wind direction and speed (from actual weather observations, ROMAN, WRCC or where ever you can get the best information). It is critical to get these as accurate as possible since FSPro will use only these values for the duration of your calibration run. Save Stream and Forecast.

At this point it would be good to go to the Draw Extent screen. Click on the Map tab and zoom into your fire area. From the Overlays options choose Final Fire Size (this is your uploaded perimeter that you will be calibrating against) and clip your landscape (using the  button) to just a little larger than the perimeter.

Next add the necessary Landscape Editor rulesets then on the Landscape screen "Create Landscape". Use the View Landscape to ensure the landscape is as you expect.

After you've checked over your work, Run FSPro. If you clipped your landscape and have only requested 1 fire and a few days forecast, the run should be completed within a couple of minutes. Evaluate your run by comparing your "final fire" perimeter with the red 80-100% probability contour. Since you've used a forecast for each day of the run, this contour is the fire perimeter that FSPro is projecting. If your perimeter does not fit well with the red contour, determine what you want to change before doing another run. Perhaps the winds used in

the “forecast” were incorrect, perhaps your burn period was too long, live fuel moistures too high, or maybe changes need to be made to the landscape. Make only one “tweak” at a time so you can determine what is working and what is not. Once you’ve gotten things to match reasonably well, you will have some good ideas of the inputs needed for further FSPro analyses for your fire.

If your fire has been growing for several days you can calibrate on two different perimeters instead of the fire origin.

**IT IS IMPORTANT TO NOTE THAT WFDSS / FSPro IS A “PROTOTYPE APPLICATION – Currently Under Development”.**

**FSPro IS DYNAMIC AND CHANGING WEEKLY. WHAT YOU SAW LAST WEEK MAY BE DIFFERENT TODAY. IT IS VIRTUALLY GUARANTEED THAT WHAT YOU SEE THIS FIRE SEASON WILL CHANGE DRAMATICALLY BEFORE THE 2009 SEASON.**

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