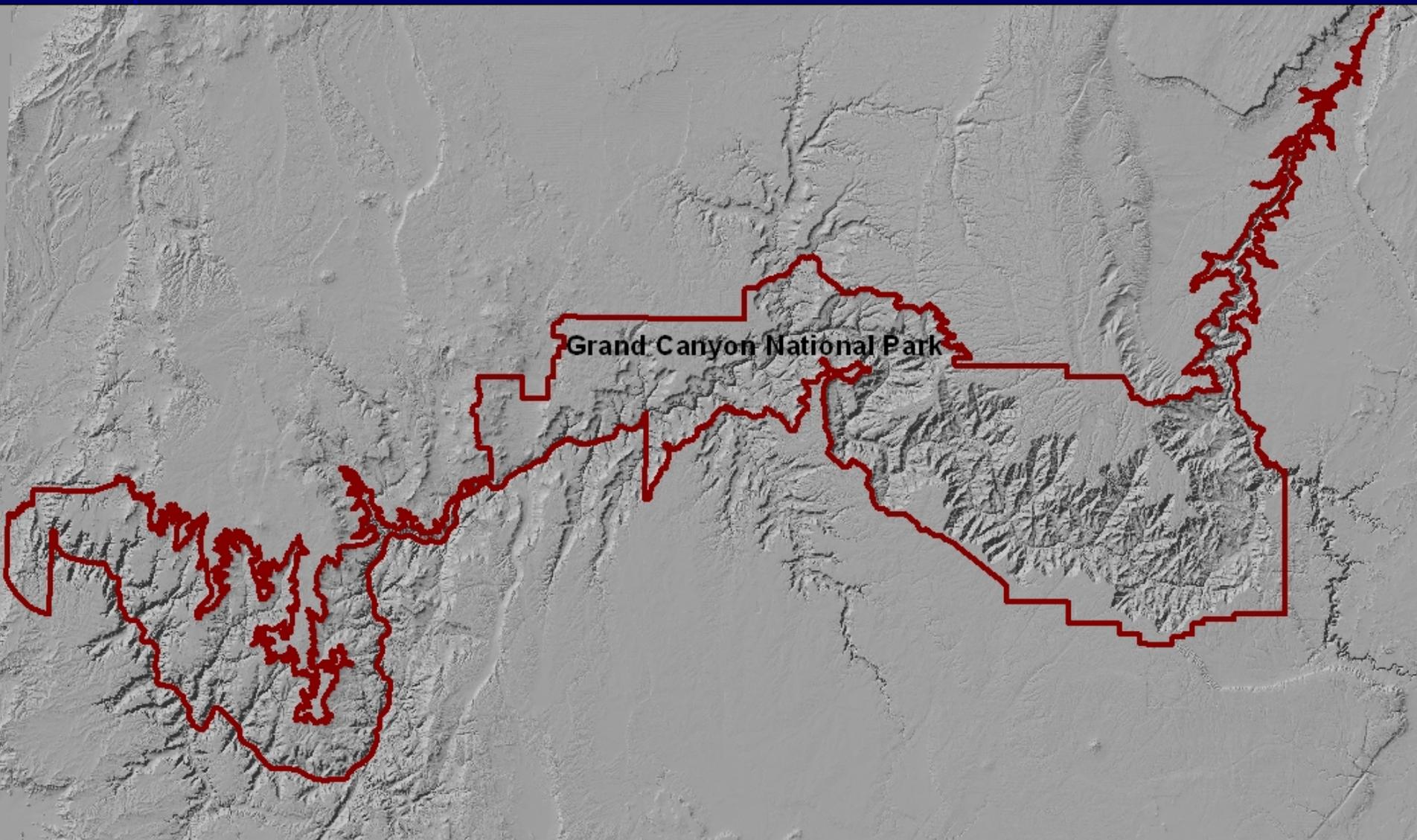


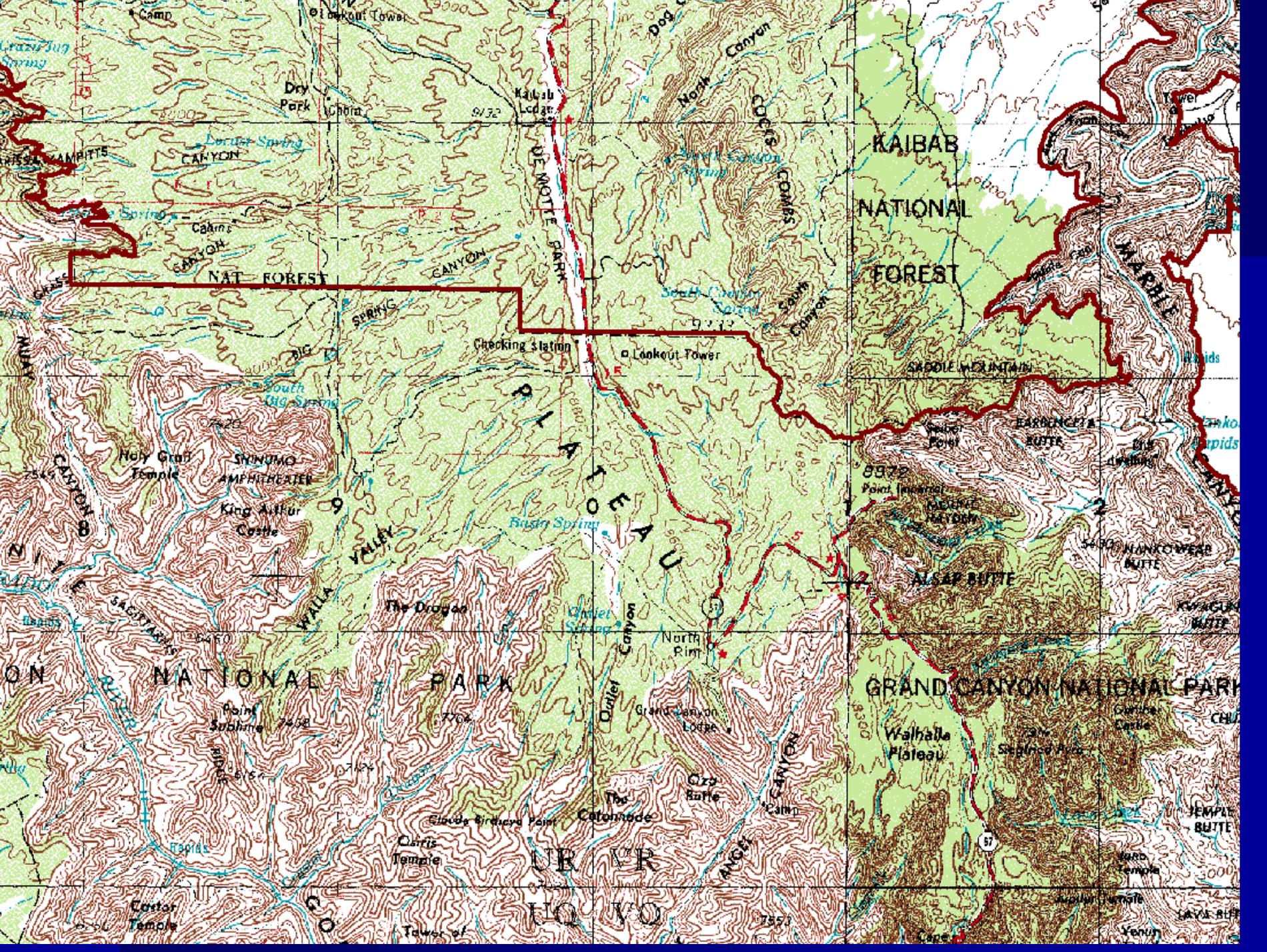


Grand Canyon National Park

Fuel and Fire Behavior Analysis Visit - April 2005



Grand Canyon National Park



BACKGROUND:

Mixed Conifer issues:

- Resource managers concerned about overstory mortality on large diameter trees as well as patch size mortality.
- Mixed conifer forest is designated as critical habitat for Mexican spotted owl.
- Initial draft environmental analysis estimated high negative impacts to vegetation.
- Initial response was to do nothing, and respond to fire starts as they occur.

Meeting with EIS team

- Overview of Fire Behavior Models
 - Behave
 - NEXUS
 - FARSITE
 - FlamMap
 - Forest Vegetation Simulator (FVS)
 - Stand Visualization Simulator (SVS)
 - Fuel Management Analyst
- Preliminary Modeling Results
 - FARSITE
 - Poplar Fire
 - "Possible Future Fire"
 - FlamMap
 - FVS
- Summary and conclusions

Overview of Fire Behavior Models:

(BehavePlus, NEXUS, FARSITE / FlamMap, FVS, SVS)

- Explained the Assumptions and Limitations
 - Data requirements to run the models

Some final thoughts when using Fire Behavior Models:

- Know what you are doing
- Know the assumptions that you are making
- Know the limitations of the model
- Ensure that the inputs to the model are good
- Make sure the people using the outputs know the assumptions and limitations
- Use your judgement - based on what you know, do the model outputs make sense?
- Use the model to increase your understanding of fire behavior - models are a great way to gain insight into very complex subjects

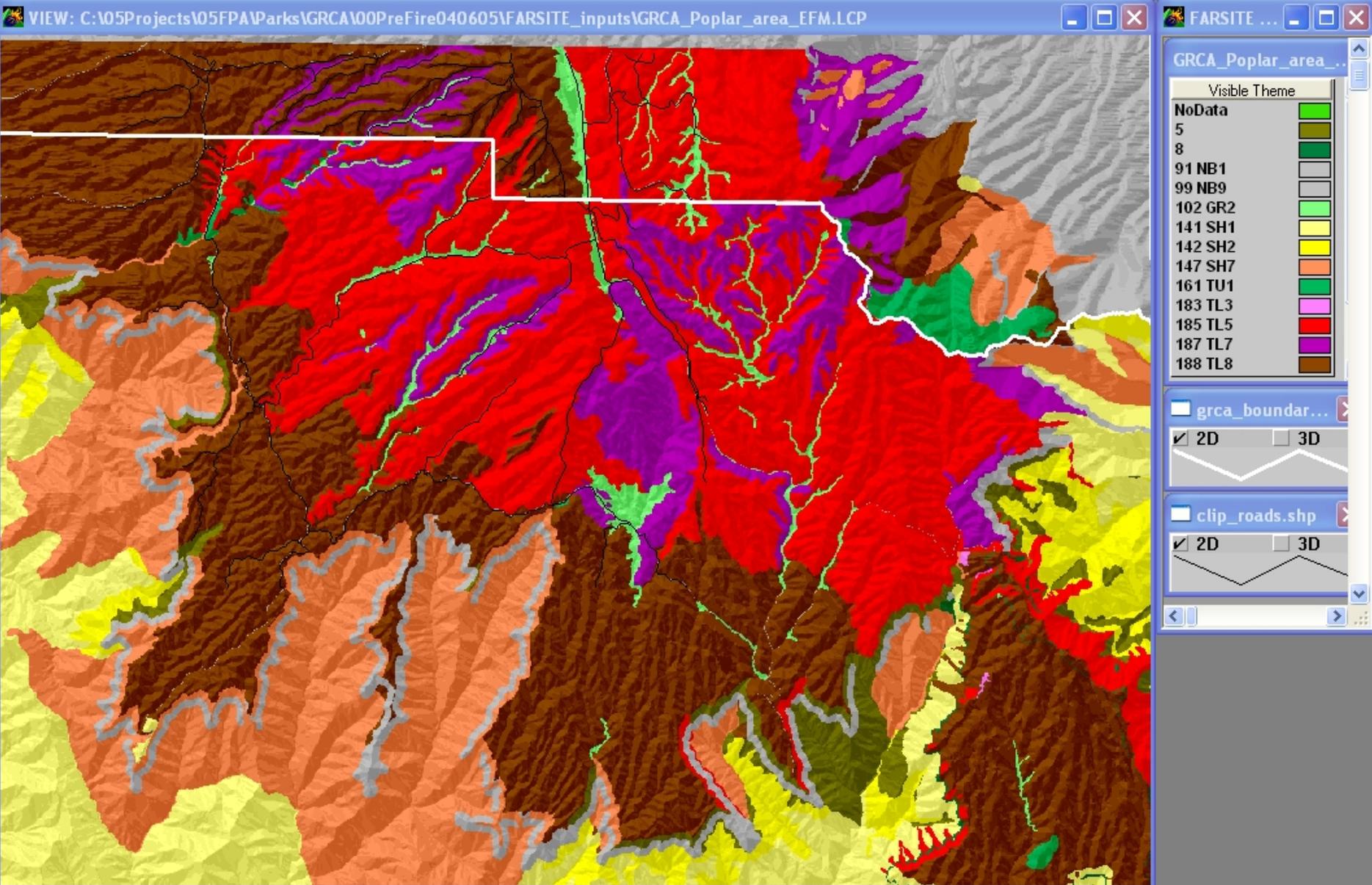
All Models are wrong.....

HOWEVER
Some models are useful !

Fuel layers development :

- FPA Team and Grand Canyon fire personnel in Feb. 2004 using existing vegetation and fuels layer developed in 2000
- Further changes & refinements made in March, 2005
 - Included crosswalk to new fuel models (Rob Seli)
 - Canopy base height refinements
- Initially these layers were not updated to reflect recent fires or fuel treatments - thus providing us with a "pre-fire" landscape

FARSITE Landscape using the new Expanded Fuel Models Pre-fire



Our PROCESS

Using a very modified version of the Region 5 FireShed Assessment Process we attempted to:

- model potential results of a "no action alternative" in the mixed conifer
- model the change in fire behavior / size on a landscape that had been "treated" by fire

FARSITE (Fire Area Simulator) modeling:

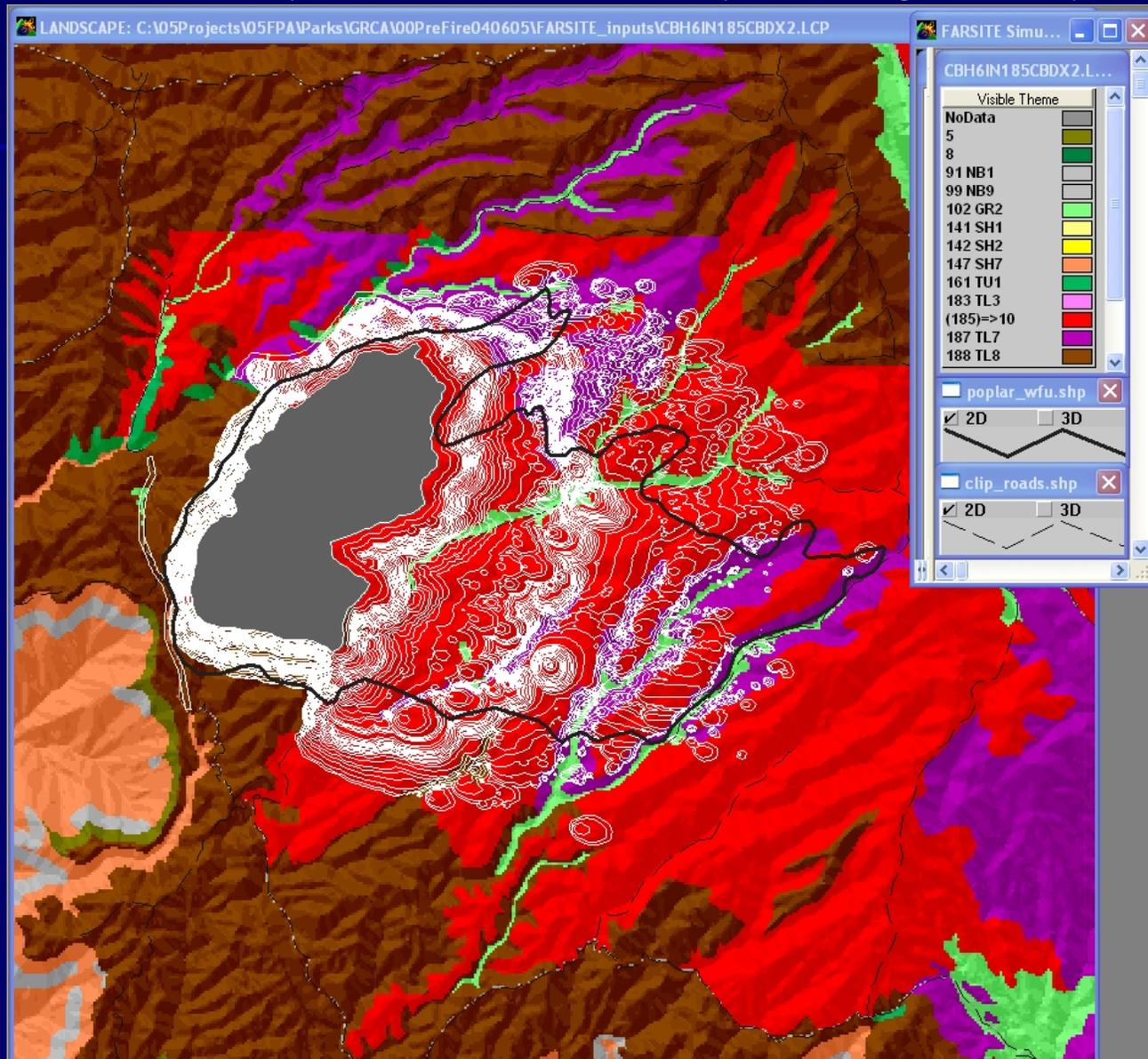
- Chose a recent fire in the area and vegetation of concern (mixed conifer)
 - Poplar Fire (2003)
- “Calibrated” and “validated” the landscape and inputs to roughly re-create the fire
- Using the same conditions, modeled another fire on the pre-fire landscape (fuel layers)
- Updated the fuel layers to reflect changes 2000+
- Performed simulations on “treated” landscape

Testing FARSITE Layers using Poplar Fire Perimeters And observed weather conditions

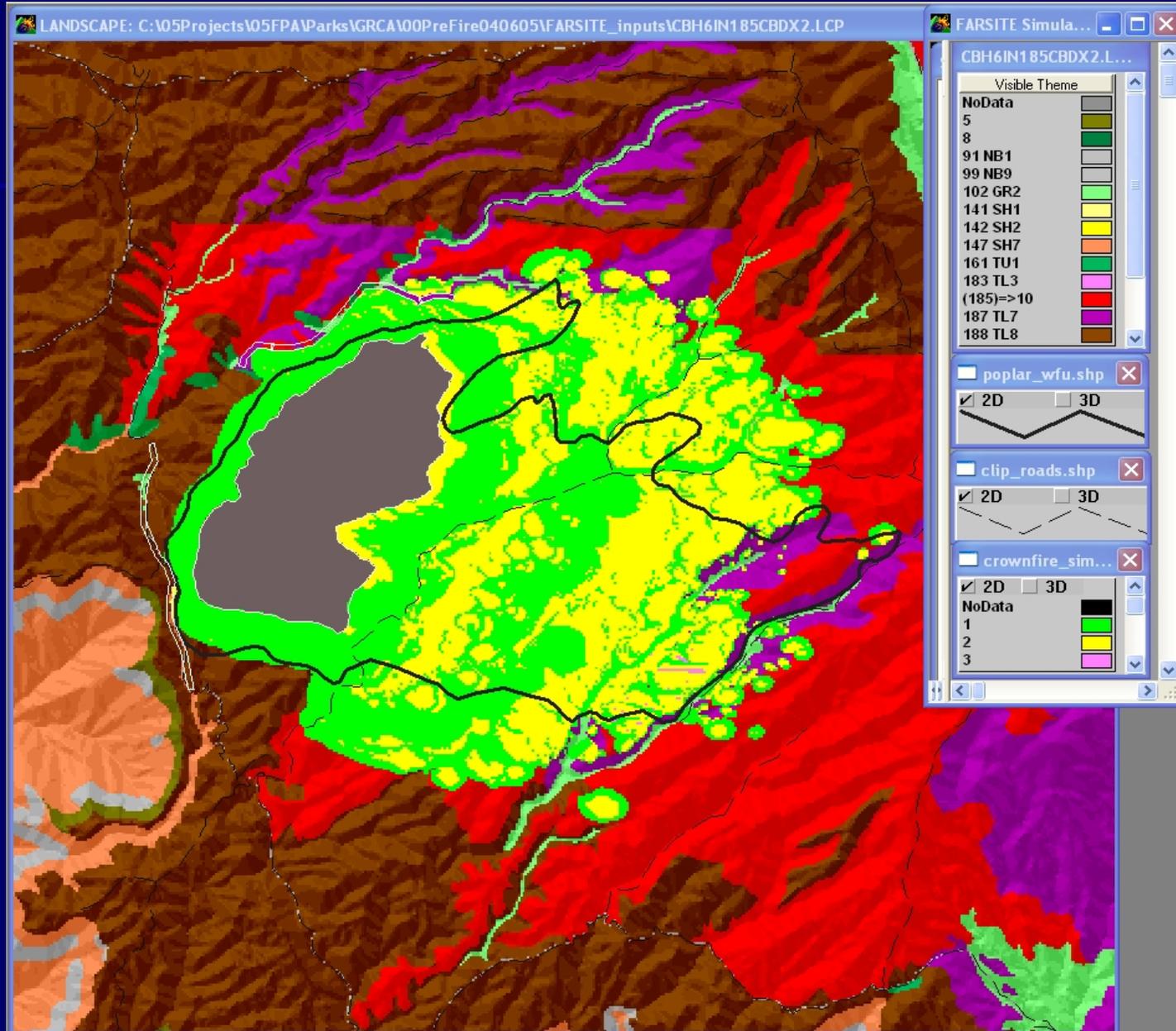
2 day simulation - from 1700, Sept.27 through 1700 Sept.29

Inputs:

- Weather obs from:
Dry Park RAWS
 - Wind obs from:
Lindbergh Hill RAWS
& FBAN field notes
- Conversions:
- FM TL5 converted to
Fuel Model 10
- Ignition file:
- Poplar Fire Sept.27
perimeter



FARSITE Simulation of Poplar Fire- Crown Fire Activity:

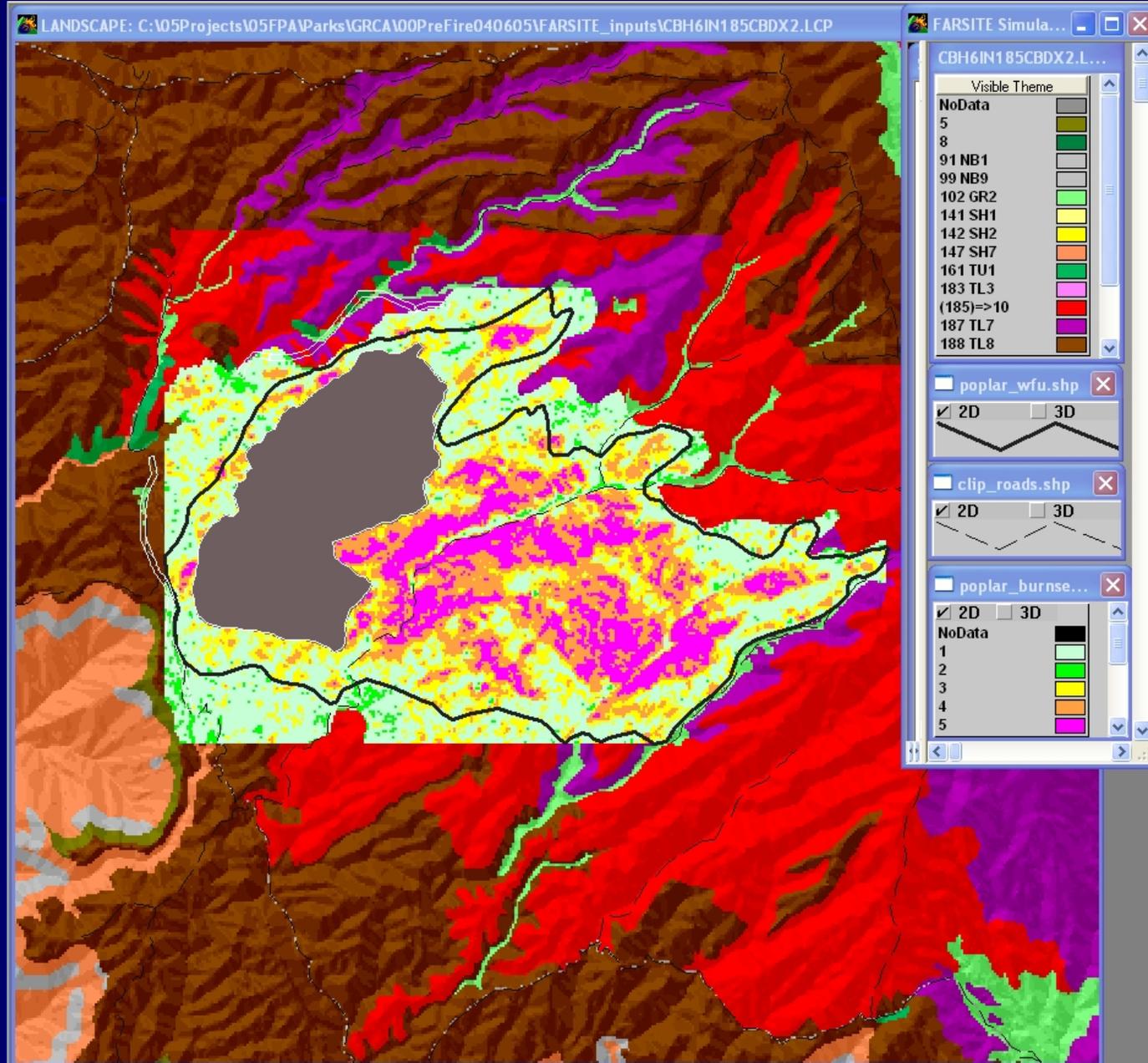


Green = surface fire

Yellow = crown fire

Remotely-sensed Burn Severity of Poplar Fire Area

Pink = High Severity
Orange = Moderately-Hi
Yellow = Moderately-Lo
Green = Low Severity
Lt. Green = Unburned

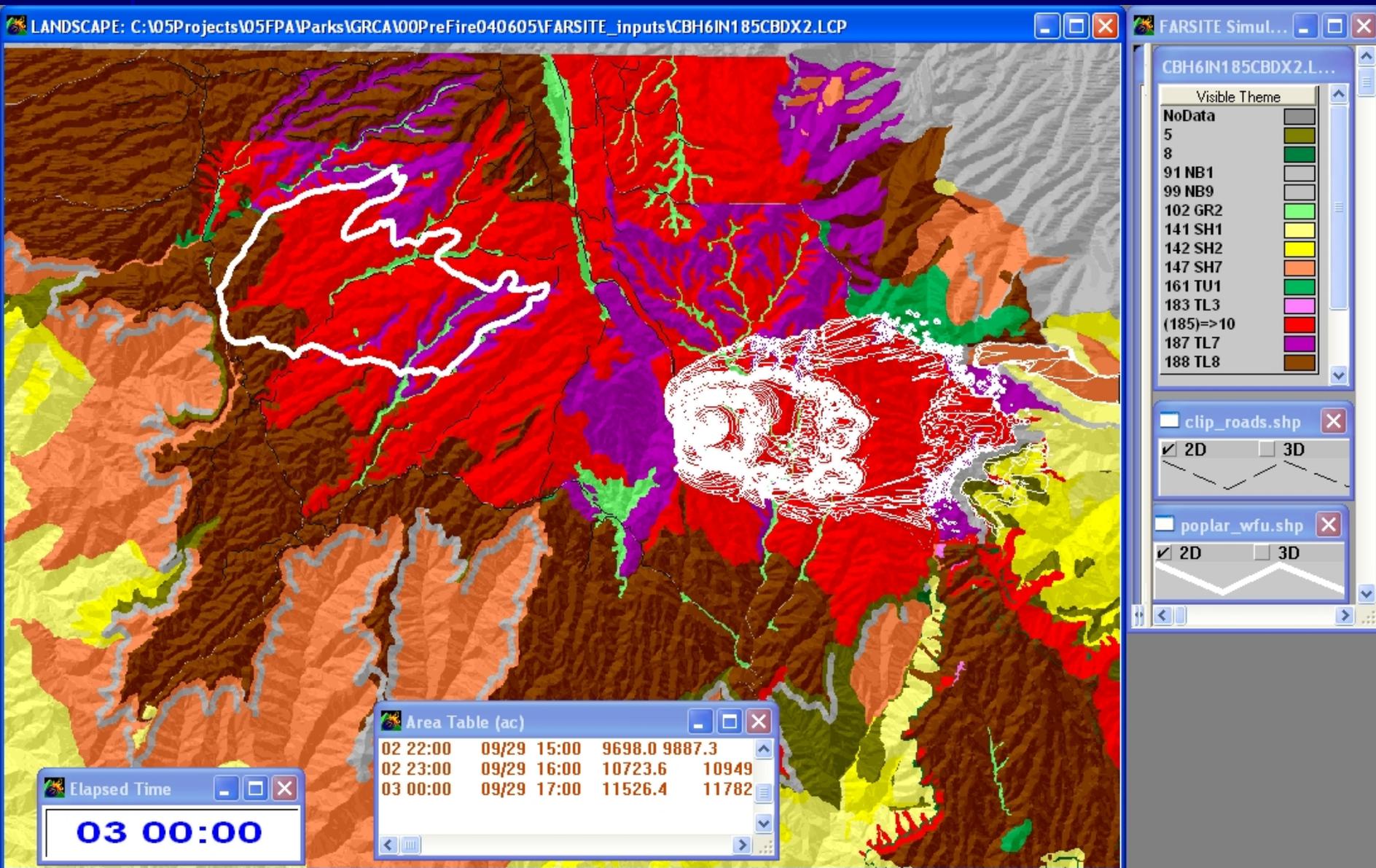


Modeling Results

- FARSITE "Possible Future Fire" Results

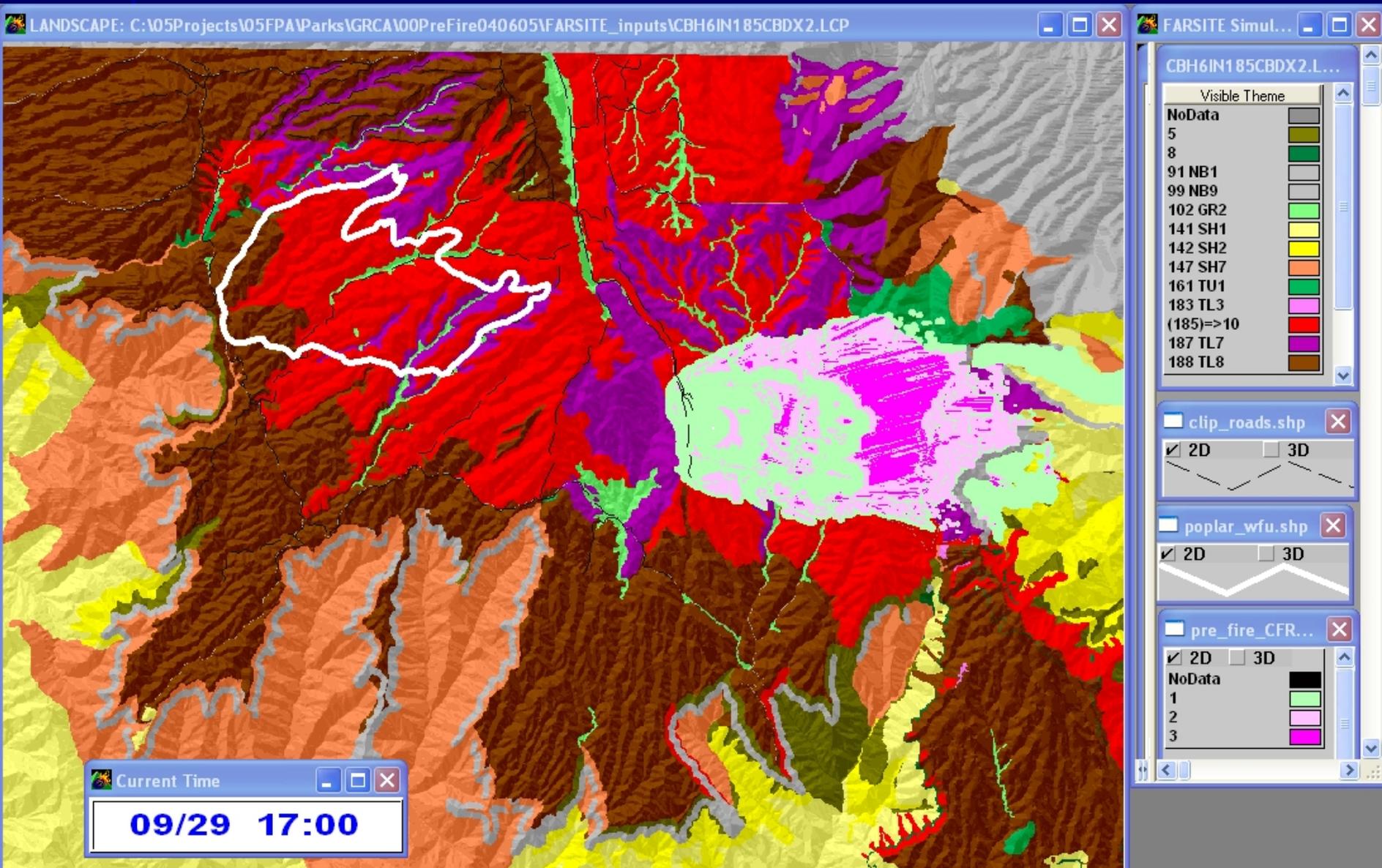
Simulated Fire on Pre-fire Landscape - 3 day projection

Inputs the same as for Poplar Simulation



Simulated Fire on Pre-fire Landscape - with crown fire

Inputs the same as for Poplar Simulation

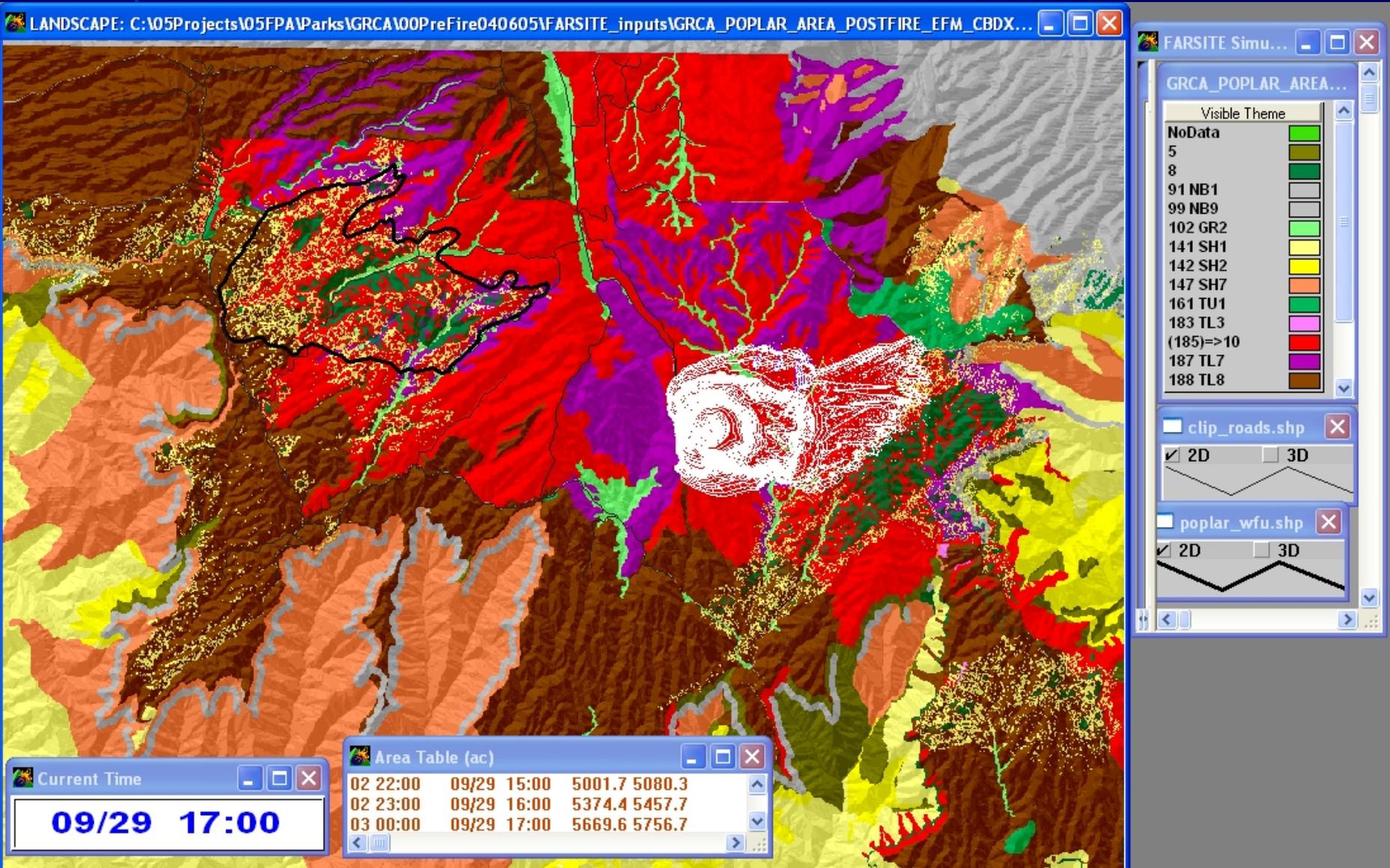


Updates made to fuels layers to reflect changes due to fire: (per fire ecologists' recommendations)

- **In areas of high burn severity (2000-2003)**
 - All fuel models were changed to fuel model 8
 - All canopy characteristics were assigned 0
- **In areas of moderate burn severity (2000-2003)
(moderately-low or moderately-high)**
 - Canopy Base Heights < 8' were changed to 8 feet
- **In areas of moderately-low burn severity (2000-2003)**
 - Fuel model changed to Fuel Model 5
 - Canopy cover category was changed to 1 (0-20%)

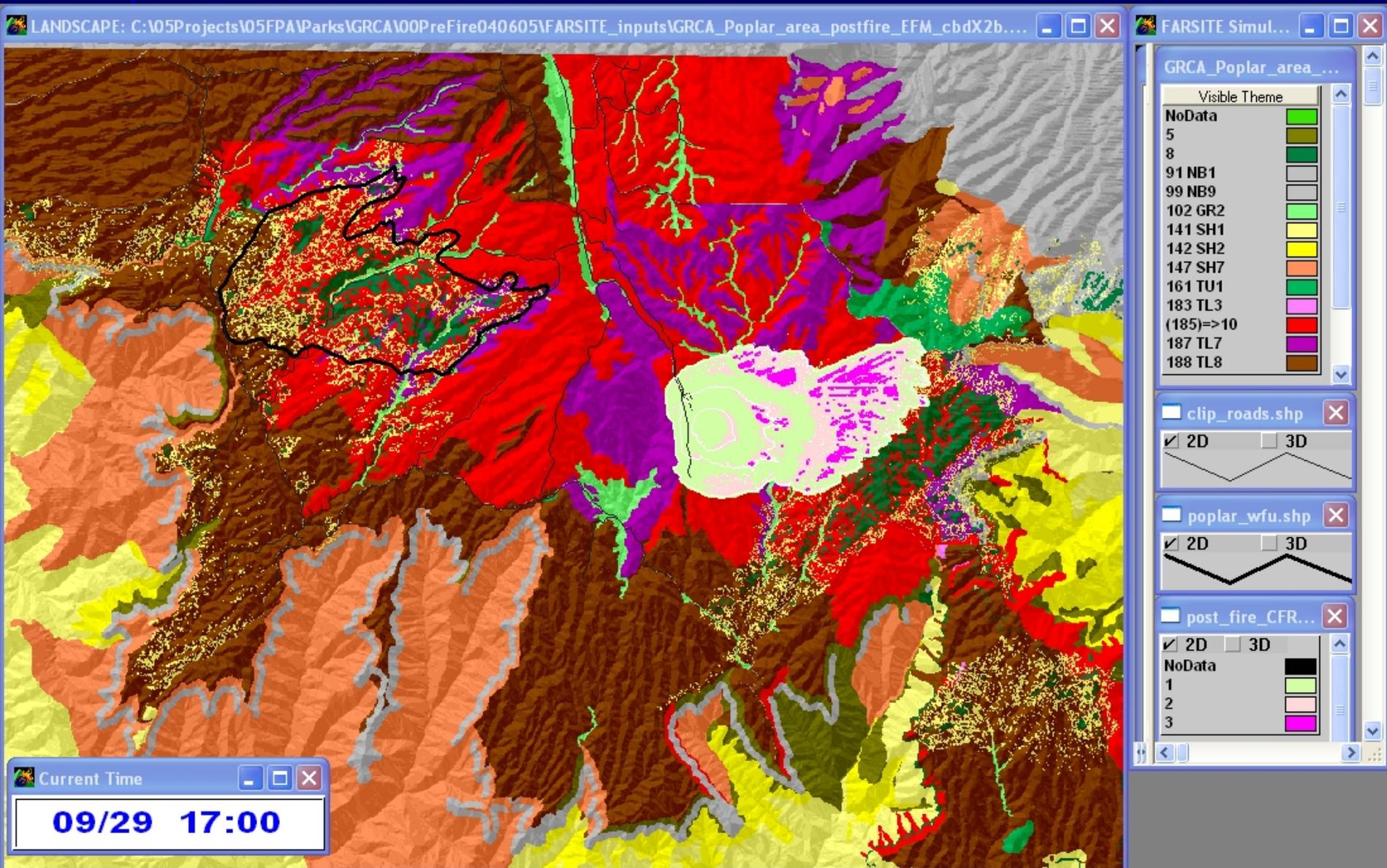
Simulated Fire on POST-fire Landscape - 3 day projection

Inputs the same as for Poplar Simulation



Simulated Fire on POST-fire Landscape - 3 day projection

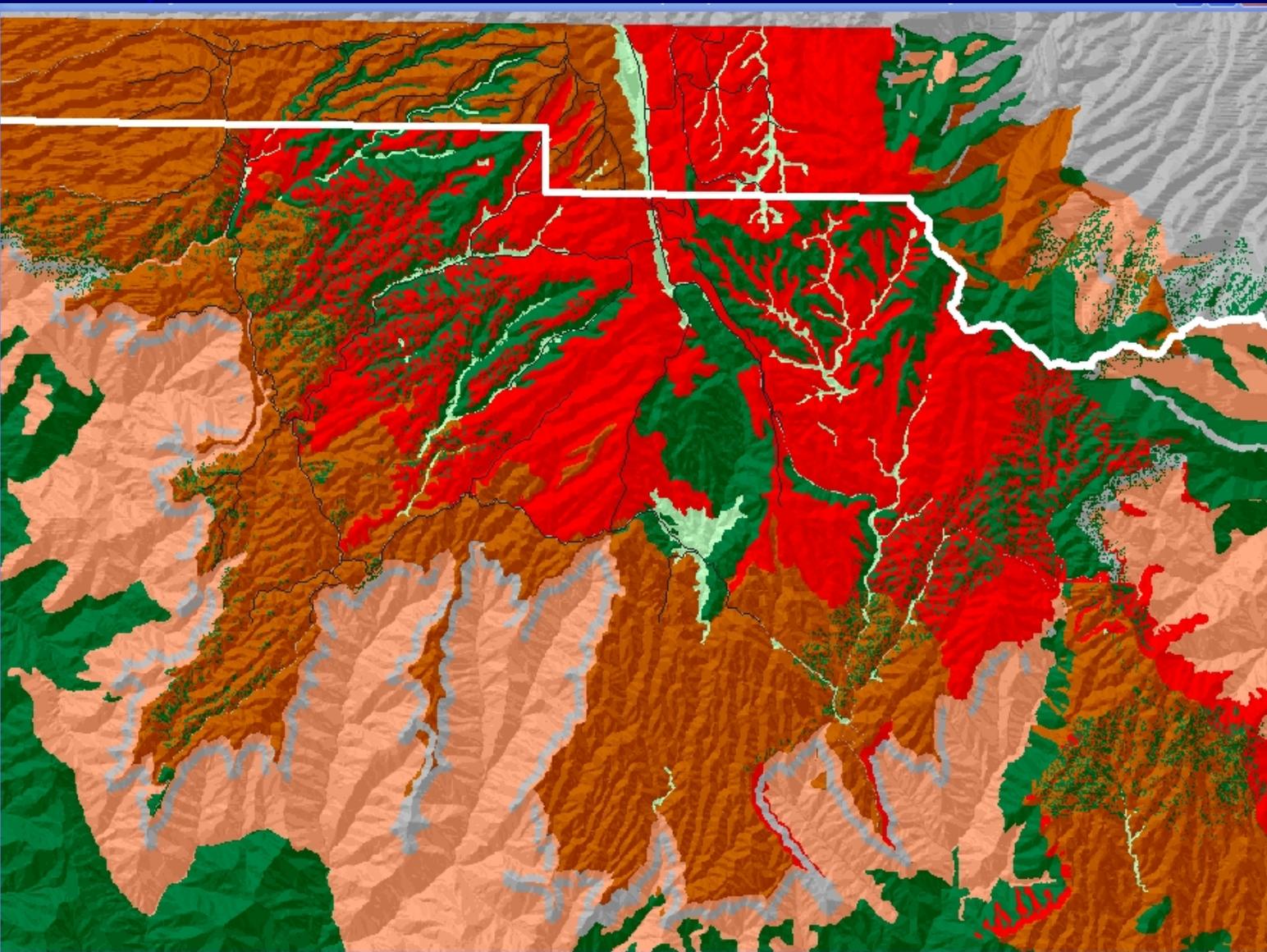
Inputs the same as for Poplar Simulation



Modeling Results

- FlamMap Results

Fire Behavior Prediction System (FBPS) Fuel Models - for FlamMap



post_fire_FBPS_mod...

Visible Theme

NoData	
1	
5	
8	
9	
10	
99 NB9	

grca_boundar...

2D 3D

clip_roads.shp

2D 3D

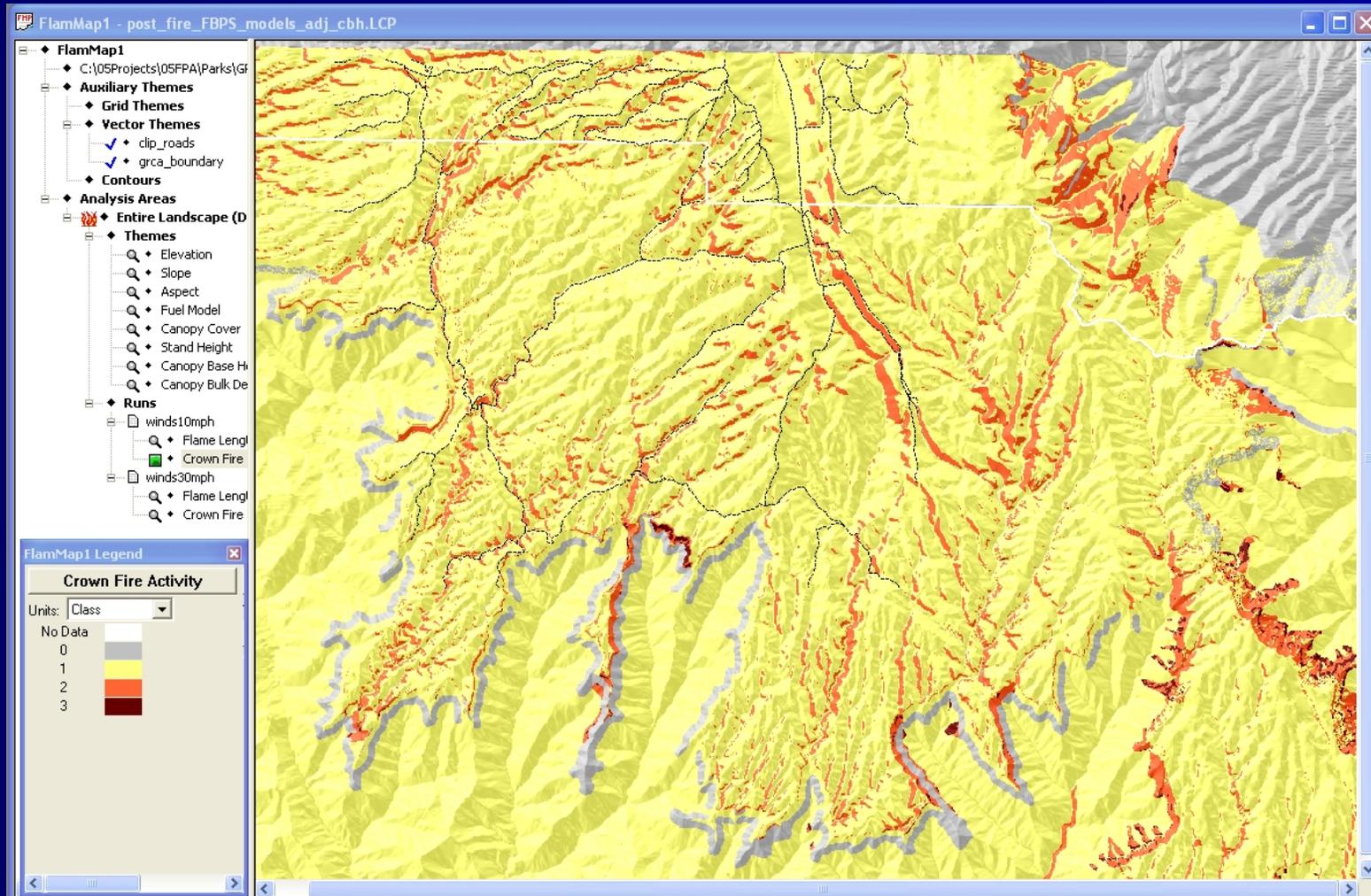
Crown Fire Map

FlamMap Outputs Post-Fire Landscape

Inputs:

- Fuel moisture file:
 - 1 hr = 5%
 - 10 hr = 6%
 - 100 hr = 7%
 - Live herb. = 75%
 - Live woody = 75%

- Winds:
 - southwest
 - 10 mph



FlamMap1 Legend

Crown Fire Activity	
Units:	Class
No Data	
0	
1	
2	
3	

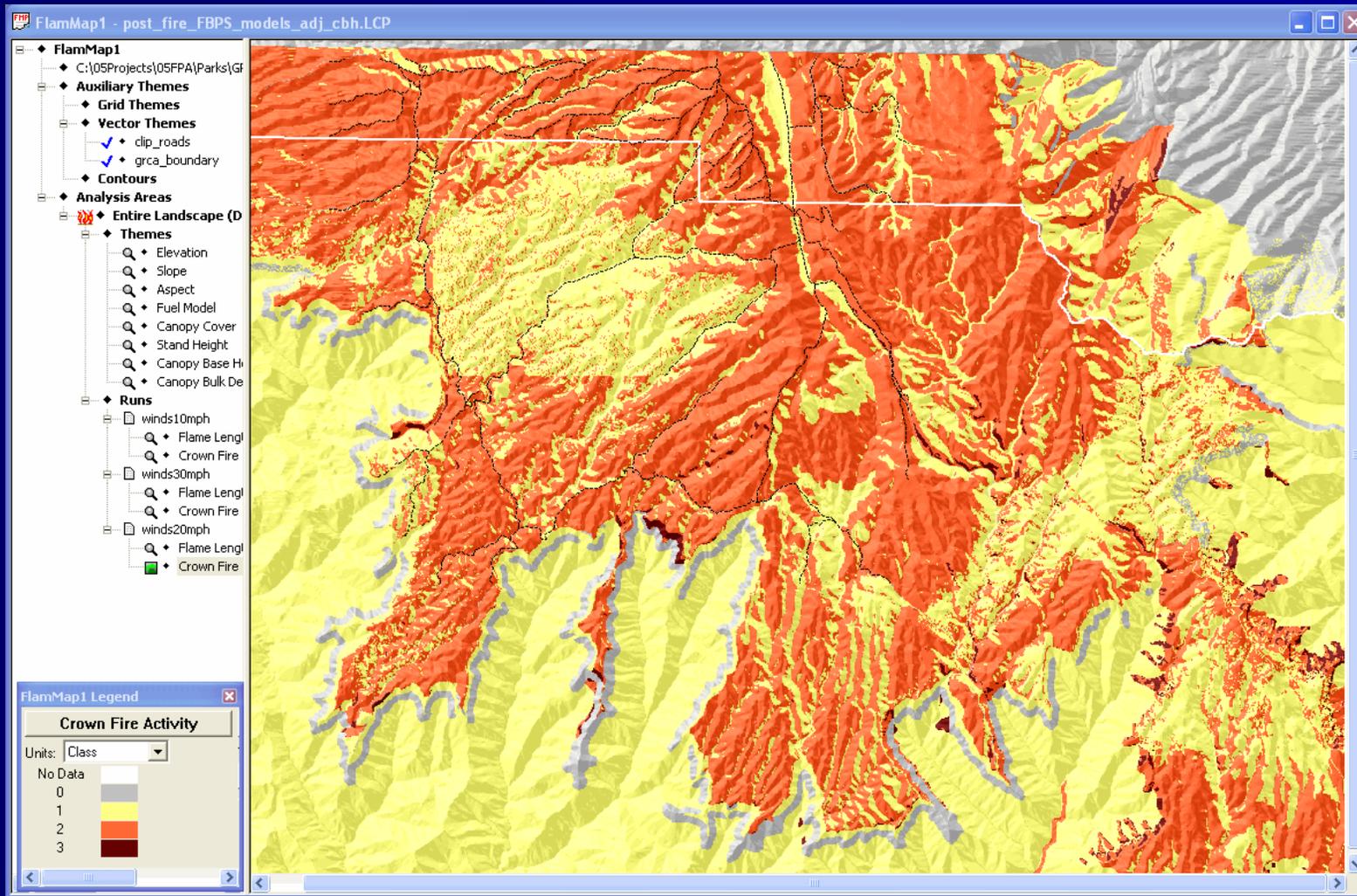
Crown Fire Map

FlamMap Outputs Post-Fire Landscape

Inputs:

- Fuel moisture file:
 - 1 hr = 5%
 - 10 hr = 6%
 - 100 hr = 7%
 - Live herb. = 75%
 - Live woody = 75%

- Winds:
 - southwest
 - 20 mph



Crown Fire Map

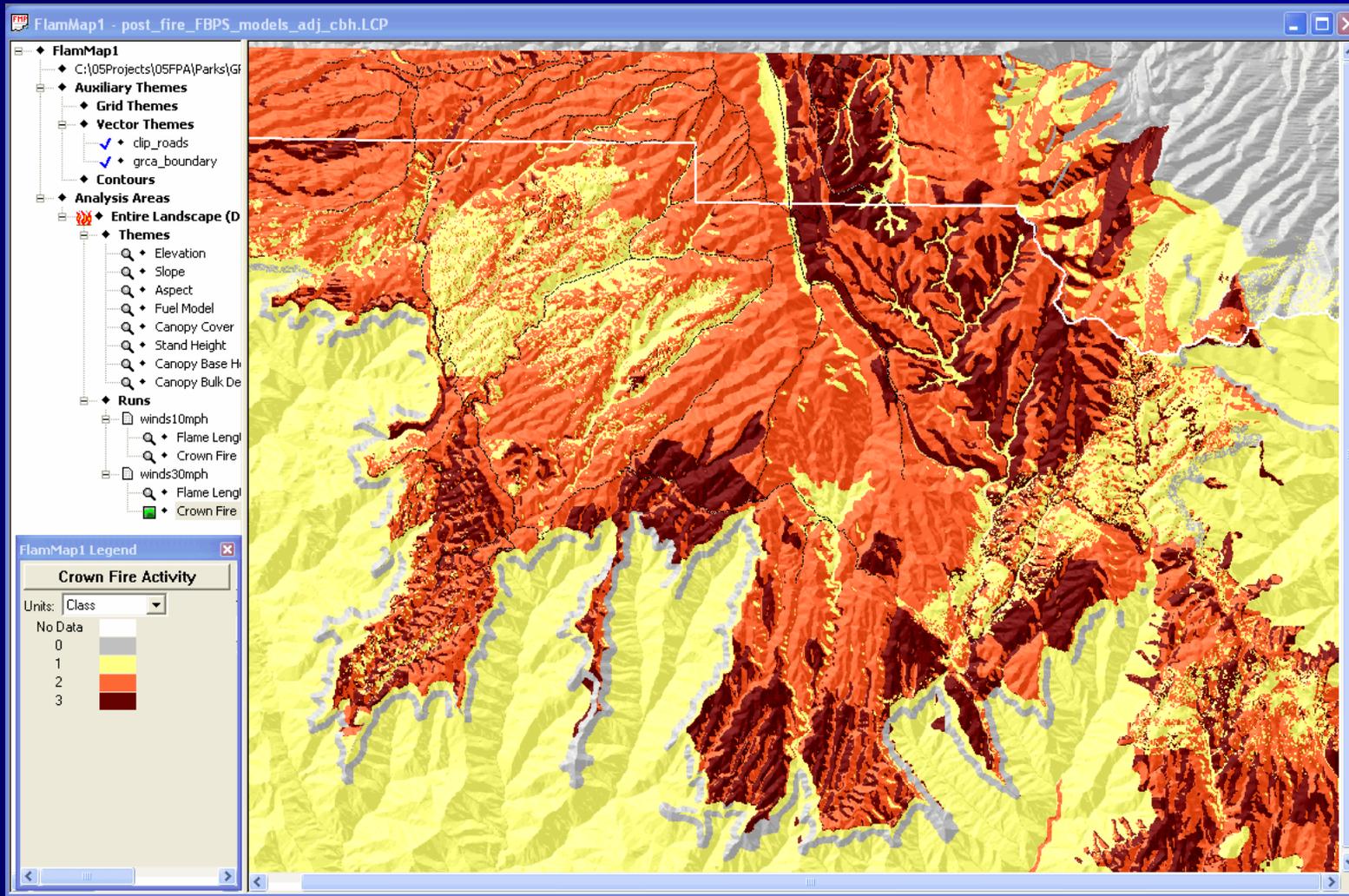
FlamMap Outputs

Post-Fire Landscape

Inputs:

- Fuel moisture file:
 - 1 hr = 5%
 - 10 hr = 6%
 - 100 hr = 7%
 - Live herb. = 75%
 - Live woody = 75%

• Winds:
southwest
30 mph



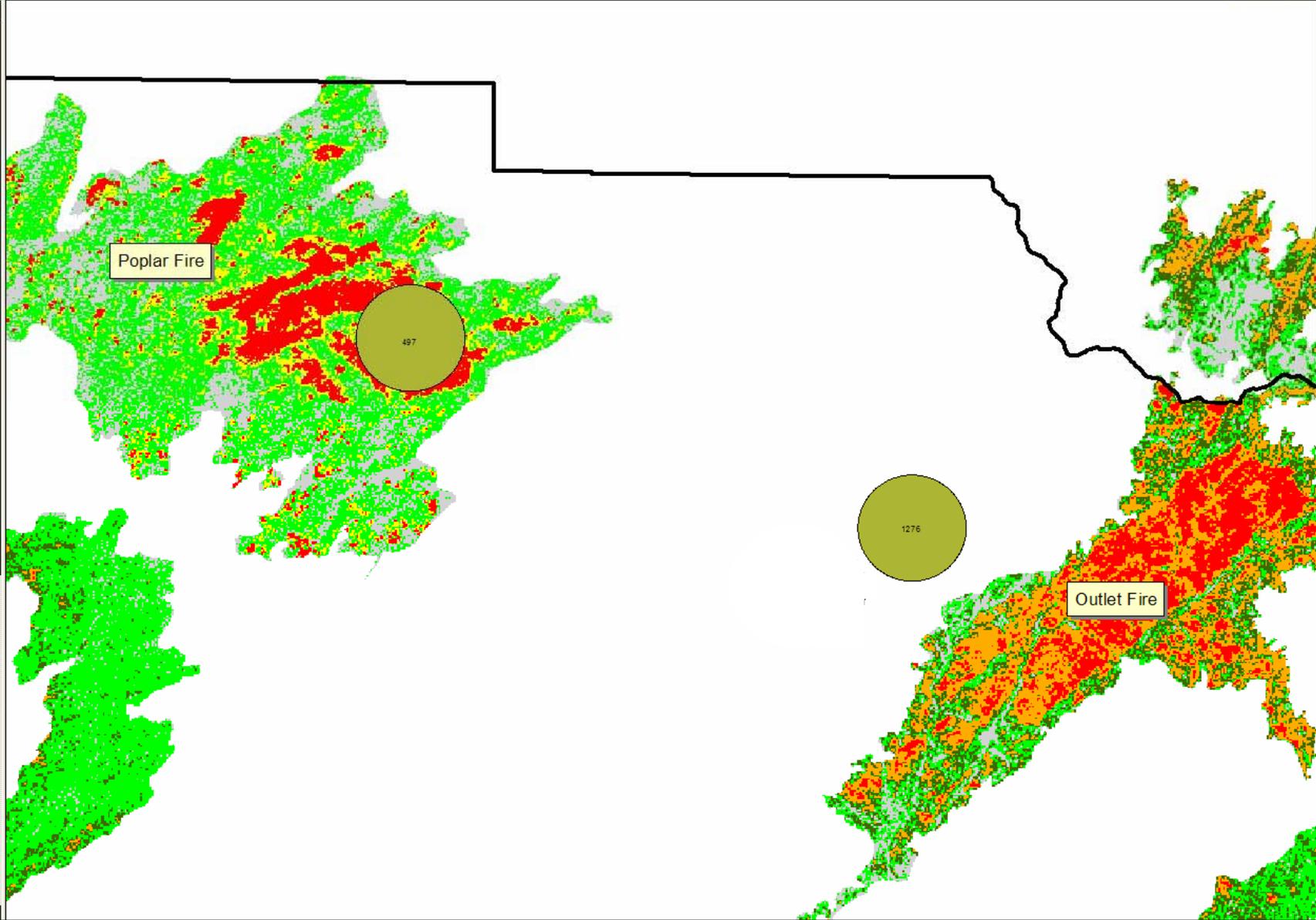
Modeling Results

- Forest Vegetation Simulator – FFE
 - Chose a Forest Inventory Analysis plot that:
 - Was in the area of concern
 - Was similar vegetation and stand structure



View1

- Fia_plots.shp
 - High
 - Low
 - Moderate
 - Moderate/High
 - Moderate/Low
 - Unburned
- Grca_bnd
- Severity_1999-200
 - High
 - Low
 - Moderate
 - Moderate/High
 - Moderate/Low
 - Unburned
- Grca-fuels_1
 - 0
 - 2
 - 3
 - 4
 - 5
 - 6
 - 8
 - 9
 - 10
 - 22
 - 30
 - 31
 - 32
 - 33
 - 99
 - No Data
- Grca_all_fuels.shp
 - Grass
 - Recent Crow
 - asp
 - asp-pp-wf-go
 - asp-wf
 - asp-wf-pp
 - asp-wf-pp-loc
 - barren
 - bs-grass
 - cliff
 - cr-bs-pj-bg
 - df-asp-wf-pp
 - df-wf-asp-pp
 - ga-loc
 - grass
 - grasses-forb
 - j-p
 - j-pp
 - jp-py
 - plen-wf-asp-p
 - pj
 - pj-cr
 - pj-ga-loc
 - pj-grass
 - pj-py-sg-gras
 - pp
 - pp-asp
 - pp-asp-go-loc
 - pp-asp-grass
 - pp-asp-pien
 - pp-asp-wf
 - pp-asp-wf-Gr
 - pp-asp-wf-gr
 - pp-asp-wf-loc



Plot #1276

- Vegetation types = WF, ES, AS, PP, DF
- Stand age = 125 years
- Aspect = 350 degrees
- Slope – 10%

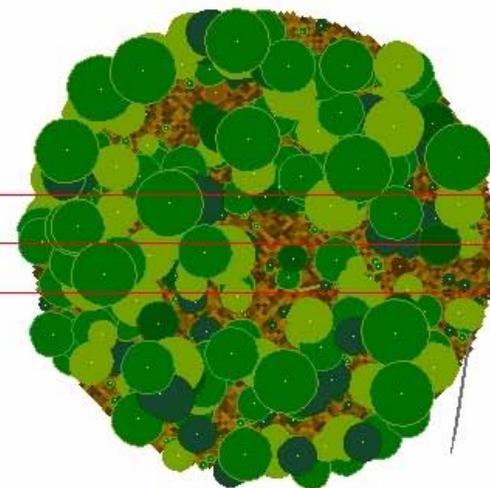
Forest Vegetation Simulator Results

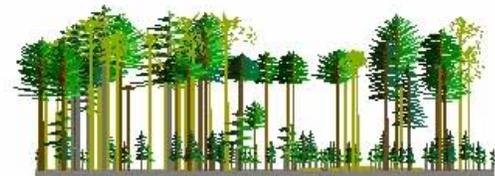
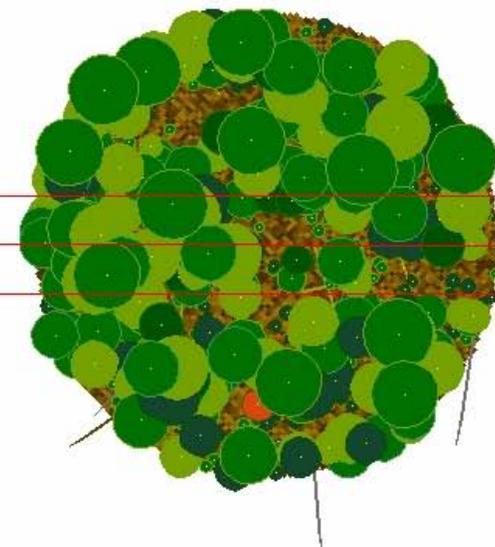
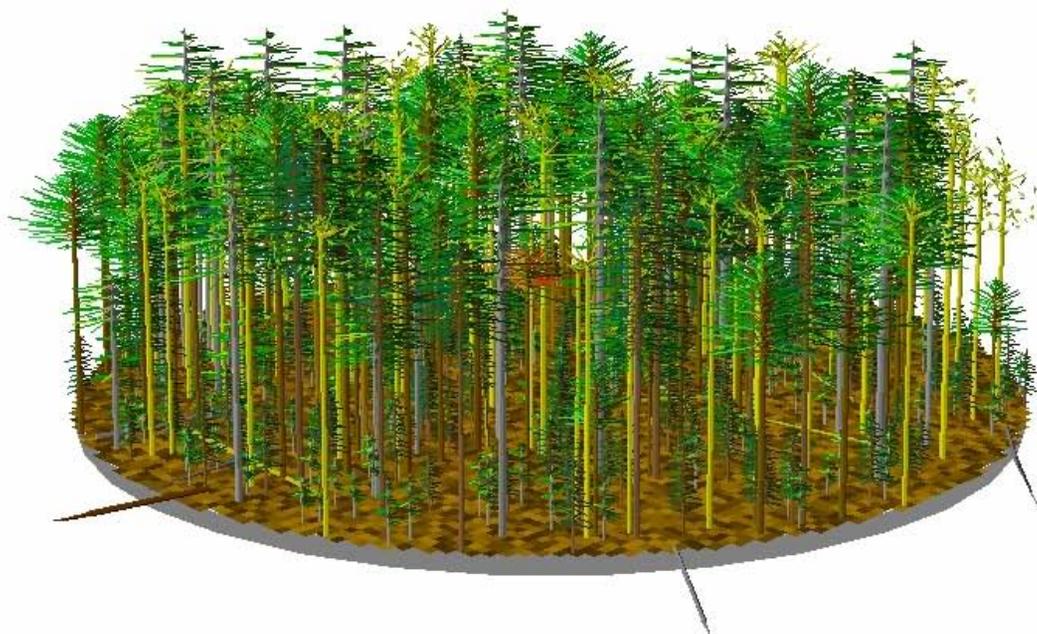
- Forest Inventory Analysis Plot 1276
- Three scenarios for the plot
 - No fires 2005 – 2065
 - Hot fire in 2005
 - Moderate fire 2005 (prescribed fire conditions) followed by a hot fire 2055

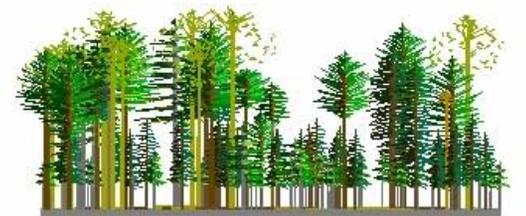
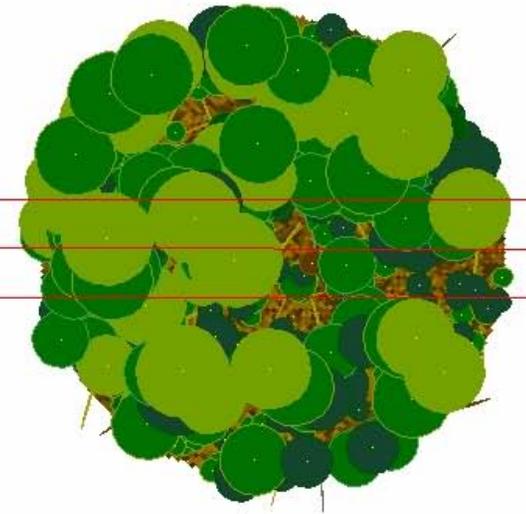
Plot 1267 Fire Scenario 1

(change over time – no action - no fire)

PLOT ID #1276	Initial conditions 2005	2005 Fire	Conditions 2015	Fire 2055	Conditions 2065
Scenario 1		NO		NO	
Fuel Model	10 = .86 8 = .14		10 = .86 12 = .14		12
Fire Type	Sev = A Mod = S		Sev = A Mod = S		Sev = A Mod = S
Potential BA Mortality	Sev = 100% Mod = 30%		Sev = 100% Mod = 29%		Sev = 100% Mod = 24%

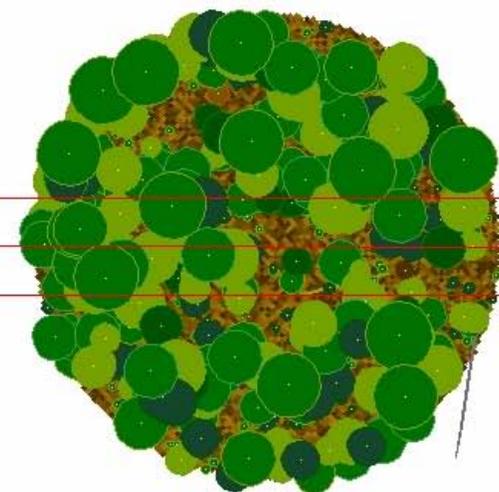


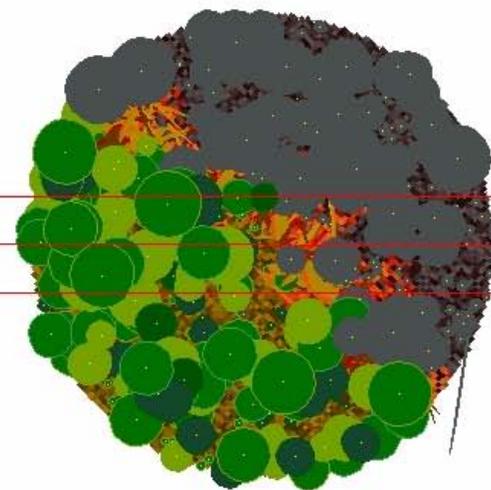
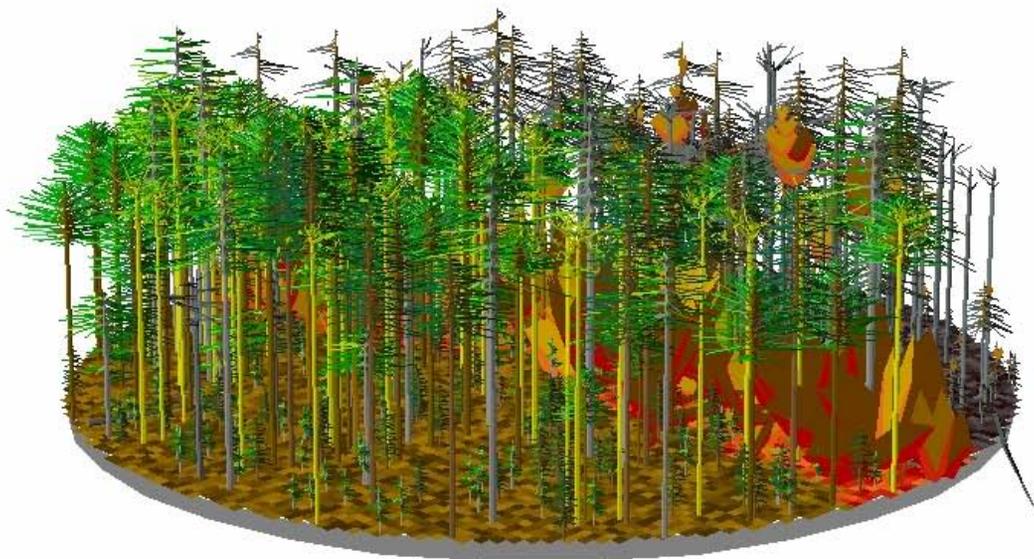


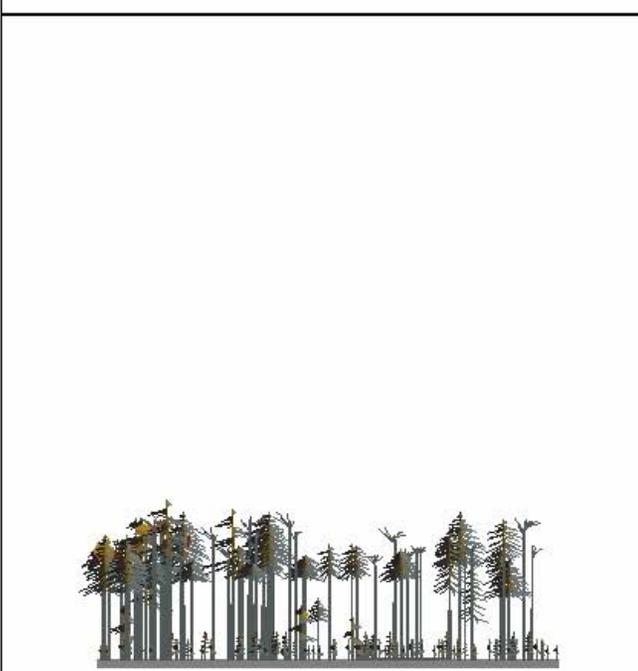
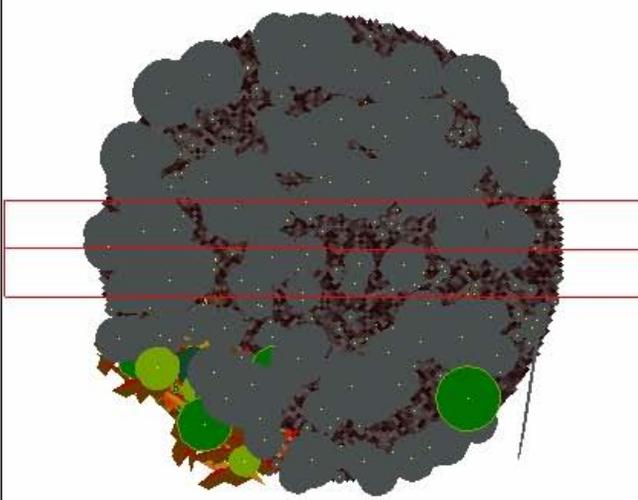
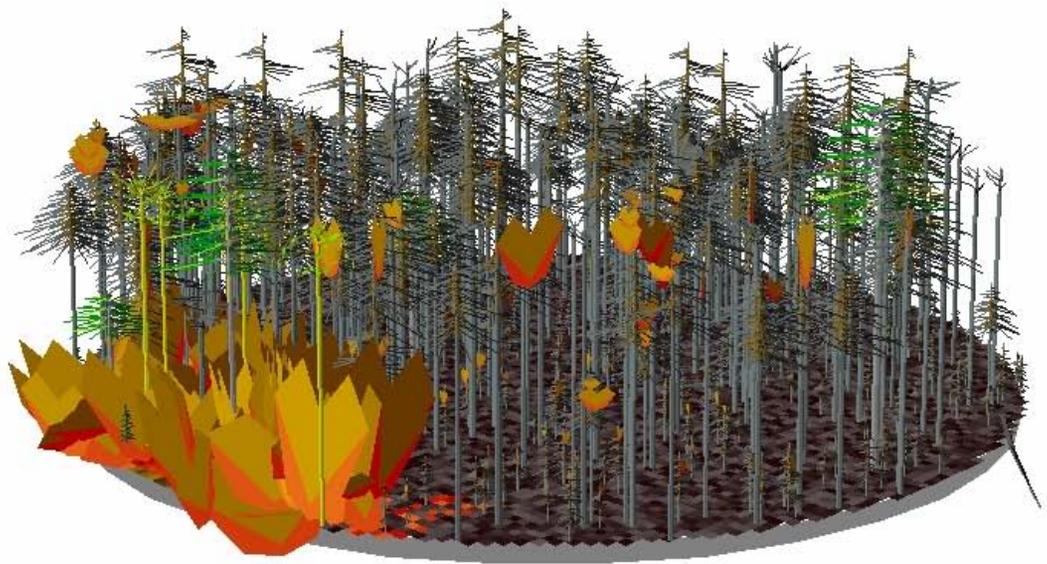


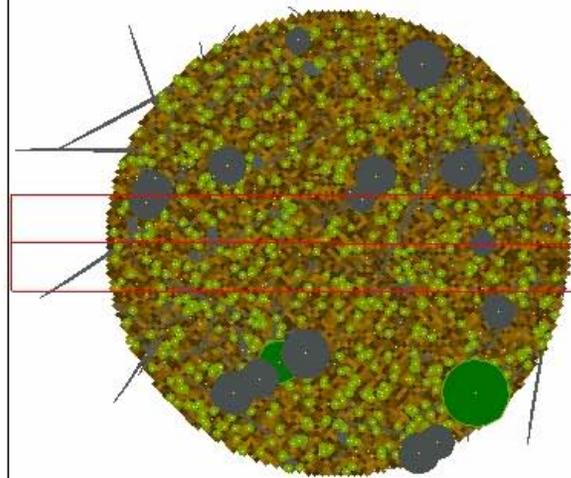
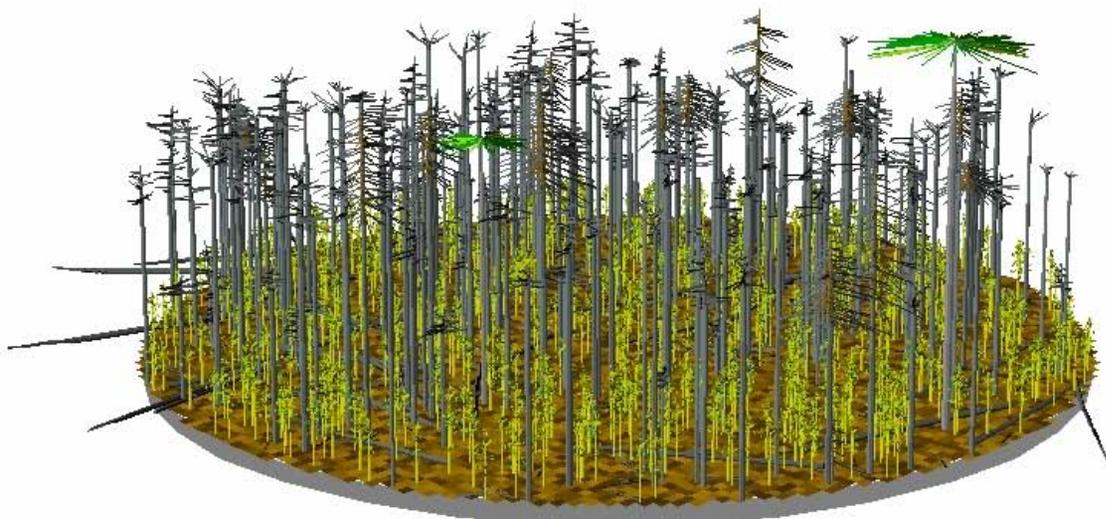
Plot 1276 Fire Scenario 2

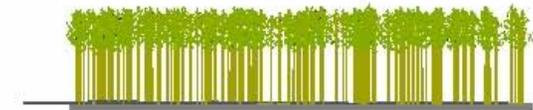
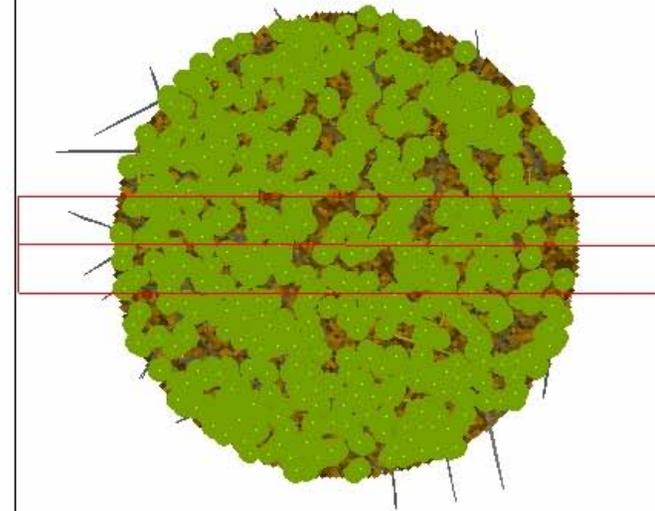
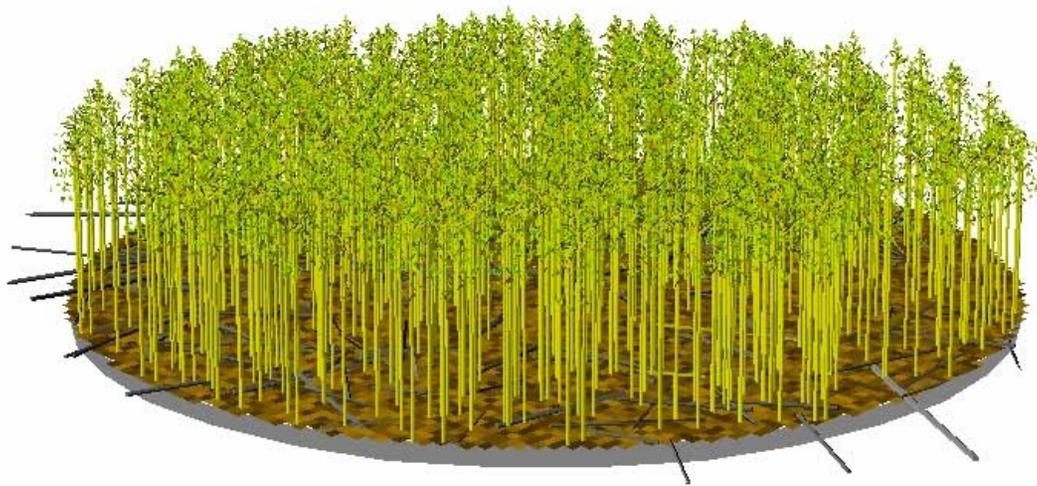
Scenario 2	Initial Conditions 2005	Hot Fire 2005	2015	2065
Fuel Model	10 = .86 8 = .14		12	12
Fire Type	Sev = A Mod = S		Sev = S Mod = S	Sev = S Mod = S
Potential BA Mortality	Sev = 100% Mod = 30%		Sev = 98% Mod = 95%	Sev = 98% Mod = 60%





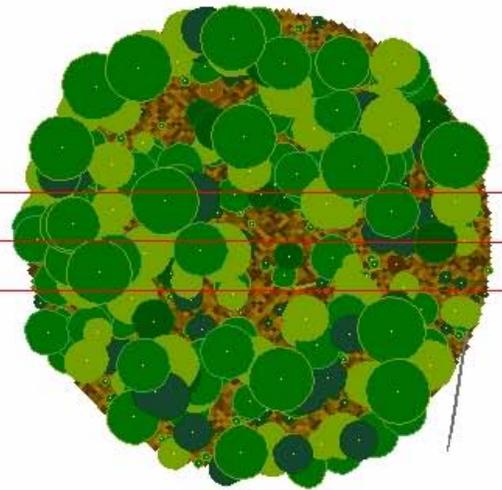


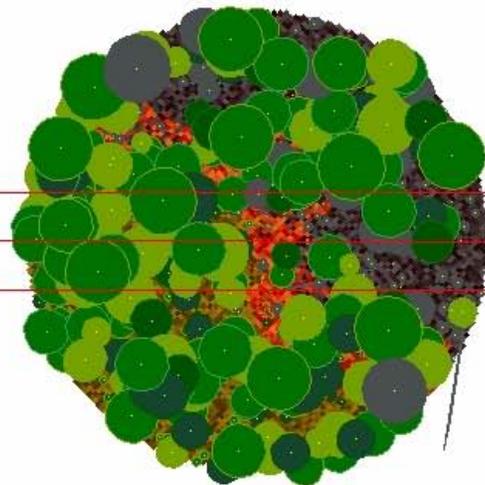


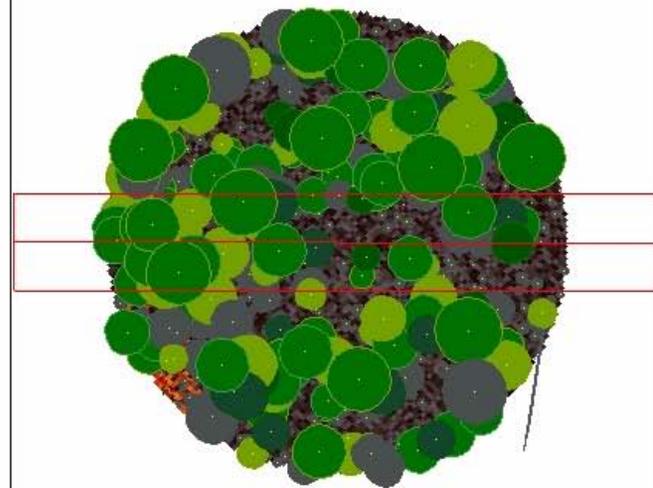


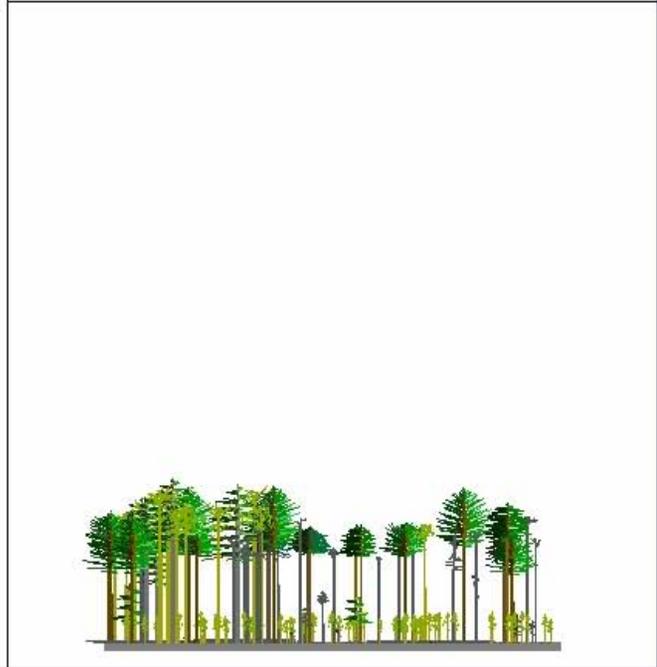
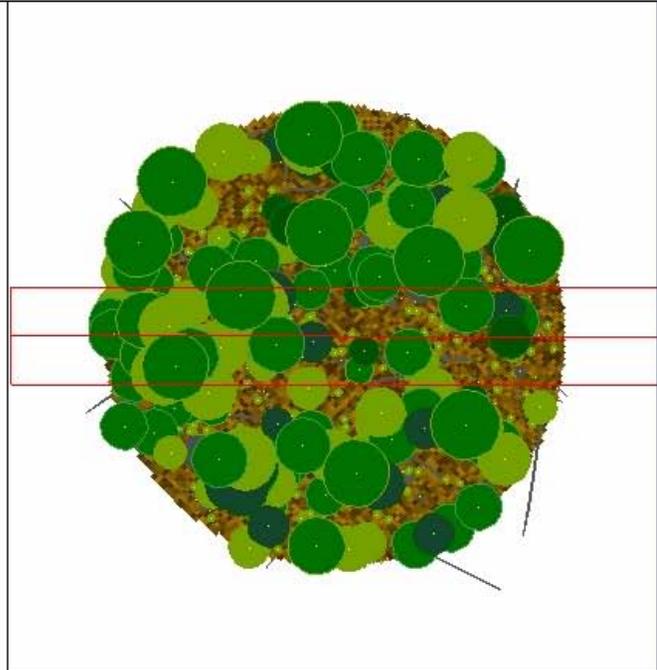
Plot 1276 Fire Scenario 3

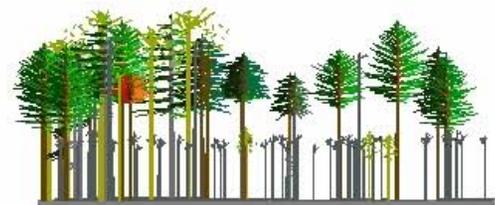
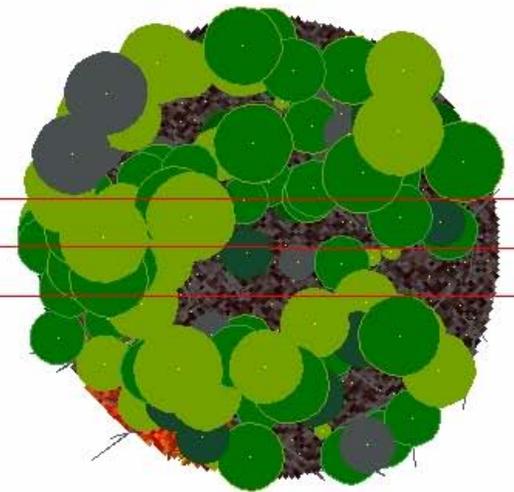
Scenario 3	Initial Conditions 2005	Mod Fire 2005	2015	Hot Fire 2055	2065
Fuel Model	10 = .86 8 = .14		10 = .85 12 = .15		12 = .57 10 = .43
Fire Type	Sev = A Mod = S		Sev = C Mod = S		Sev = S Mod = S
Potential BA Mortality	Sev = 100% Mod = 30%		Sev = 26% Mod = 25%		Sev = 16% Mod = 15%

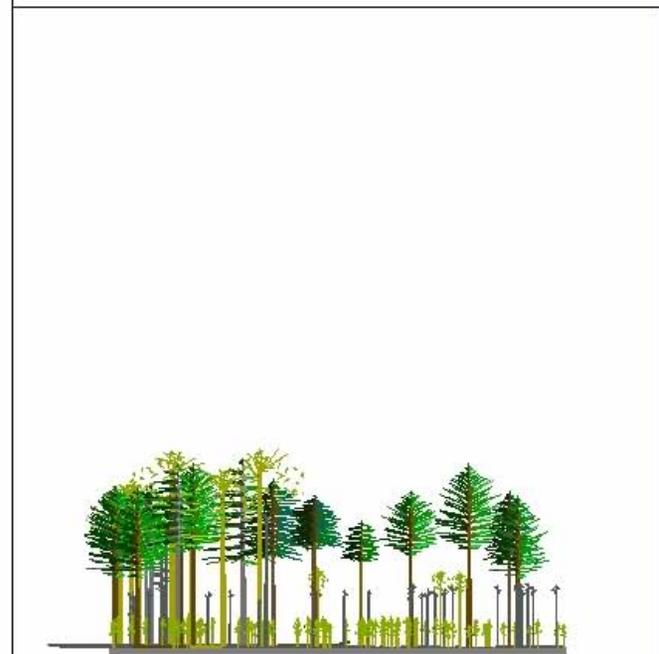
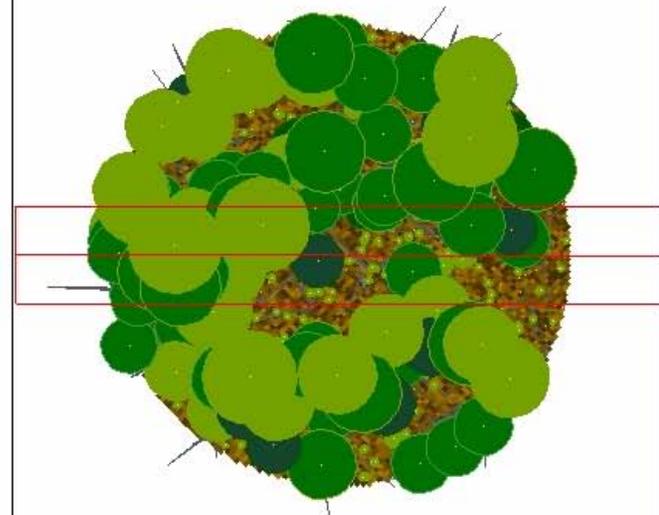








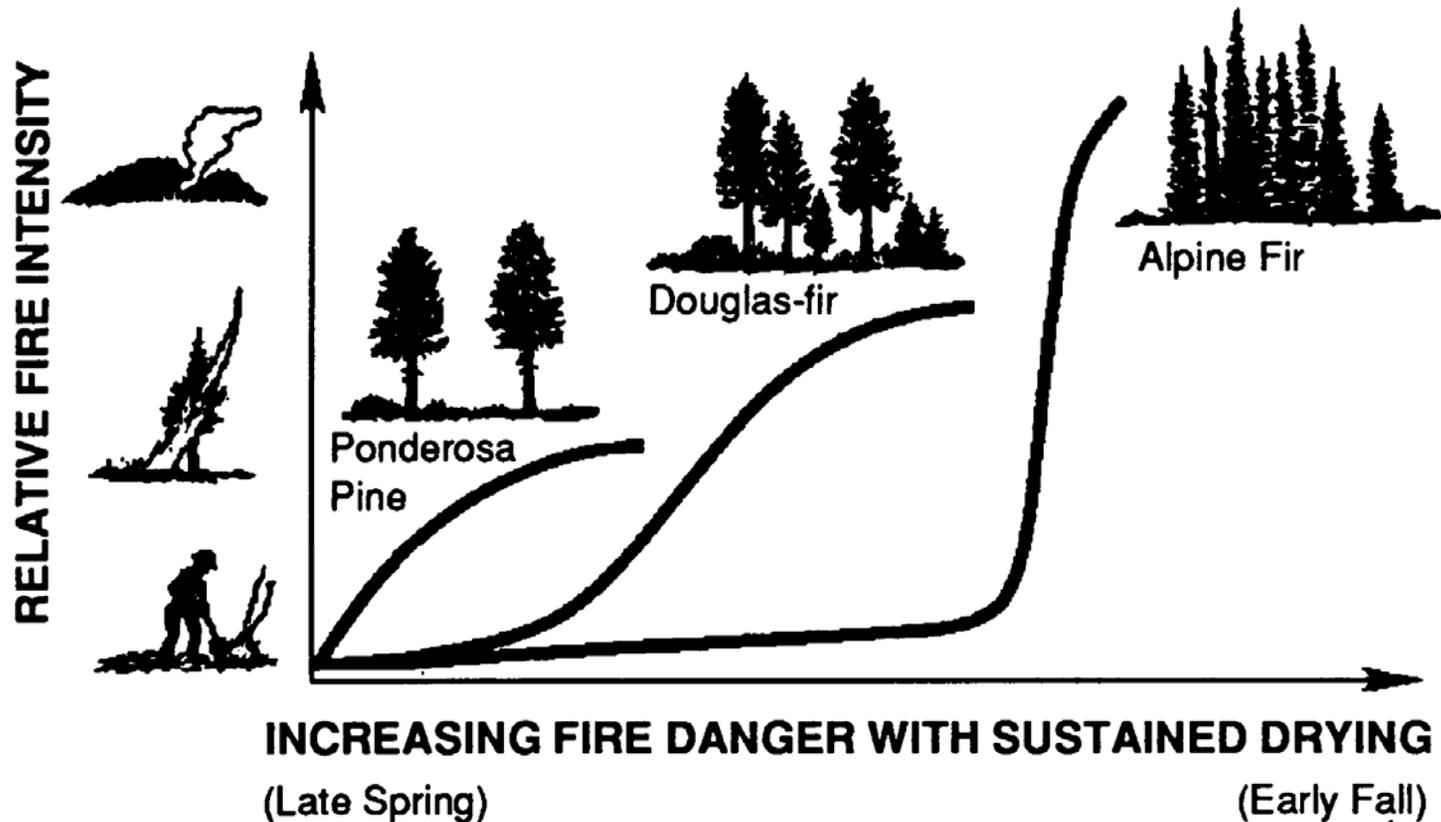




Summary

- Under extreme conditions fire suppression efforts in some areas of the mixed conifer are unlikely to be successful
- With the stand diversity, topographic variations, and diurnal changes in weather, burn severity would be mixed under even “hot” fire conditions

Following is a graph from Williams and Rothermel's "Fire Dynamics in Northern Rocky Mountain Stand Types". The line for alpine fir can be considered representative of mixed conifers.



Summary of modeling results

- Without fire or other treatment the surface fuel loading will increase in the mixed conifer

Summary (continued)

- Exclusion of fires will likely cause changes in surface fuel models from FM8 (compact needle litter) through FM10 with higher dead and down fuel loadings to FM12 with heavy dead and down loading
 - Increased fire intensity and higher burn severity would be expected under these conditions

Summary (continued)

- A mosaic of fuel changes resulting from fires in the area will limit future fire extent and severity

Summary (continued)

- Many tools are available to help with fire related management decisions
- All of the tools require information about current conditions
 - More information about current conditions would allow more in-depth modeling
 - Considerable insight into the implications of various decisions and events can be gained with the available information and tools

Current Status:

- Resource management staff of Grand Canyon National Park has agreed to allow the Fire Management staff to include the areas of mixed conifer into prescribed fire units.



Questions?

Fire Behavior Section needs from Lookouts, FEMOs, FOBS:

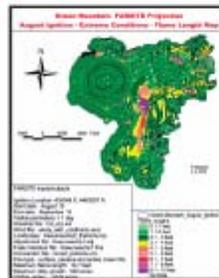
- If possible, note time, location, weather, as well as vegetation/fuel type when the transition from surface to crown fire occurs (passive and active)
- Peak burning period rate of spread and flamelength
- Length of burning period
- Mapping of fire perimeter including spots (when possible)
- Note sections of the perimeter that are still active
- Photos (with documentation) of fire behavior
- Please note (and notify fire behavior section) if actual weather observations deviate significantly from forecast

Wildland Fire Use

Implementation Procedures Reference Guide



May 2005



Appendix B: Preplanning Wildland Fire Implementation Plan Elements

- **Monitoring Plan** – do not confuse the monitoring plan with monitoring as an appropriate management response. The monitoring plan is intended to determine if the fire is meeting or has met management objectives. Since nearly all the management objectives should be known in advance, this plan can also be prepared in advance.
- **Information Plan** – use experience from past fires, both suppression and wildland fire use, to develop many elements of the information plan. Some elements may be more situational or new contacts or contact methods may occur between the development of this preliminary plan and an actual fire.
- **Agreements** – although not technically part of the WFIP, fully implementing a WFIP may require that cross-jurisdiction agreements be in place to allow the fire to move from one jurisdiction to another. These jurisdictions may be other land management agencies; state or local fire protection agencies or districts; or private landowners.
- Term files for use in RERAP
- Preliminary RERAP assessments for individual FMUs with assumptions (risk of fire movement over set distances by time of year and general direction)
- FARSITE layers, including changes resulting from the previous year's fires and vegetation management actions
- Structure protection plans
- Potential evacuation needs, routes and responsibilities, which should be shared with the appropriate authority in advance of an ignition.
- Mitigation measures for threatened and endangered species (TES) (i.e. plants, animals, and fish) that have been successful in the past
- Data layers (actual data or location of data)
 - Fuels
 - Roads and trails
 - Streams
 - Values to be protected (some of this data may be protected)
 - Land status
 - Fire history
 - Fuels treatment history
 - Vegetation type or dominant species
 - Vegetation structure
 - Potential vegetation
 - Fire regime or fire regime condition class
 - Smoke sensitive areas

In addition to WFIP elements, several types of data are recommended for advanced development or for addition to the fire management plan as data are developed from different fires. As appropriate, update data each year. The following list is not exhaustive but intended as a tickler:

- Weather Data
 - NFDRS station catalogs and weather files
 - Definitions for:
 - ... Season or fire-ending event
 - ... Fire-slowing events (event plus number of days the event is effective)
 - ... Large fire growth events or key weather events that result in large fire growth