Modeling Fire Spread and Intensity Across Bark Beetle-Affected Landscapes

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BACKGROUND

During the first year of this project (2007), we used our custom bark beetle fuel models, Forest Health Monitoring, aerial detection survey maps, and data from LANDFIRE (Landscape Fire and Resource Management Planning Tools Project) to create FARSITE/FlamMap fire growth and intensity simulations in bark beetle-affected landscapes in Intermountain lodgepole pine (*Pinus contorta Dougl.ex Loud*), Engelmann spruce (*Picea engelmannii Parry ex Engelm.*), and Douglas-fir (*Pseudotsuga menziesii var. glauca (Beissn.) Franco*) forest types (Figure 1).

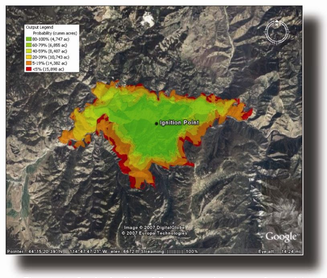


Figure 1. Probobality of fire spread, output from 30 FARSITE simulations for lodgepole pine.

These simulations provide fire planners, forest health specialists, forest health monitoring personnel and other land managers with information necessary to evaluate the ecological impacts of bark beetle activity based on fire risk, intensity and spread.

OBJECTIVE

Our present objective is to develop web-based, step-by-step instructions that will enable users to simulate fire growth and intensity specific to bark beetle-affected lands they manage.

Minimum requirements for running simulations include some familiarity with Farsite and ArcGIS

Step 1: Define goal (i.e. compare probabilities of fire size in endemic vs epidemic stands)

Step 2: Download necessary programs and data

Step 3: Choose landscapes

Step 4: Obtain LANDFIRE data and shapefiles of FHM aerial detection survey maps

Step 5: Obtain weather data: Historic weather data input consists of 30 randomly selected three-day weather windows within the peak fire season (August and September).

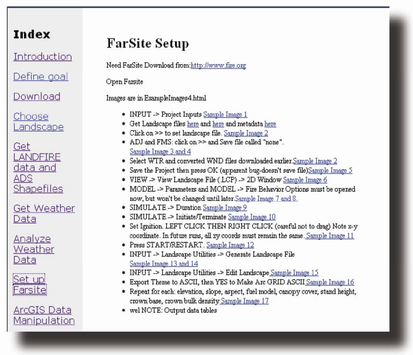
Step 6: Analyze weather data

Step 7: Set-up FARSITE

Step 8: Calibrate: These simulations were calibrated with actual fire events that occurred in the bark beetle-affected areas

Step 9: Make FARSITE runs

Step 10: Analyze outputs in ArcGIS: Model outputs were exported into ARCMAP to display resulting FARSITE probability of spread projections.



Index
Introduction
Define goal
Download
Choose Landscape
Get LANDFIRE data and ADS Shapefiles
Get Weather Data
Analyze Weather Data
Set up Farsite
ArcGIS Data Manipulation

FarSite Setup

Need FarSite Download from http://www.fire.org

Open Farsite

Images are in ExampleImages4.html

- INPUT -> Project Inputs Sample Image 1
- Get Landscape files here and here and metadata here
- Click on => to set landscape file Sample Image 2
- ADJ and FMS: click on => and Save file called "none". Sample Image 3 and 4
- Select WTR and converted WND files downloaded earlier Sample Image 2
- Save the Project then press OK (apparent bug-doesn't save file)Sample Image 5
- VIEW -> View Landscape File (.LCP) -> 2D Window Sample Image 6
- MODEL -> Parameters and MODEL -> Fire Behavior Options must be opened now, but won't be changed until later Sample Image 7 and 8.
- SIMULATE -> Duration Sample Image 9
- SIMULATE -> Initiate/Terminate Sample Image 10
- Set Ignition. LEFT CLICK THEN RIGHT CLICK (careful not to drag) Note x-y coordinate. In future runs, all xy coords must remain the same. Sample Image 11
- Press START/RESTART. Sample Image 12
- INPUT -> Landscape Utilities -> Generate Landscape File Sample Image 13 and 14
- INPUT -> Landscape Utilities -> Edit Landscape Sample Image 15
- Export Theme to ASCII, then YES to Make Arc ORID ASCII Sample Image 16
- Repeat for each: elevation, slope, aspect, fuel model, canopy cover, stand height, crown base, crown bulk density Sample Image 17
- wel NOTE: Output data tables

Figure 3. Detailed instructions. Screen capture from http://www.usu.edu/forestpathology/entomology/index.html

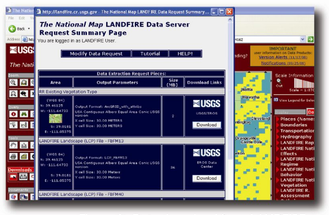


Figure 2. Data download from LANDFIRE

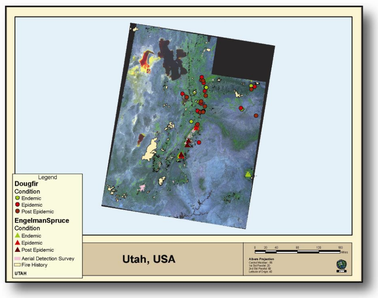
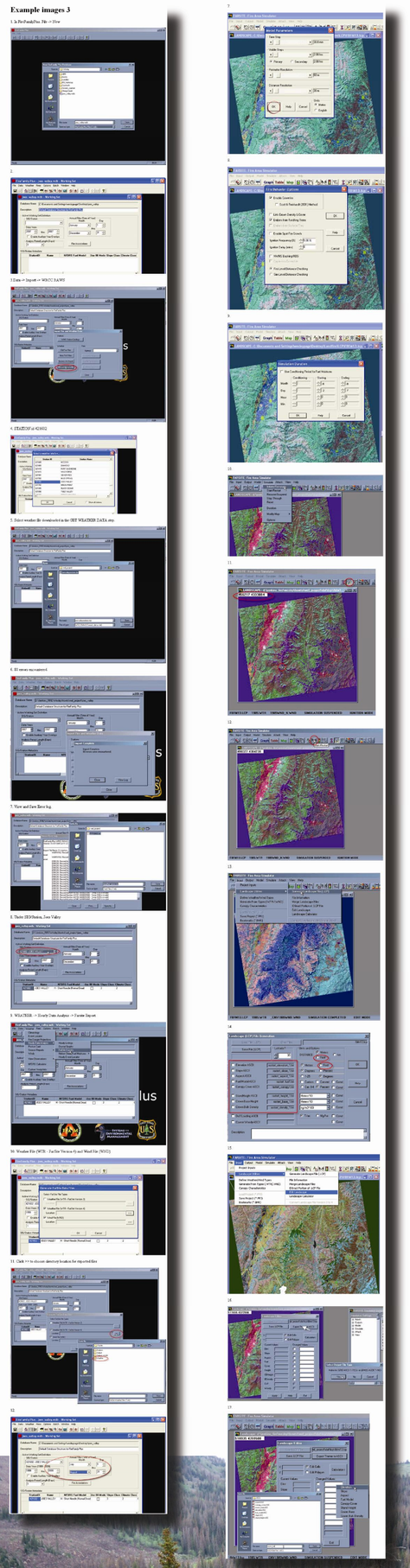


Figure 4. Some of the GIS data layers used to modify fuel model, canopy cover and stand height to custom values.



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