Lab #7 – Fire spread simulation with FARSITE

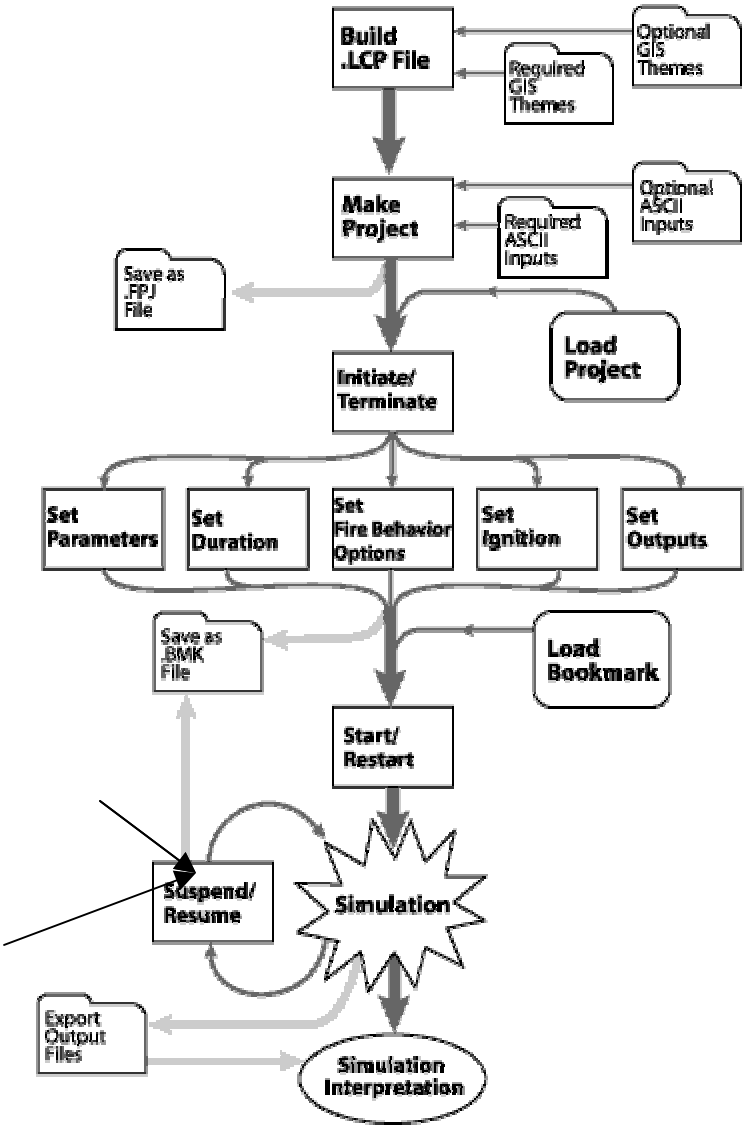
NR506 – Advanced GIS Applications in Fire Ecology and Management

Objectives

- Create input layers in GIS for FARSITE
- Learn how to enter weather data into FARSITE
- Build a FARSITE project
- Run FARSITE and interpret the results

We will use data for Craig Mountain and use FARSITE to re-create the Maloney Creek fire, Aug 12-24, 2000

Flowchart for setting up a FARSITE project (see FARSITE Users Guide)



File Name	File Ext.	File Type	Required	Optional
Landscape	.LCP	GIS	Fuel Model , Slope , Aspect , Elevation , Canopy Cover	Crown Bulk Density , Crown Base Height , Stand Height , Duff Loading , and Coarse Woody themes
Weather	.WTR	Text	At least one file	*FARSITE* can use up to 5 .WTR files in a simulation
Wind	.WND	Text	At least one file	*FARSITE* can use up to 5 .WND files in a simulation
Adjustment	.ADJ	Text	Although required, this file can consist of all zeros	Adjustment factors other than zero are optional
Initial Fuel Moisture	.FMS	Text	*FARSITE* needs moistures at least one day before the beginning of the simulation	none
Fuel Model Conversion	.CNV	Text	none	yes
Custom Fuel Models	.FMD	Text	none	For fuel models other than the 13 standard NFFL models
Fire Acceleration	.ACL	Text	none	yes
Air Attack Resources	.AIR	Text	none	needed to implement the air attack functions
Coarse Woody Profiles	.CWD	Text	none	specifies > 3" fuels for the Coarse Woody GIS theme used by Post Frontal Combustion Model.
Burn Period	.BPD	Text	none	specifies a daily burn period by date
Gridded Weather and Winds	.ATM	Text	none	uses gridded weather files if a weather model to provide them is available
Ground Attack Resources	.CRW	Text	none	needed to implement the air attack functions

GIS File Data Units

File Theme	Required	Default Units	Alternate Units
elevation	yes	meters	feet
slope	yes	degrees	percent
aspect	yes	categories 1-25	degrees
fuel model	yes	13 NFFL models	custom or converted models
canopy cover	yes	categories 1-4	percent
tree height	no	meters*10	meters, feet, feet*10
crown base height	no	meters*10	meters, feet, feet*10
crown bulk density	no	kg/m^3*100,	kg/m^3, lbs/ft^3, lbs/ft^3*100
duff loading	no	Mg/ha	tons/acre
coarse woody	no	coarse woody models	none

1. Generate Landscape layers for the Craig Mountain area in ArcGIS

Layers to generate are: elevation, slope, aspect, fuel models and canopy cover

- Start a new ArcMap project – make sure the Spatial Analyst extension is loaded.

- All data for this lab is located in c:\nr506\data\farsite_data
- All data in this folder is in projection: UTM, Zone 11, datum NAD83, map units meters

- Add the following layers:

dataset	description	data type	scale/resolution	
ele	Elevation, meters	grid	30 m pixels	
canopy	Canopy cover	grid	30 m pixels	
Fuelmodel	Fuel models (1-13) created in lab#4	shapefile	30 m pixels	
Fire_area83	Advancement of fire Aug15-24, 2000 Folder: c:/nr506/data/craig_mtn	coverage		
Canopy_lookup.dbf	Lookup table for canopy codes	DBASE		

NOTE: When working with FARSITE it is very important that all raster data layers have the same extent and bounding coordinates. You can easily ensure that this is the case by defining extent, mask etc. in the Options menu in Spatial Analyst.

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- In the Spatial Analyst menu under Options set the parameters for the analysis as follows:

  General: Working directory: c:\NR506\data\farsite_data
  Analysis mask: ele
  Extent: Same as layer 'ele'
  Cellsize: Same as layer 'ele'

  The extent and bounding coordinates of the elevation layer 'ele' will be applied to all derived datasets.

- Create slope and aspect from the elevation layer using Spatial Analyst (you may have created these layers in Lab #4)

- FARSITE requires the canopy layer to be expressed in categories 1-4. The GAP canopy layer in your data folder is expressed as follows:

  0 (<15%), 1 (15-33%), 2 (33-66%), 3 (>66%)

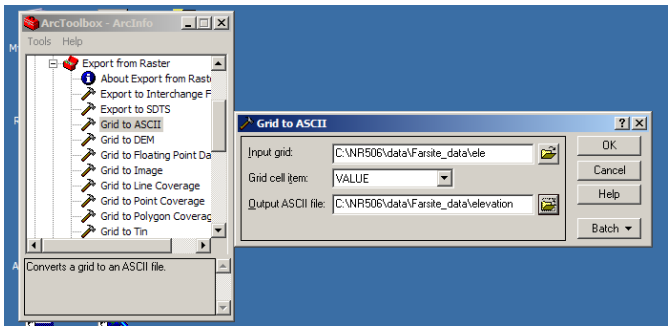
  Reclassify the GAP categories 0-3 into FARSITE categories 1-4 using the *Reclassify* option in *Spatial Analyst.* Name the output raster *canopy_far.* The output layer will be limited to the analysis mask area (this is the extent of elevation) and the new *canopy_far* data layer will therefore have the same extent as the other layers.
  Add the reclassified canopy layer to your ArcMap project

2. Generate ASCII GRIDS from the input rasters

. Use ArcToolbox to convert the raster grids to ASCII grids (can also be done in Arc Workstation).

- Start ArcToolbox *Start – Program Files – ArcGIS – ArcToolbox*

- ***Select*** *Conversion Tool – Export from Raster – Grid to ASCII*



c:\nr506\data\farsite_data\elevati

- Use the same procedure to create ASCII grids for slope, aspect, canopy (reclassified) and the fuel model layer. Save all ASCII files in c:\nr506\data\farsite_data\elevation

3. Build the Landscape file (.LCP) in FARSITE

- Start FARSITE
- Select *New Project* in the *File* menu
- Begin creating the Landscape file (.lcp) by selecting *Input – Landscape – Generate Landscape file*

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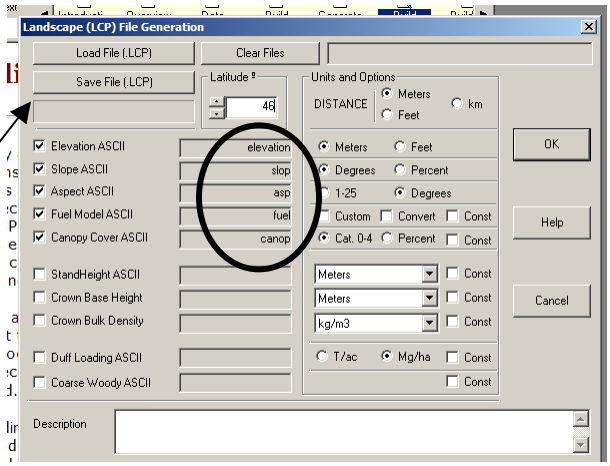
Save the LandFile (.LCP) in the Farsite_data folder.

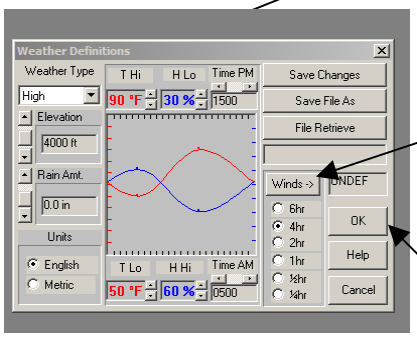


4. Create the Weather file (.WTR and .WND) in FARSITE

Open Lewiston_weather_aug_15-24.xls (in the Farsite_data folder) to find daily weather information from the Lewiston, Idaho weather station during the time period August 15-24, 2000. Use this data as a guide when creating the weather file for FARSITE. The fire actually started on Aug 12. Since the weather throughout this time period was relatively constant you can assume that the weather for Aug 12-14 is about the same as it was for Aug 15.

Select Weather types in the Input menu

Create weather definitions for Low, Moderate, High and Extreme weather conditions.



Select Weather type
Enter min, max temp and relative humidity
Create a series of wind directions and speeds

Go to the next weather type (if you started with Low, you also have to do Moderate, High and Extreme)

Click OK when you are done with the weather data. Save the .WWD file in the farsite_data folder.

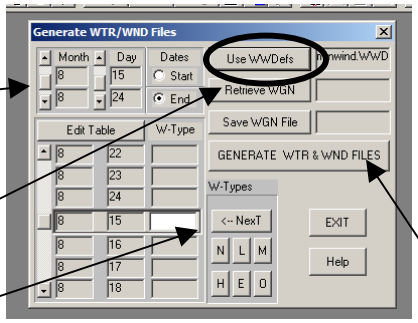
Select *Generate WTR/WND Files* in the *Input* menu to generate the weather for Aug 15-24, 2000. (or Aug 12-24)

Add Start and End dates

Specify that you want to use WWD definitions and select the .wwd file you just created in the previous step.

Assign Low, Moderate, High or Extreme weather to each day - use the Lewiston weather data as a guide.

Each weather file can only hold weather for 7 days. If you create weather for the full period Aug 12-24 you must divide it u

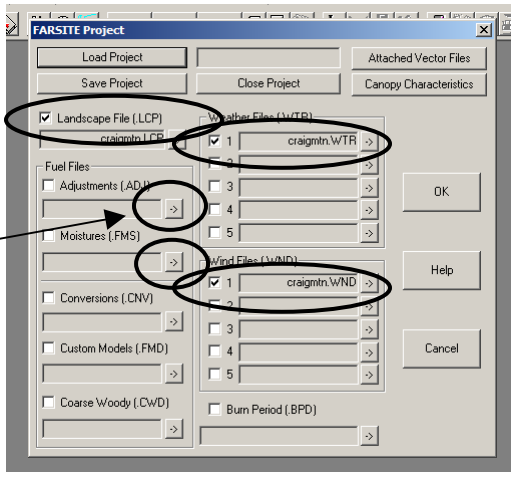


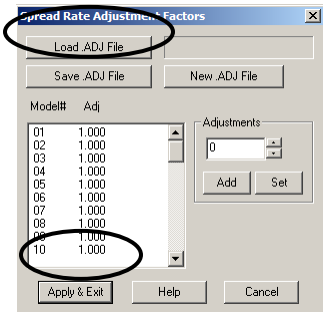
Click on GENERATE WTR & WND FILES when you are EXIT

The weather stream files .WTR and .WND files will be created.

5. Create the FARSITE project file

You are now ready to create the final FARSITE project from the Landscape (.LCP), weather (.WTR) and wind (.WND) files.





The last required input file is initial fuel moistures.

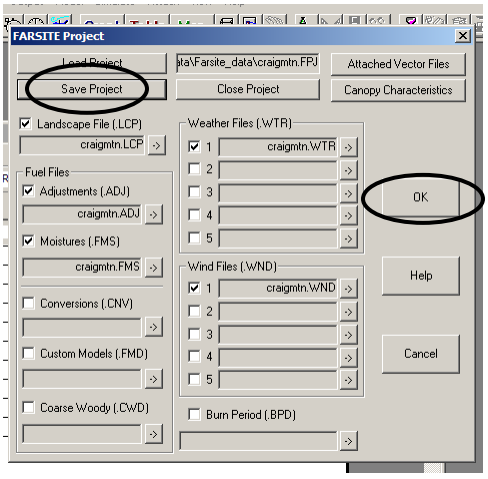
Click on the arrow to the left of Moistures (.FMS). Enter the suggested Initial Fuel Moistures according to the table below (or as you wish). Do not enter any data for the fuel models that are not used.

Fuel Model	1 hr	10 hr	100 hr	LH	LW	
1	4	7	12	50	100	
2	4	7	12	50	100	
3	na	na	na	na		
4	na	na	na	na		
5	6	8	15	60	100	
6	na	na	na	na		
7	na	na	na	na		
8	6	8	15	60	100	
9	6	8	15	60	100	
10	8	12	15	100	100	

Save the .FMS file then click *Apply & Exit.*

Back in the FARSITE Project window, save the project and click OK.

Check that you have specified:
Landscape file (LCP)
Weather file (WTR)
Wind file (WND)
Adjustment file (ADJ)
Moisture file (FMS)



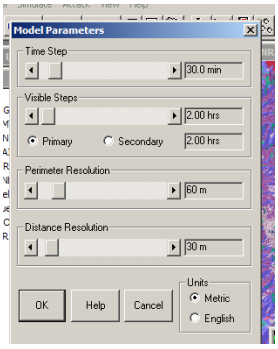
6. Set up initiate and run the simulation

Select *View Landscape File* in the *View* menu to display the map of your landscape file. Use the dialogs for *Landscape Display* (in the *Output* menu) to modify the display if desired.

Select *Initiate / Terminate* in the *Simulate* menu to initiate the run.

Click on *Elapse Time* and *Current Time* in the *Output* menu to set up the clocks.

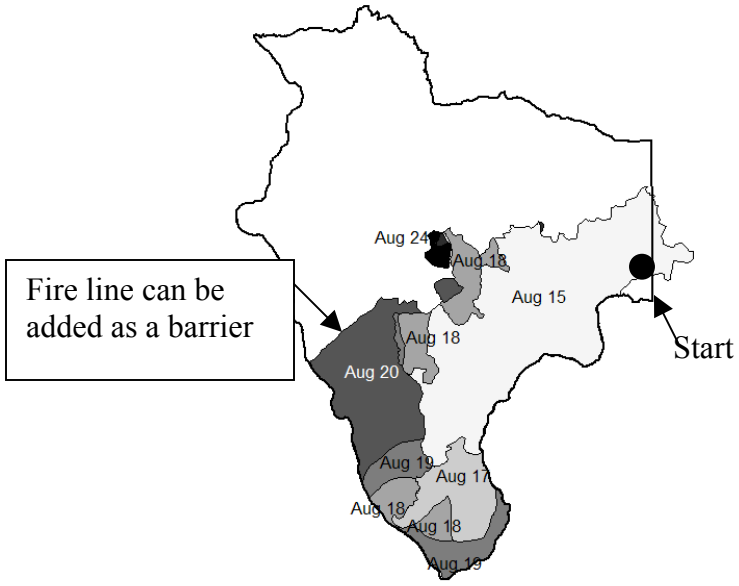
learn more about the parameters.



Click *Duration* in the *Simulate* menu and enter start and finish day and time for the fire. Enter start and end dates for the fire. Check the *Use Conditioning Period of Fuel Moistures* box and enter the conditioning for the month and day of the fire start. Click *Help* to read more about conditioning. Click OK when done.

Click on the '*Drip-torch'* icon and then click on the fire start location on the landscape.

Click *Start* in the *Simulate* menu to start the simulation – watch the fire advance.



Advance of the Maloney Creek fire August 15-24, 2000. Data from BLM office in McCall.

Compare your FARSITE run to the actual advance of the fire displayed to the left.

What parameters could be adjusted to better mimic the actual advance of the fire?