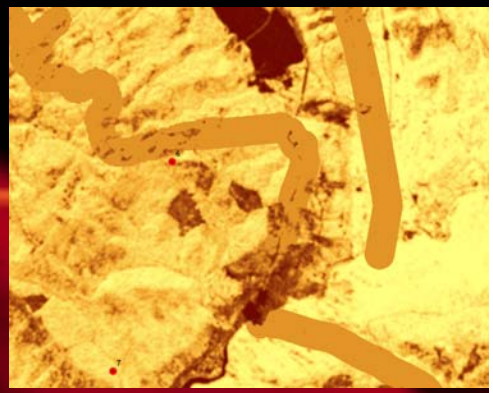
Fuels, Fire & Vegetation



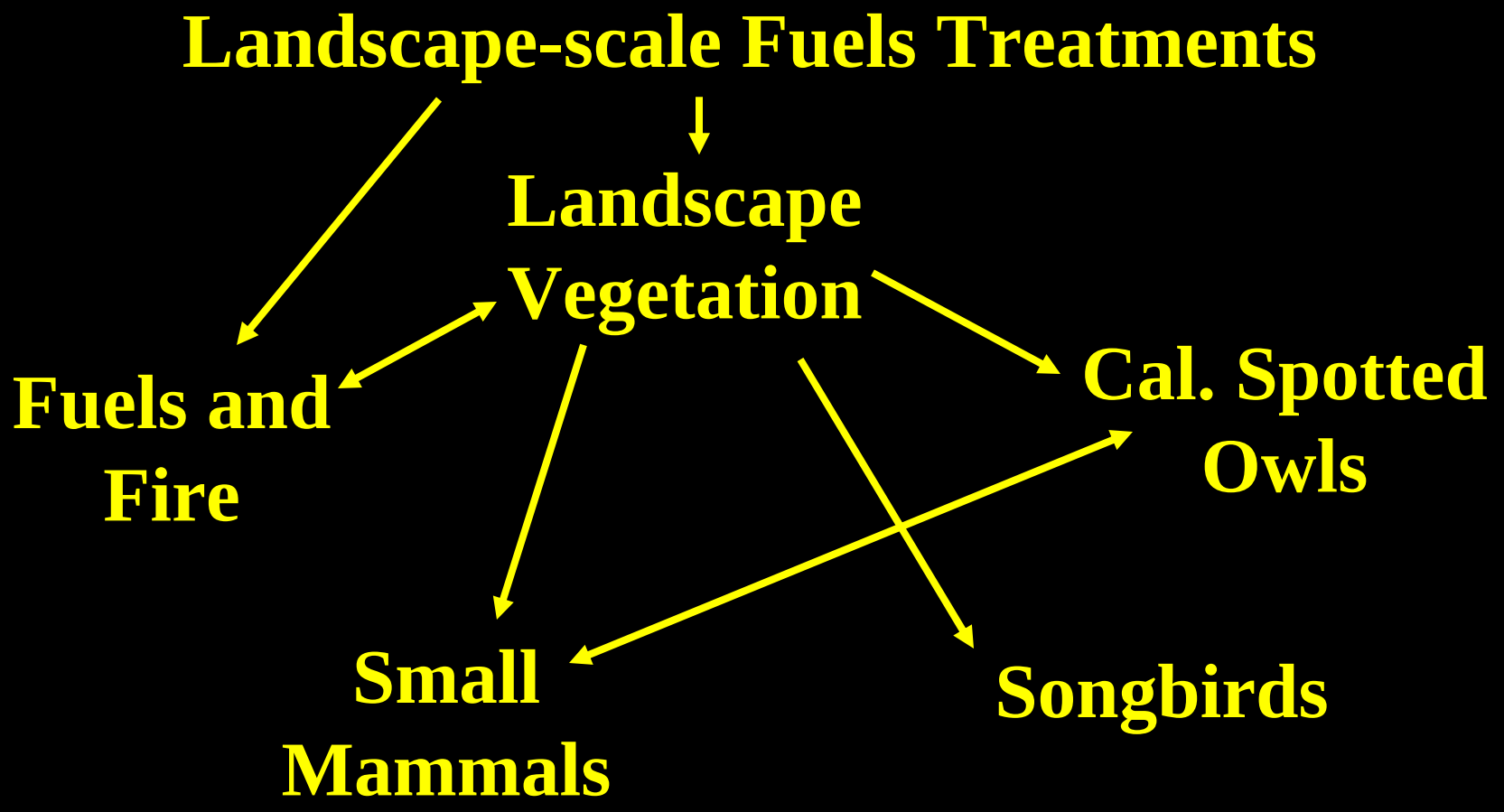
at the Landscape Scale

Scott Stephens, Kurt Menning, Nick Delaney
University of California, Berkeley

Overview

- **Introduction**
- **Data: Plot Data & GIS**
- **Remote Sensing**
- **Fire Modeling**
- **Integrative Wildlife Habitat Assessment**

Plumas-Lassen Administrative Study



Primary Objective

How do landscape-level fuels treatments affect fuel loads, fire behavior and fire effects?

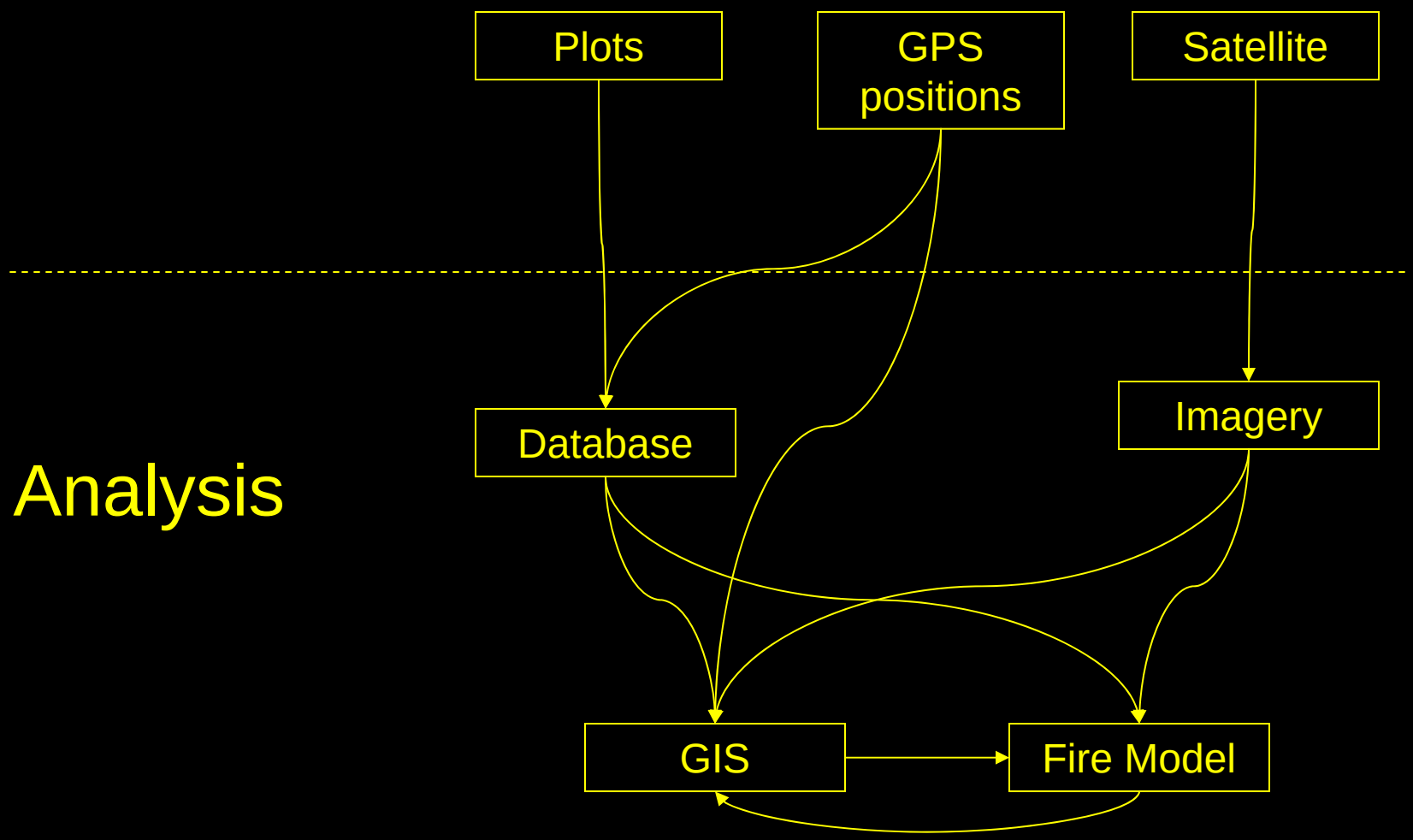
Steps being taken

1. Assess current conditions
2. Model current fire behavior & effects
3. Model fire given landscape fuels treatments (DFPZs)
4. Beyond fire: integrate vegetation, fire and habitat

Primary methods

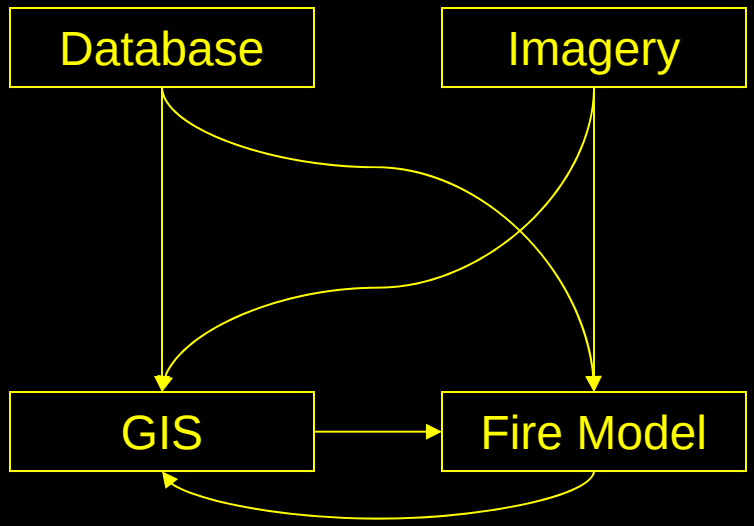
1. Extensive field sampling
2. Remote sensing
3. Modeling fire behavior and effects
4. Integrative modeling

Data Collection

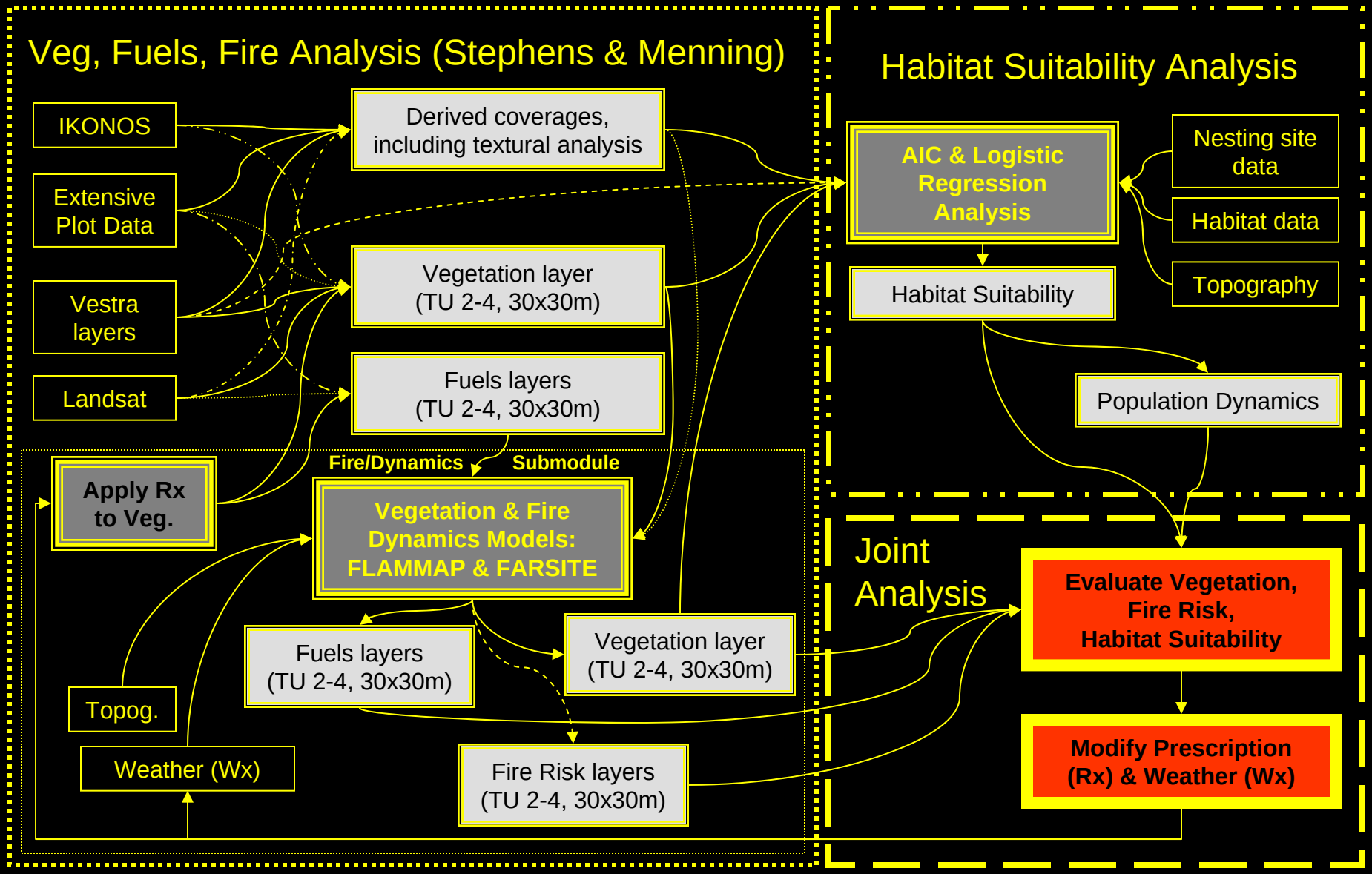


Analysis

Analytical System



PLAS Landscape Vegetation, Fire and Habitat Integration and Projection



Key: white boxes = data sources; light grey = derived products or layers; dark grey = dynamics/analytical models; black = human evaluation & decision space

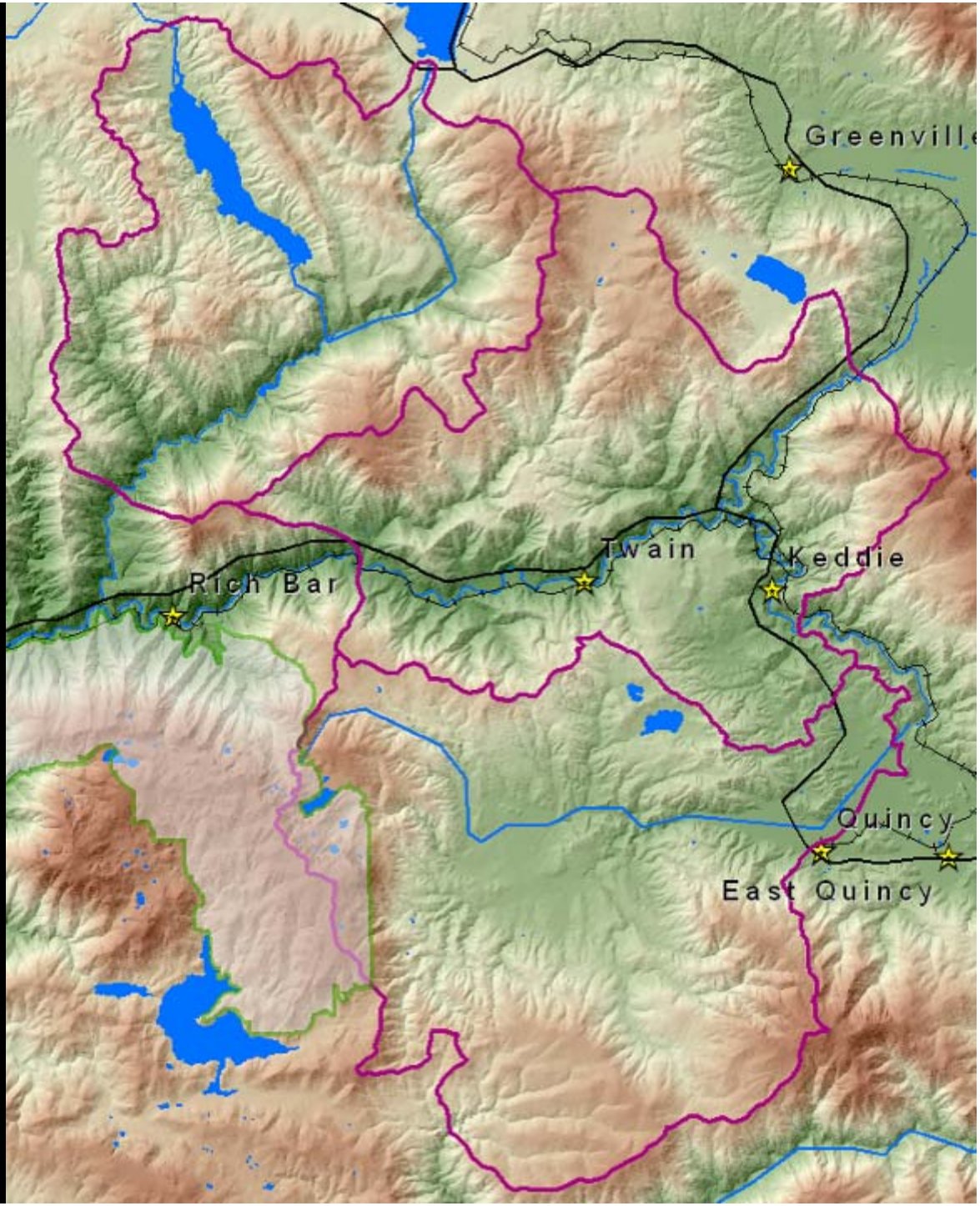

GIS & Plot Data

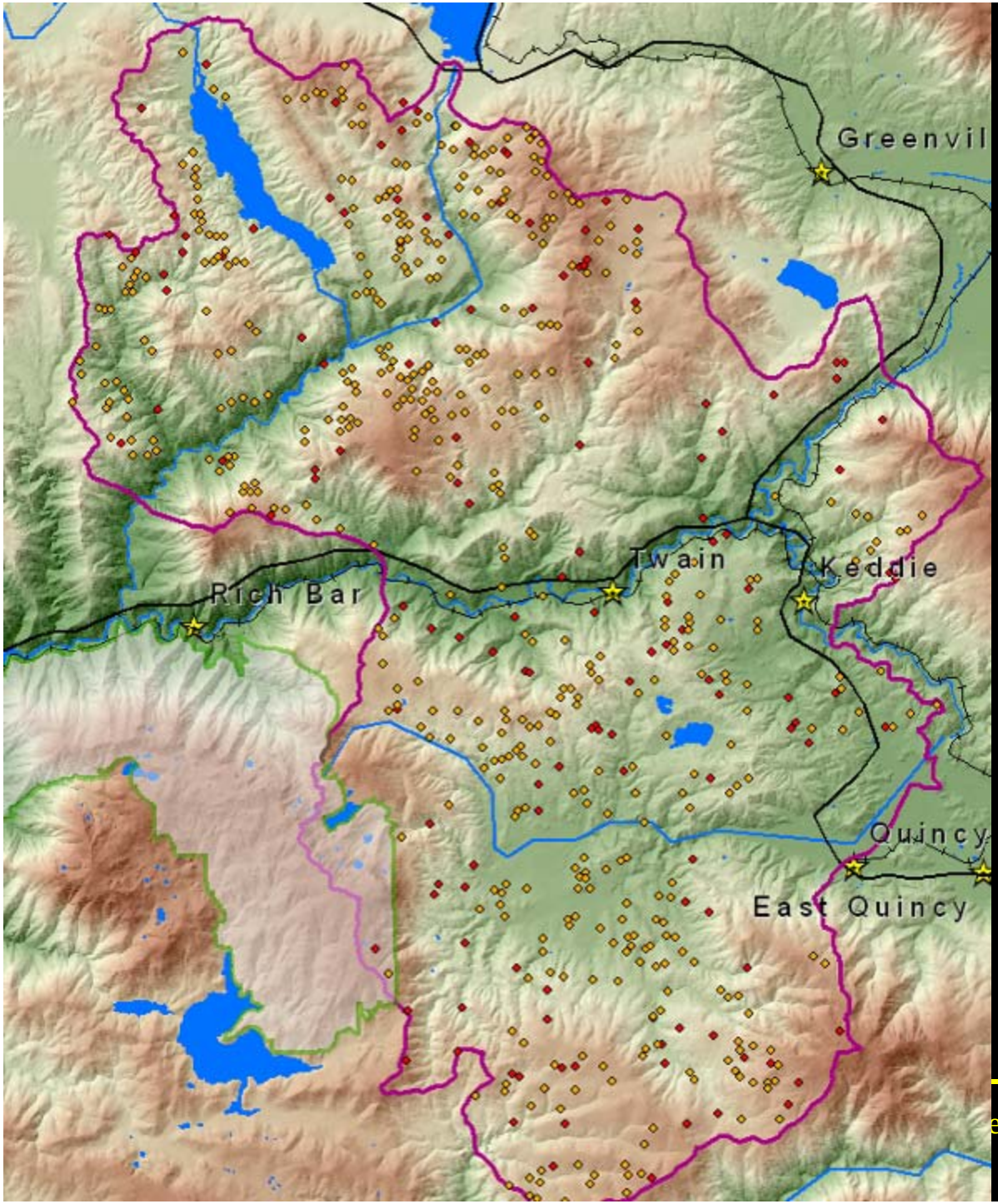
Focus: Study Areas 2-4:

150,000 ha

High Variation:

- Topography
- Vegetation type & condition
- Potential fire behavior
- Owl/wildlife habitat quality
- Owl/wildlife population density





Plot locations

- 600 plots
- 493 Stratified
- 108 Random

Summary of Forest Composition and Structure

- Inventory attributes of all trees, fuels, etc. in area equivalent to 30 ha (75 ac)
- >17,000 trees thicker than 10cm (4 inches)
- Stocking density: 585/ha (234/ac)
- Basal area: 48.0m^2/ha (207 ft^2/ac)

Tree composition by stem

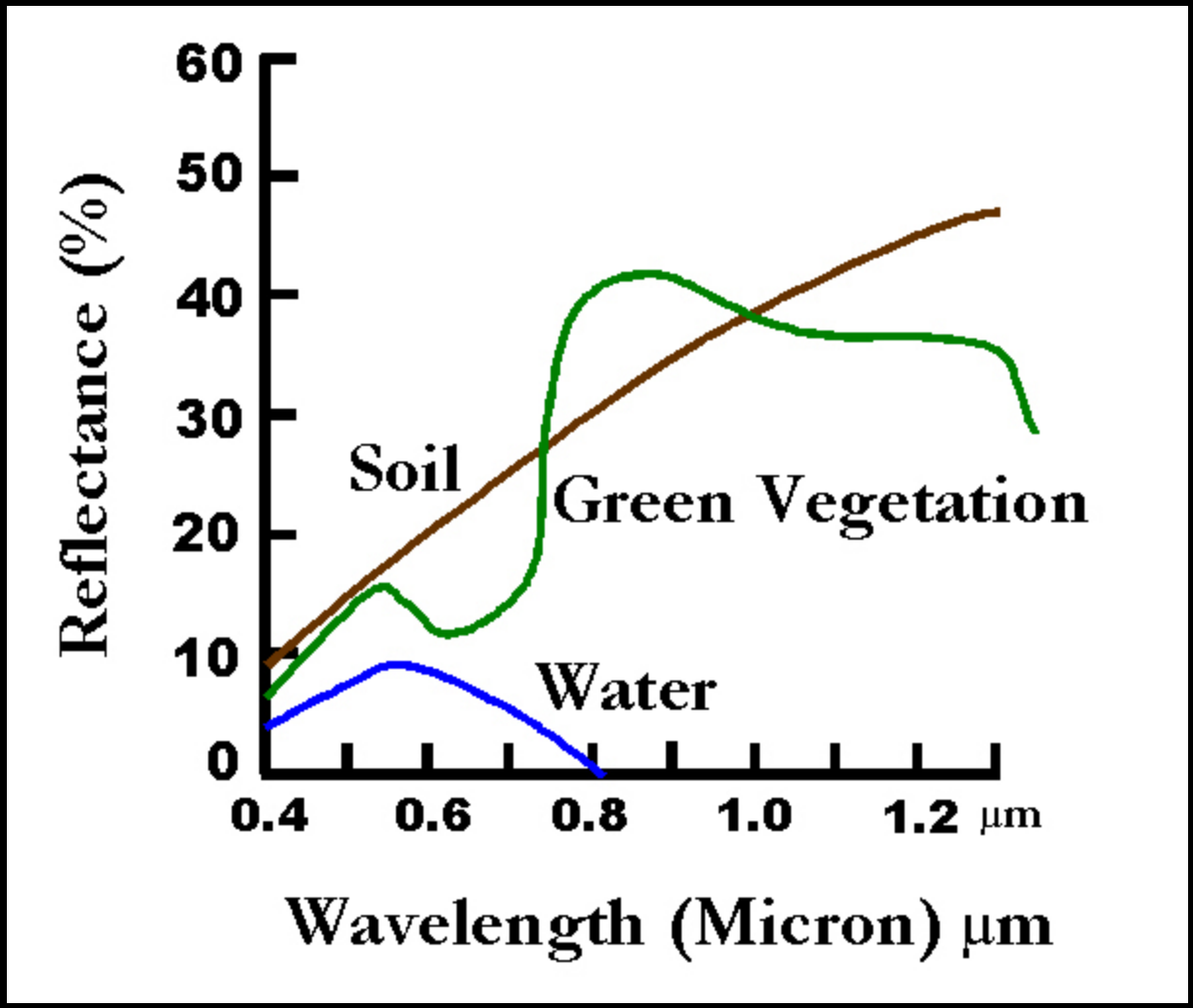
Species	Percent of total
White fir	25.9
Douglas-fir	25.8
Incense-cedar	15.1
Ponderosa	8.6
Snag	8.1
Black Oak	7.6
Sugar pine	5.8
Canyon Live Oak	1.0
Red fir	0.7
Jeffrey pine	0.6
Maple	0.4
Other (Populus, Alnus, Cornus, etc.)	0.2
Willow	0.1
Lodgepole	0.1
	100.0

Remote Sensing

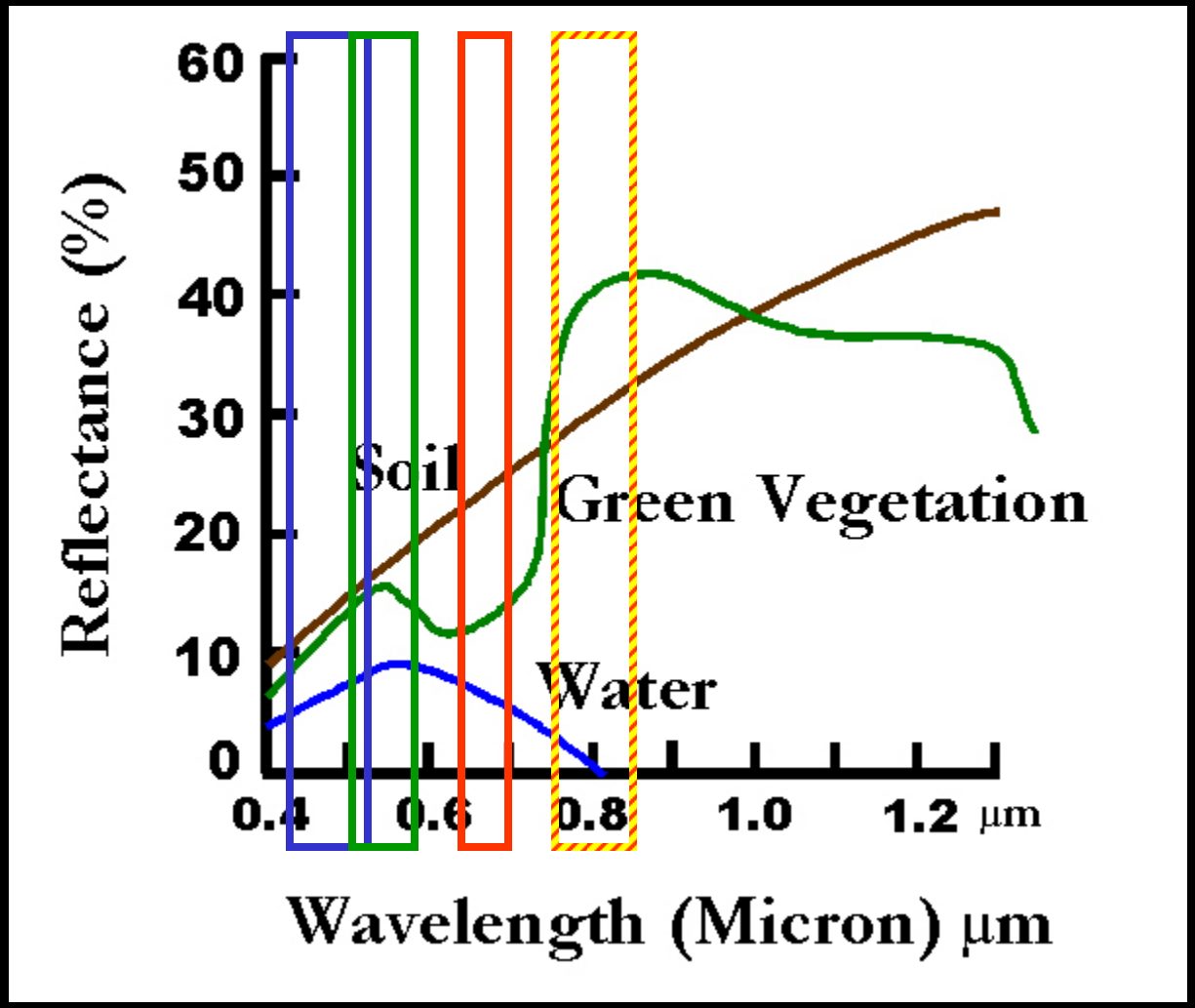
Two purposes:

- **Fire Modeling inputs**
- **Wildlife habitat assessment**

http://landsat.usgs.gov/resources/remote_sensing/images/Spectral_signature_soil_water_veg_lg.jpg



Spectral bands: IKONOS



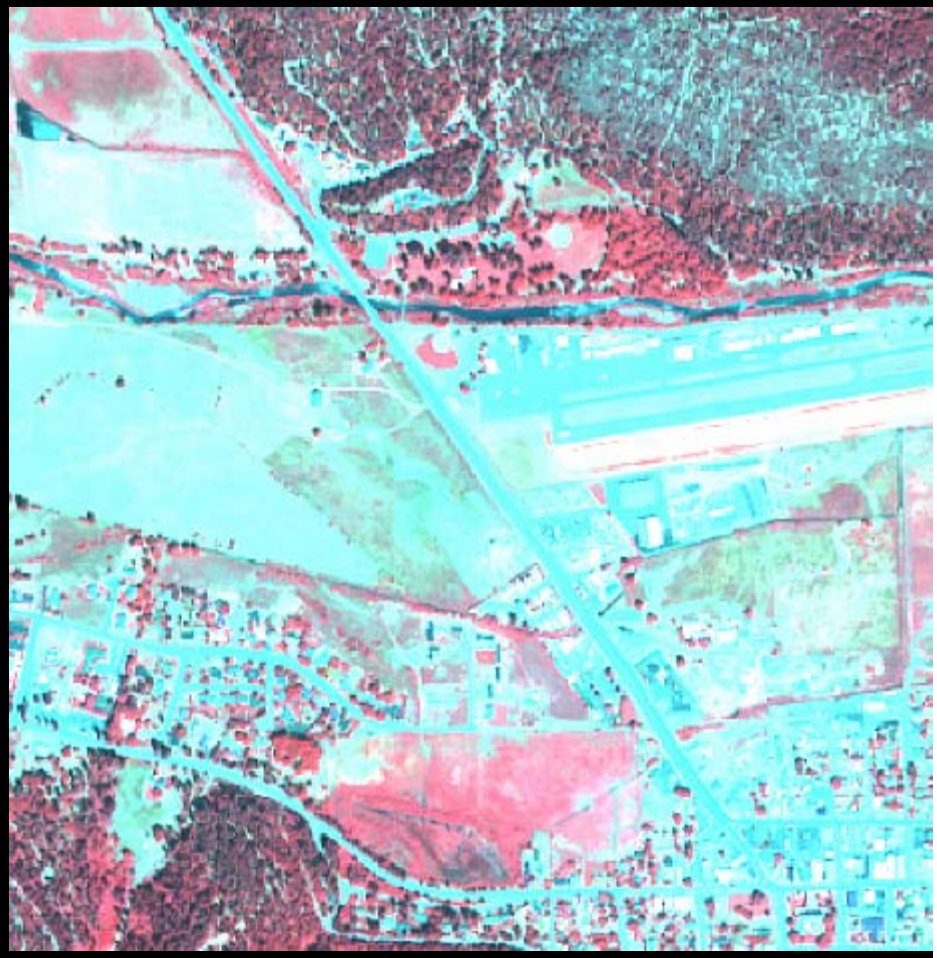
Blue: 0.445-0.516 um

Green: 0.506-0.595

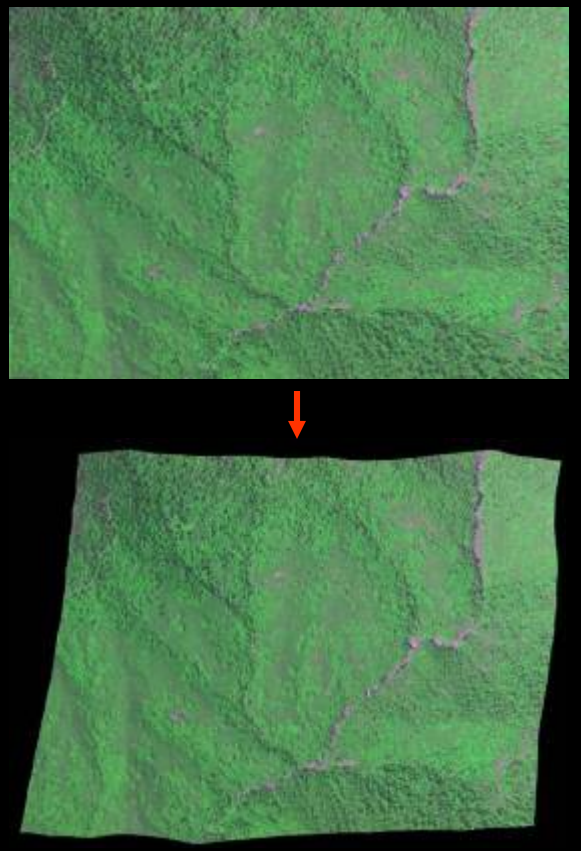
Red: 0.632-0.698

NIR: 0.757-0.853

Oak & Hardwood Extraction

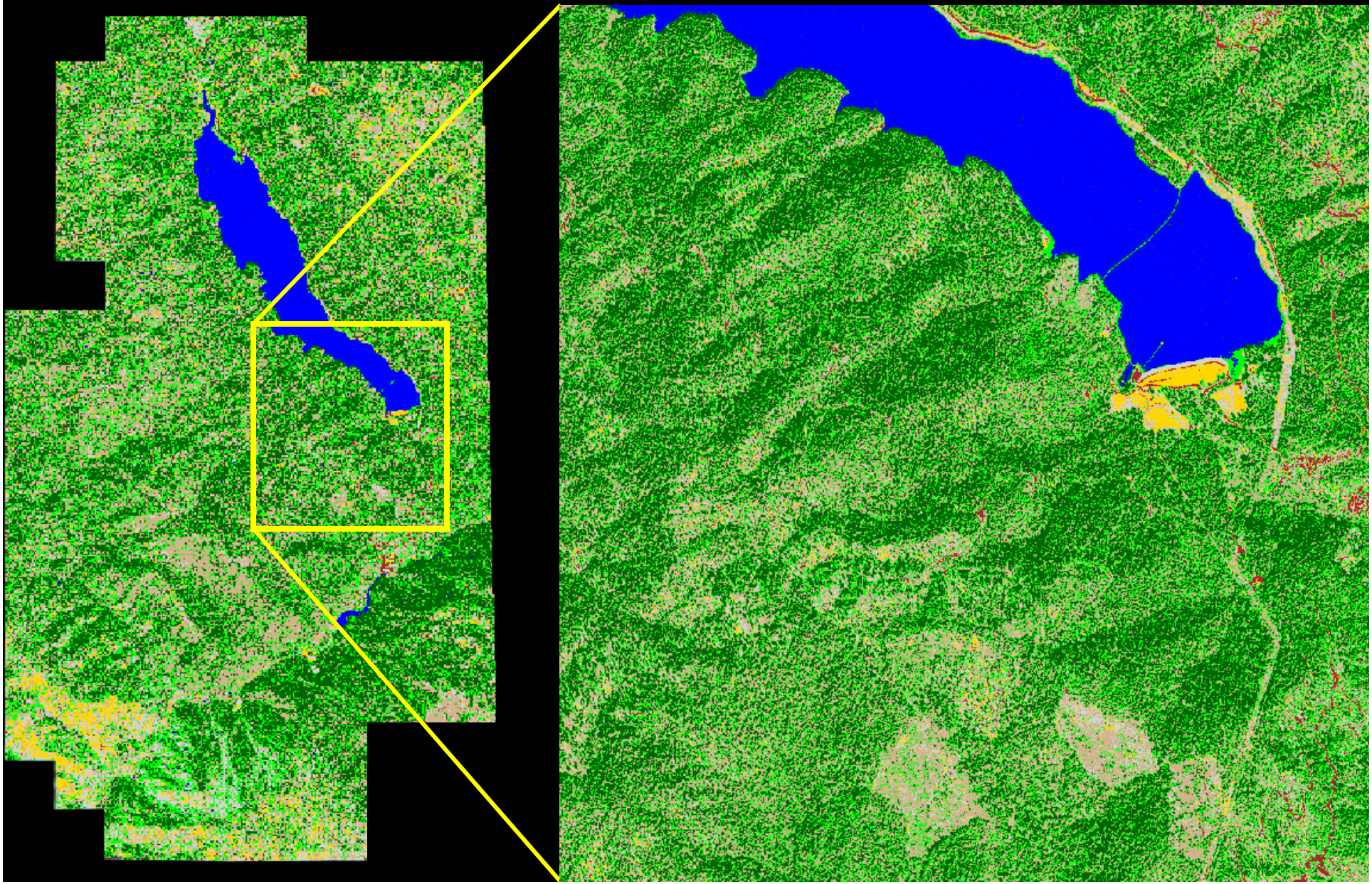


Pre-processing steps

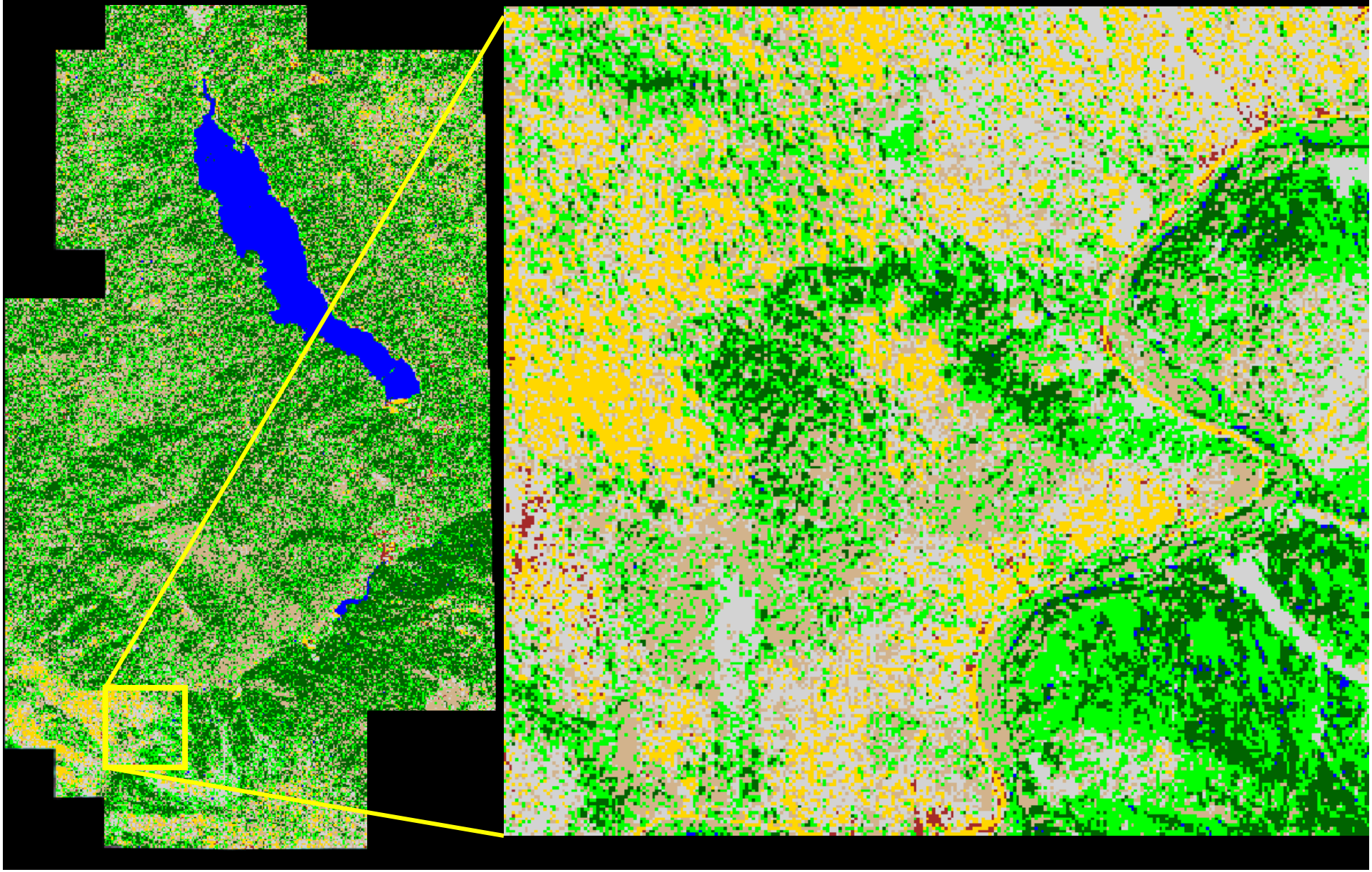


- Orthorectification
  $80K value
- Radiometric corrections:
  - Sun angle correction
  - Haze / Dark Target Removal Correction
- Adjacent image issues
  - Histogram offsets, Haze differentials

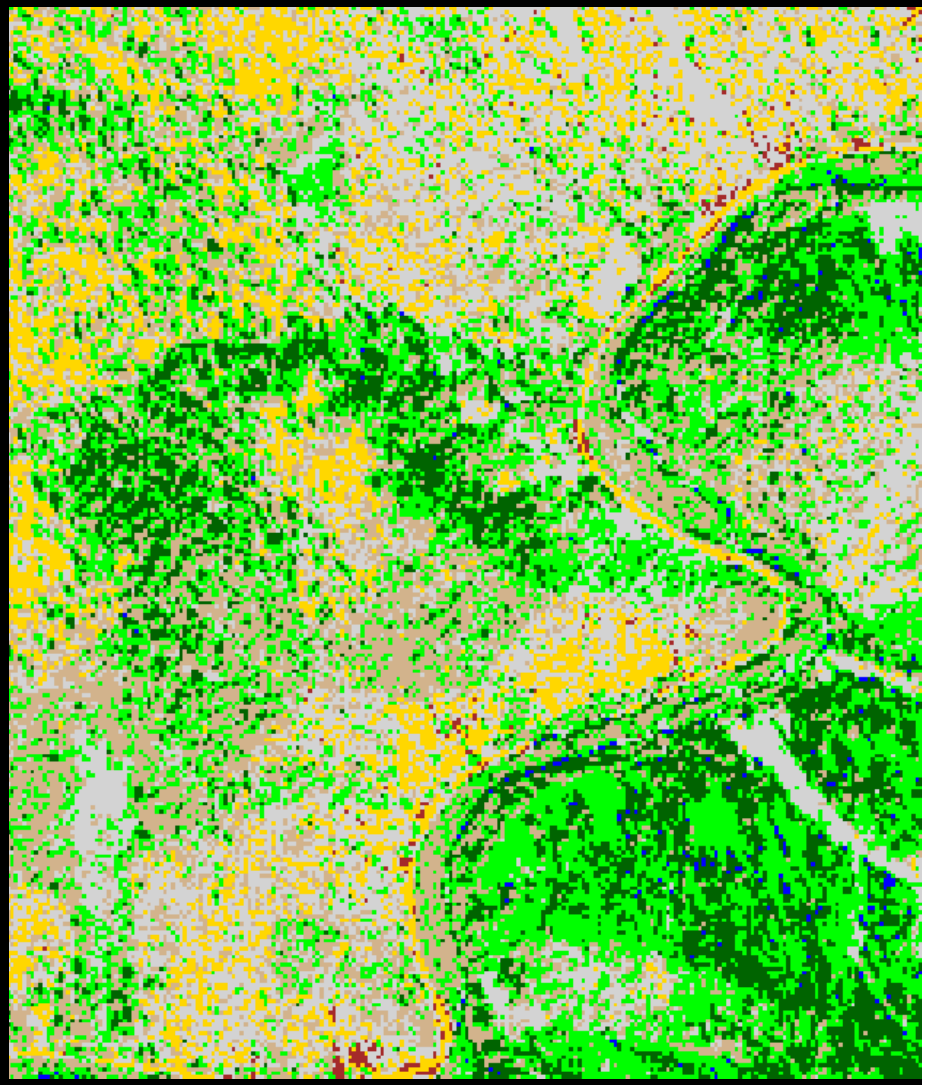
Supervised Classification 2: BGRN



Supervised Classification 2: BGRN

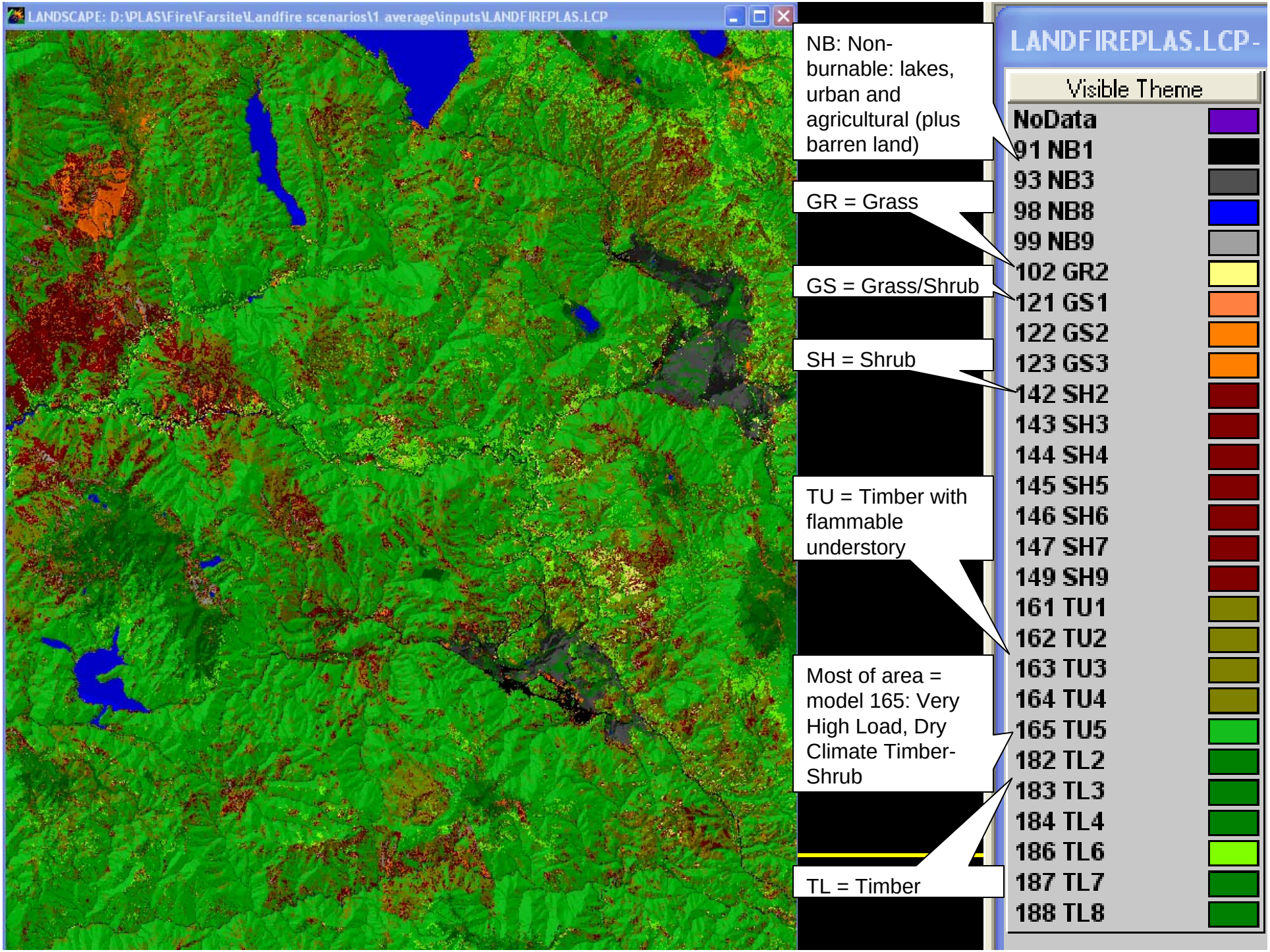


Supervised Classification 2: BGRN



Fire Modeling

- Weather scenarios:
- Moderate: 70th percentile
- Severe: 90th percentile
- Extreme: 97.5th percentile
- Comparisons
- Pre- and post-DFPZ treatment

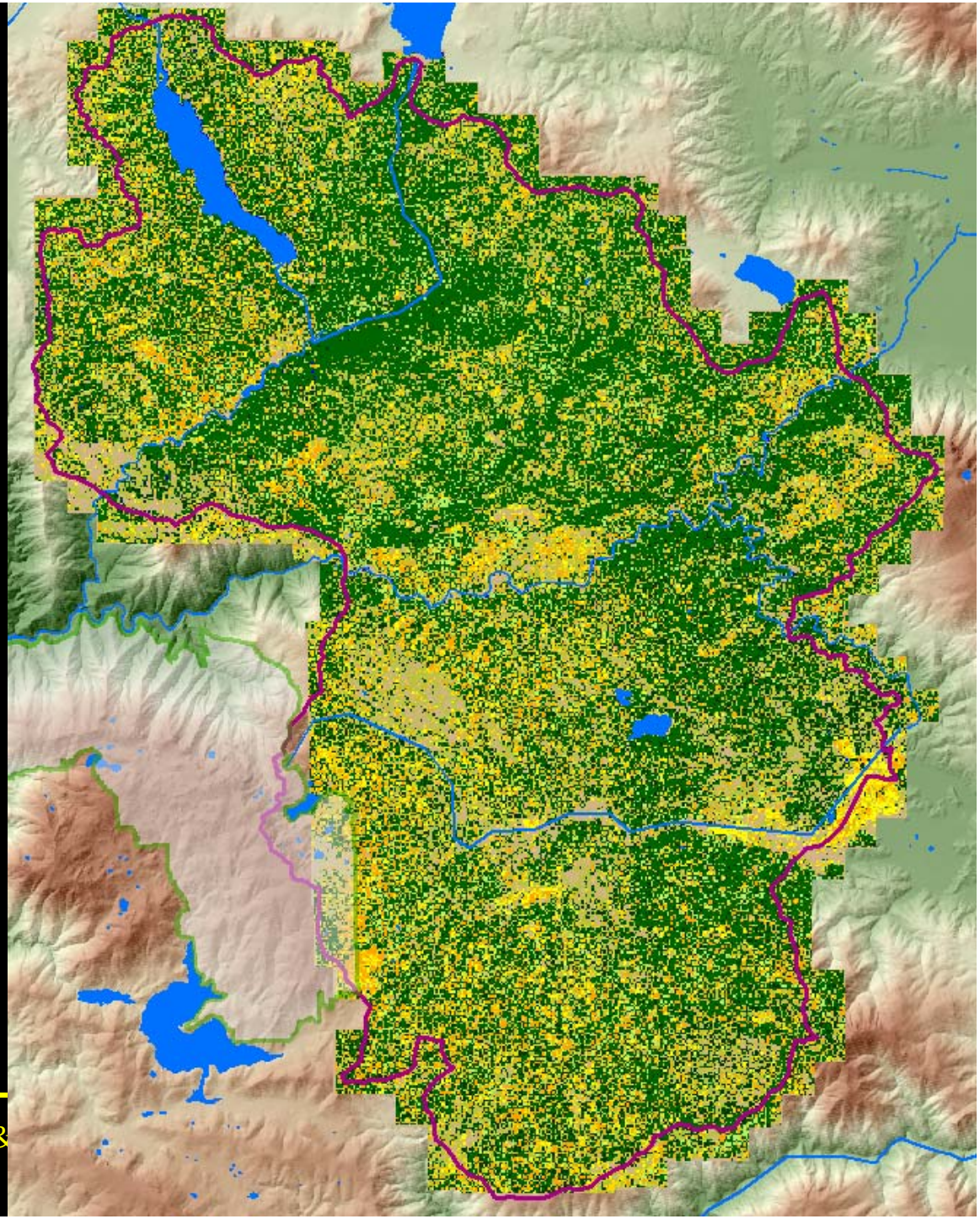

LANDSCAPE: D:\PLAS\Fire\Farsite\Landfire scenarios\1 average\inputs\LANDFIREPLAS.LCP
NB: Non-burnable: lakes, urban and agricultural (plus barren land)
GR = Grass
GS = Grass/Shrub
SH = Shrub
TU = Timber with flammable understory
Most of area = model 165: Very High Load, Dry Climate Timber-Shrub
TL = Timber
LANDFIREPLAS.LCP-
Visible Theme
NoData
91 NB1
93 NB3
98 NB8
99 NB9
102 GR2
121 GS1
122 GS2
123 GS3
142 SH2
143 SH3
144 SH4
145 SH5
146 SH6
147 SH7
149 SH9
161 TU1
162 TU2
163 TU3
164 TU4
165 TU5
182 TL2
183 TL3
184 TL4
186 TL6
187 TL7
188 TL8

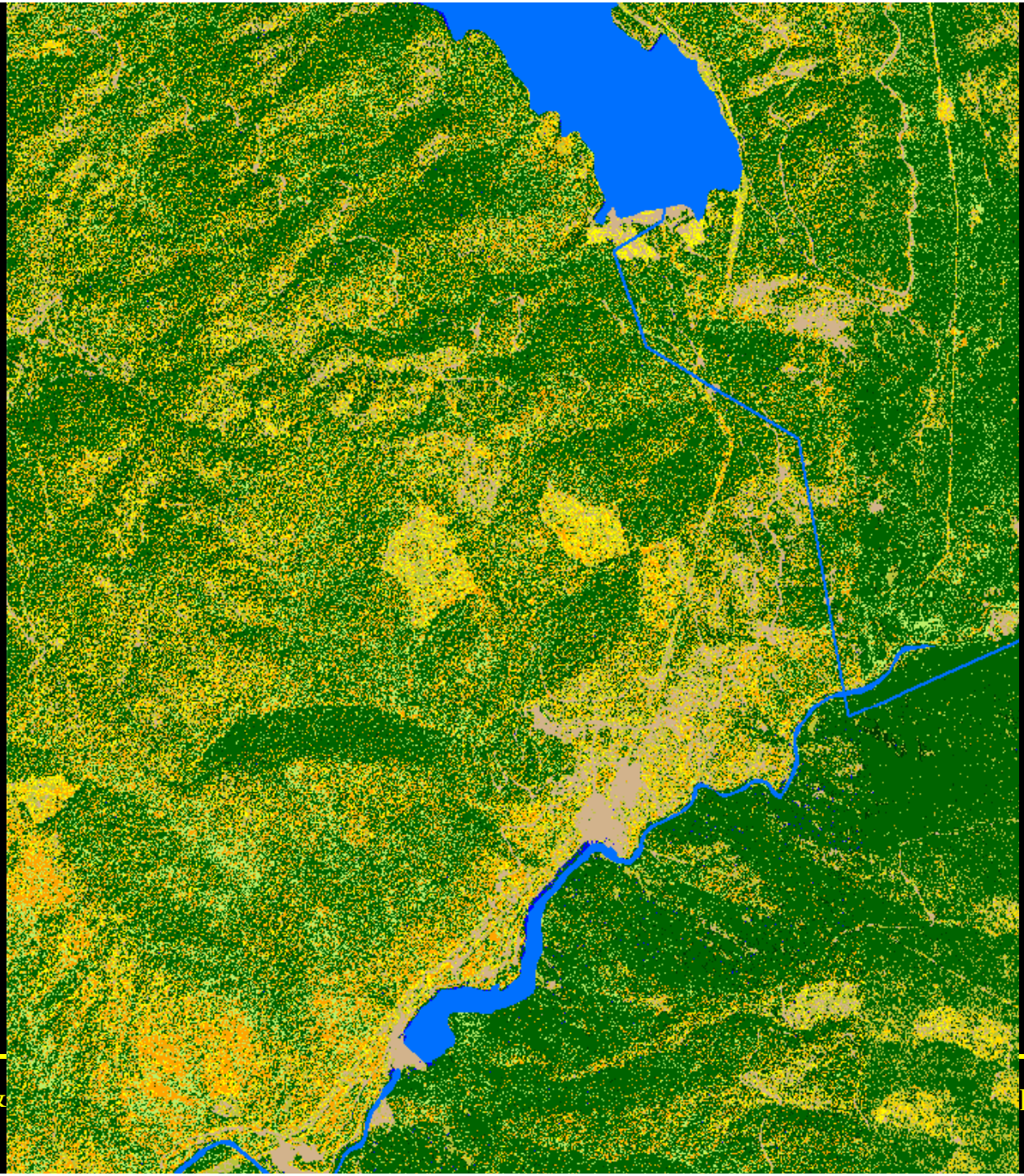
Fuels Classification

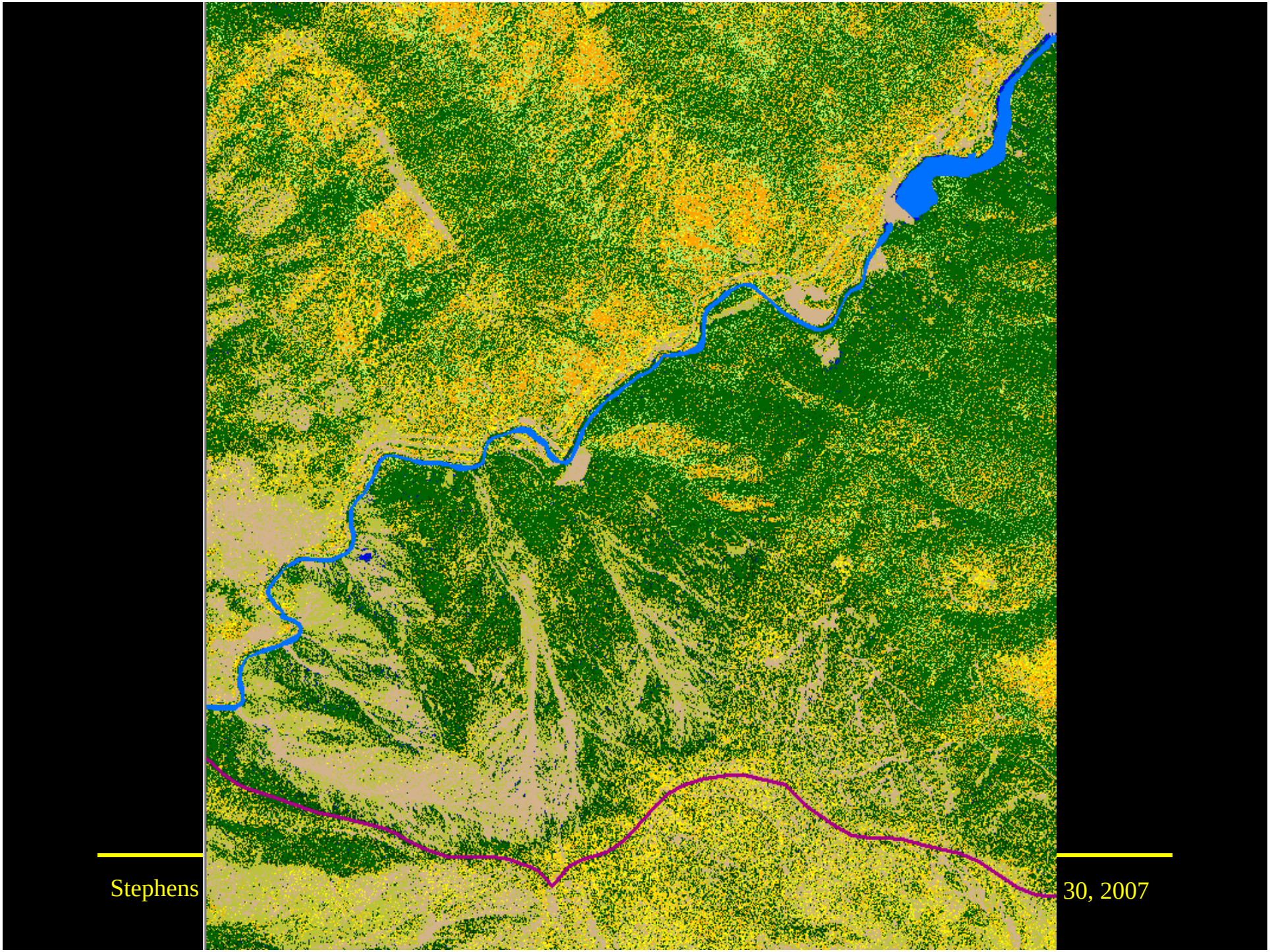
#	Fuel Model	Description	Occurrence in study area
98	NB8	Water	•Major water bodies
99	NB9	Bare ground	•Bare ground, talus, roads, semi-urban areas
102	GR2	Grass – Low load dry grass	•Extensive grasslands (American Valley, Indian Valley)
122	GS2	Grass-shrub moderate loading, dry	•South facing slopes •Recovering timber harvest areas
147	SH7	Shrub – chaparral	•Chaparral type, dense, south and west aspects
165	TU5	Timber-shrub	•South aspects only •This is the most dominant classification by Landfire (=50% of landscape)
181	TL1	Timber with compact, low volume fuel bed	•Red fir, and higher white fir areas •*Fresh timber operations, DFPZs, just after cuts*
186	TL6	Hardwood with fuel understory	•Aspen stands •Oak stands in (?) riparian areas
184	TL4	Conifer with moderate litter/fuel load	•Extensive
185	TL5	Conifer with higher litter load	•Northern aspects only

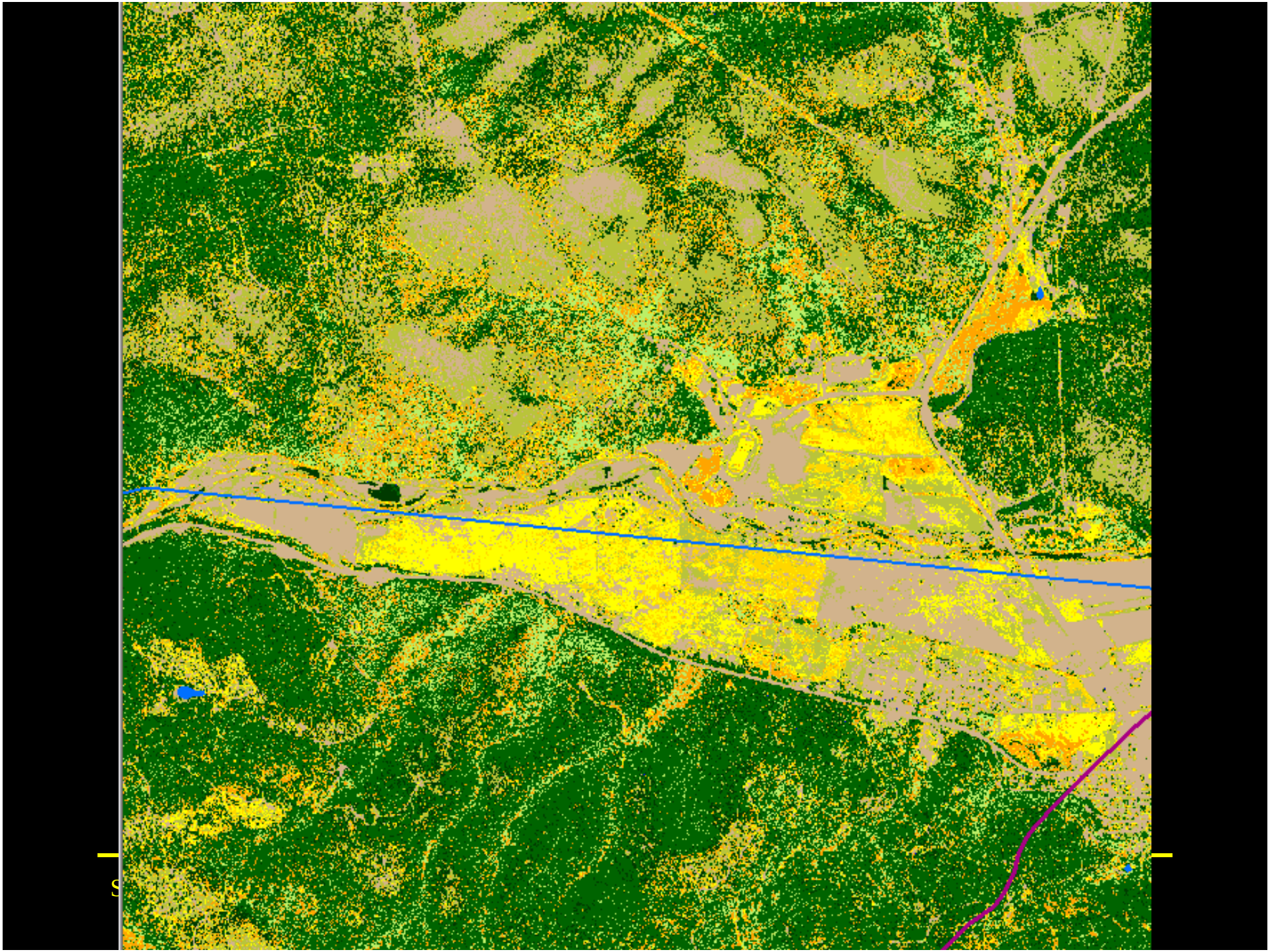
Supervised Classification

- 11 classes based on fuels
- 30-40 training sites
- 4m grain






Stephens
30, 2007



Weather

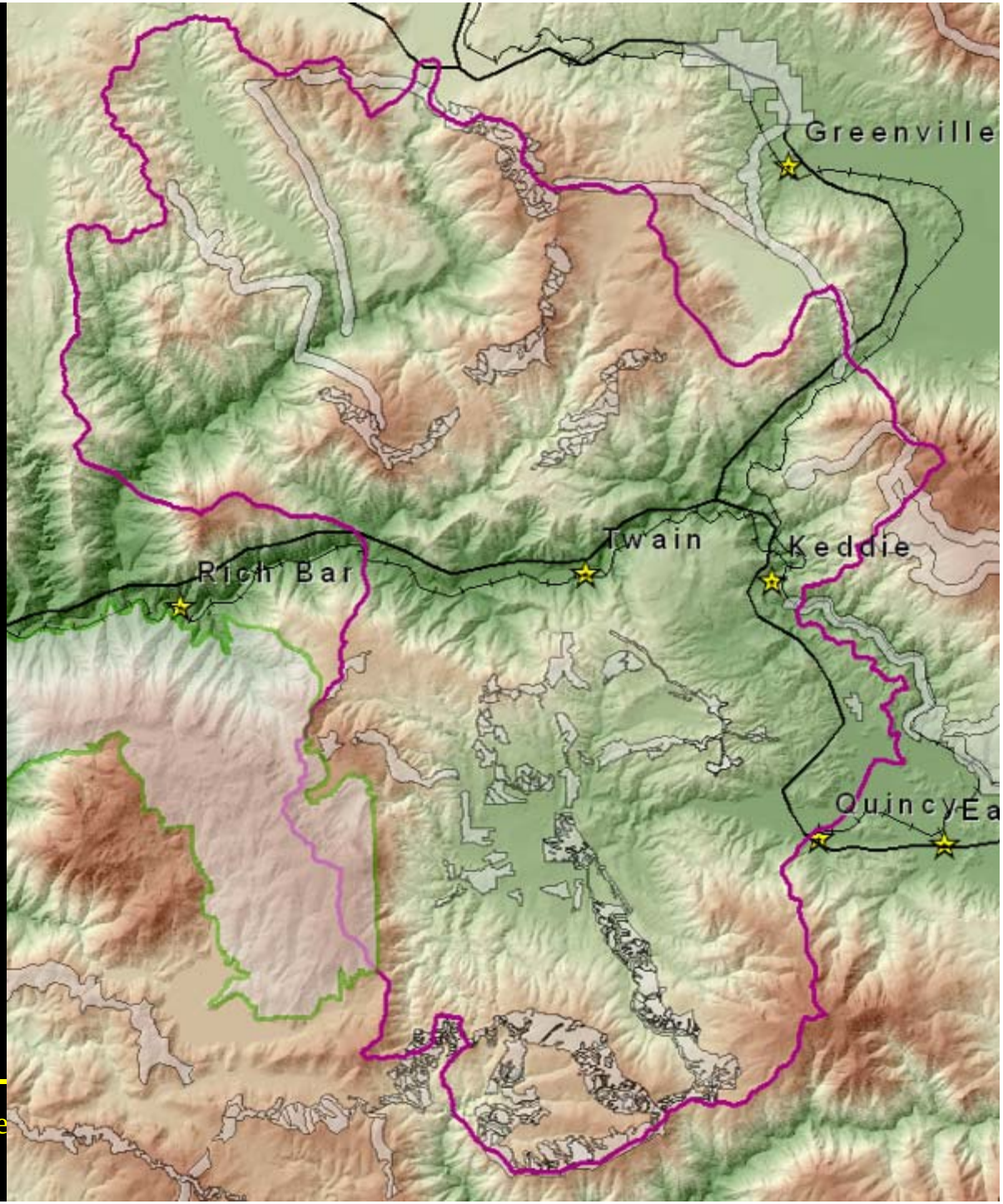
Annual Period: June 20-Sept 20 Quincy

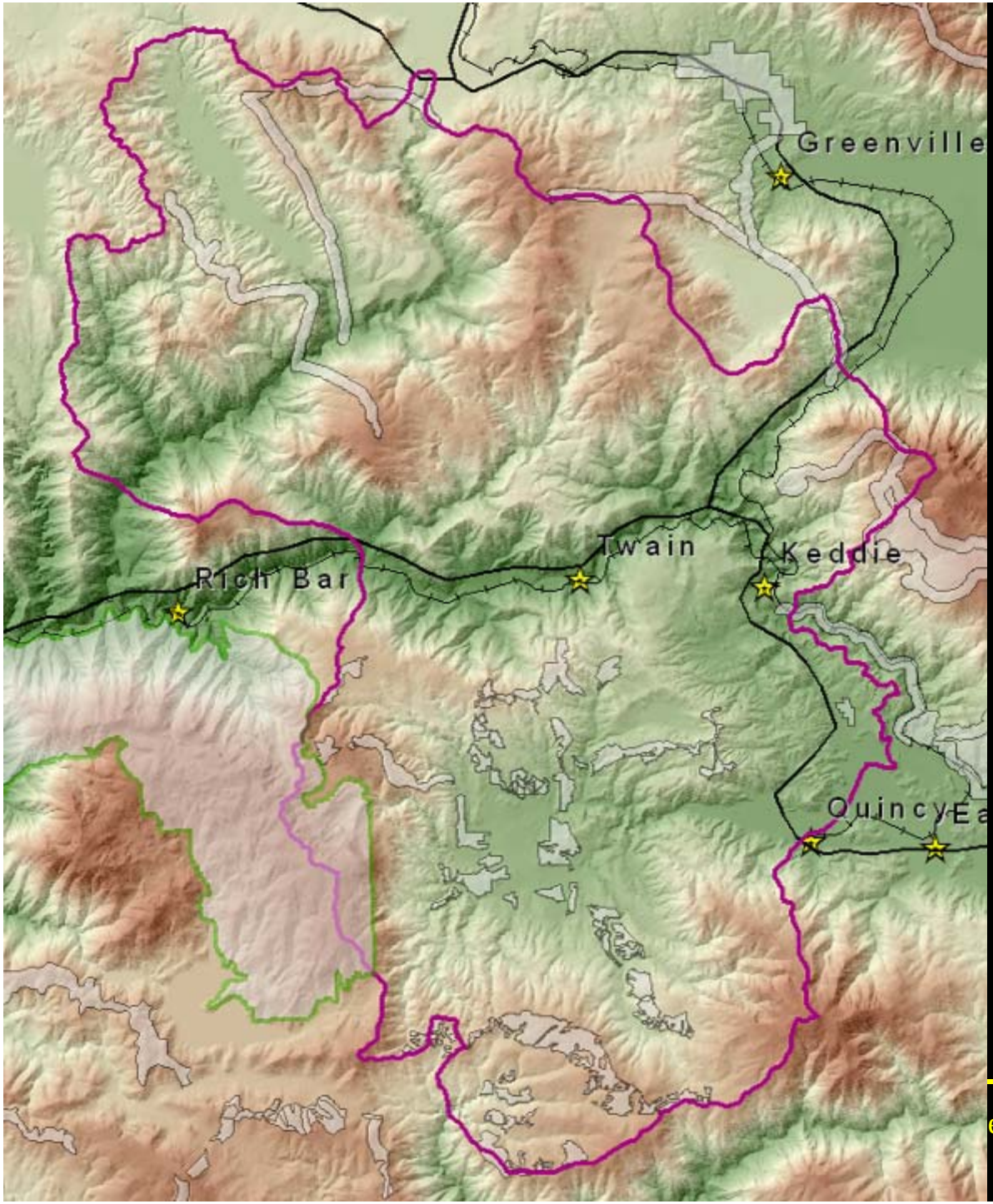
Year range evaluated: 1995-2004

	Average	moderate	severe	extreme
	50	70	90	97.5
Relative Humidity	17	14	10	7
Temp	90	94	100	103
Wind	5	6	8	9

DFPZs

- Defensible Fuel Profile Zones
- Low fuel, wide gaps, few ladder fuels
- Old: 1999-2003
- Newer 2004-2009



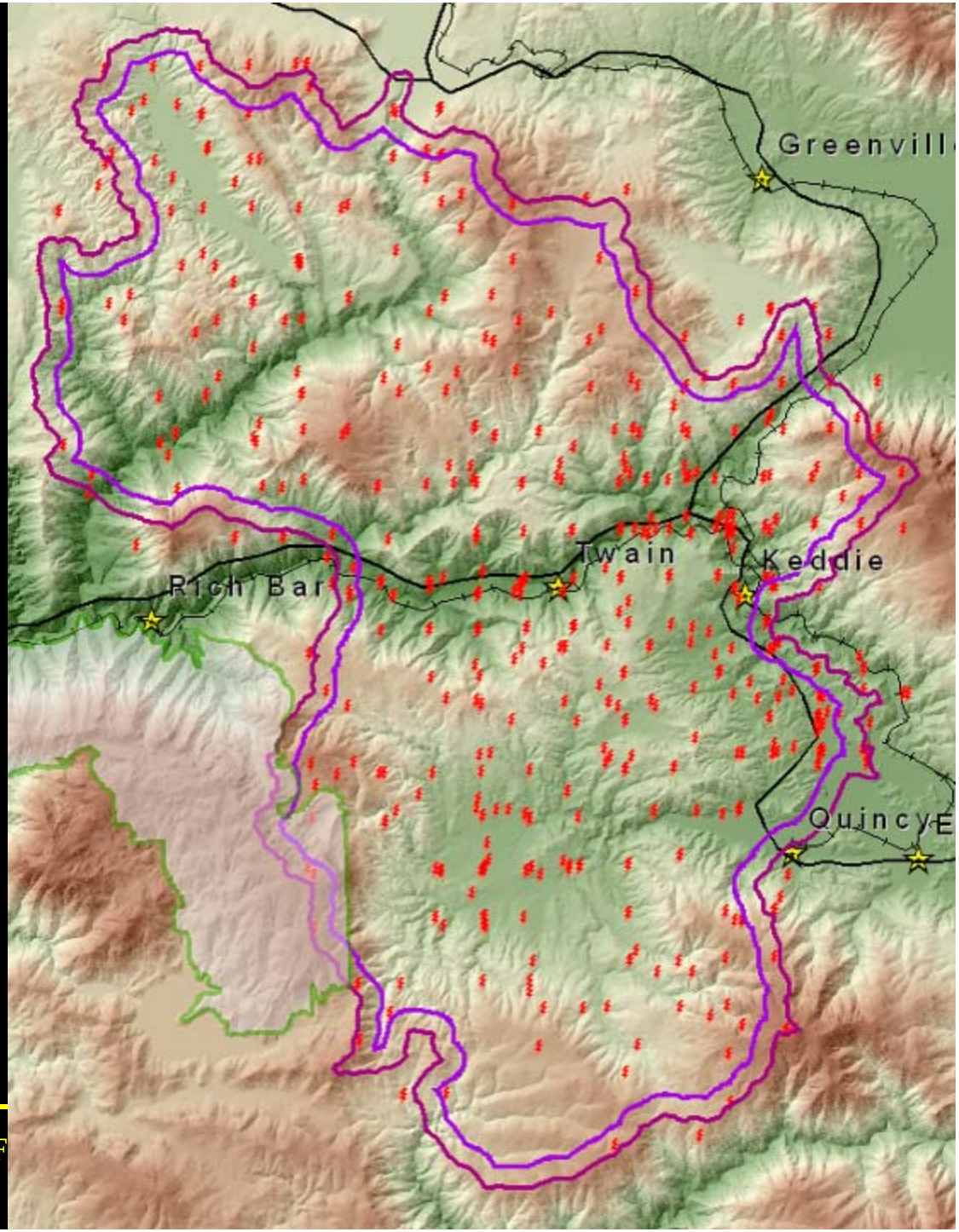


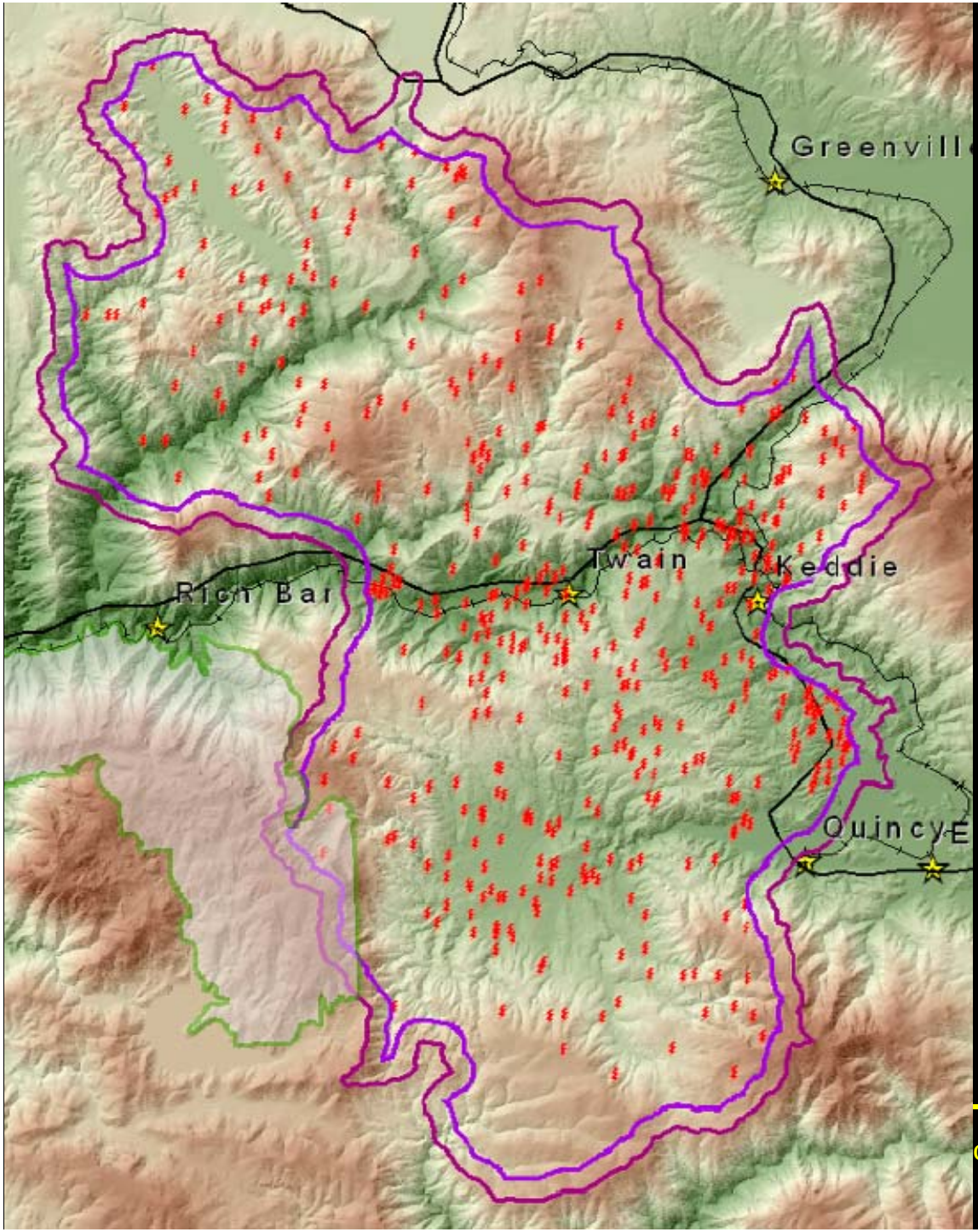
DFPZs

- Post image acquisition
- 2004 and later

Ignitions

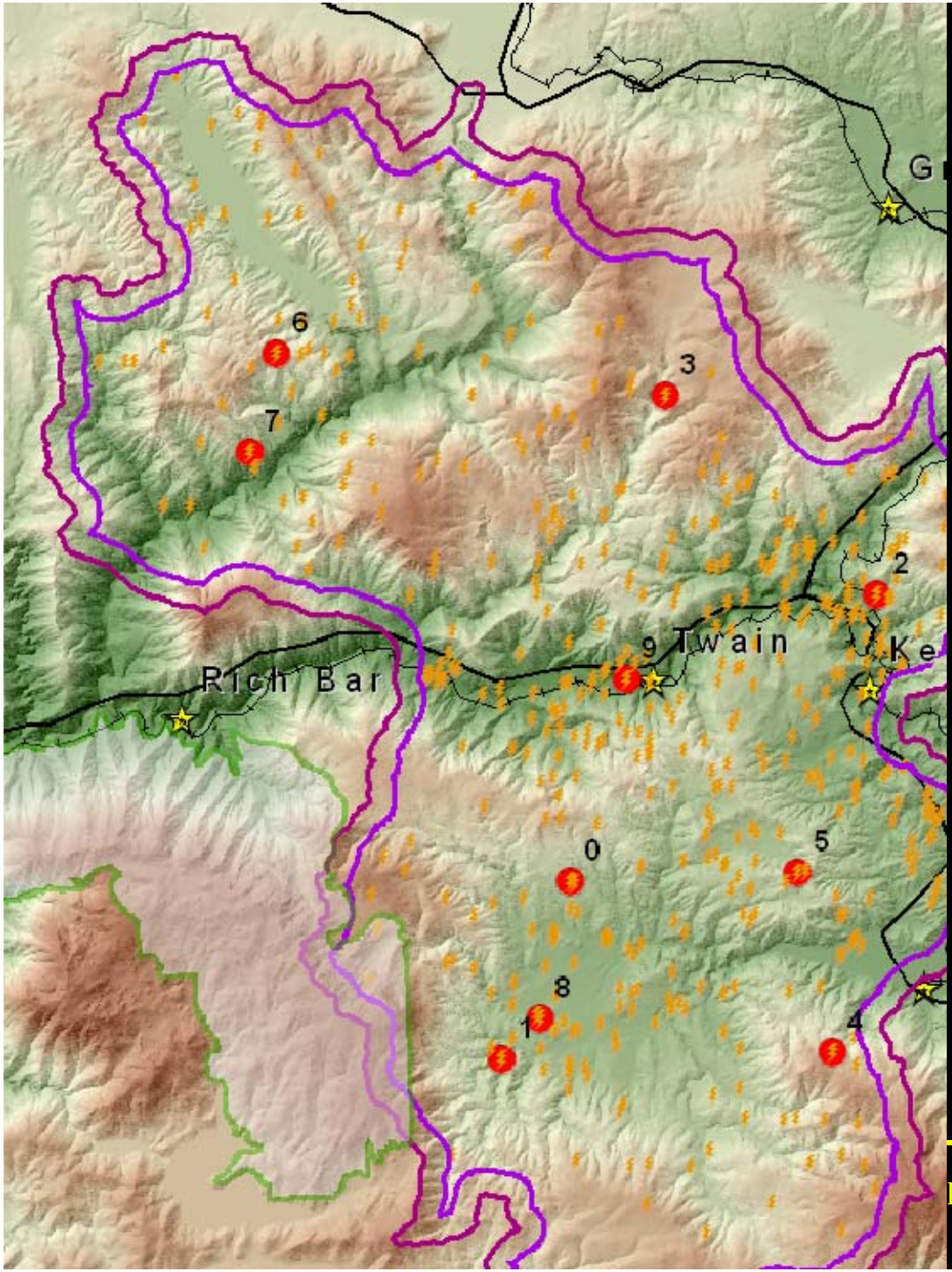
- All ignitions from Plumas
- Clipped to our area





Potential Ignitions

- Random ignitions
- Located within 0.5miles North-South and 0.5 miles E-W from historic ignition

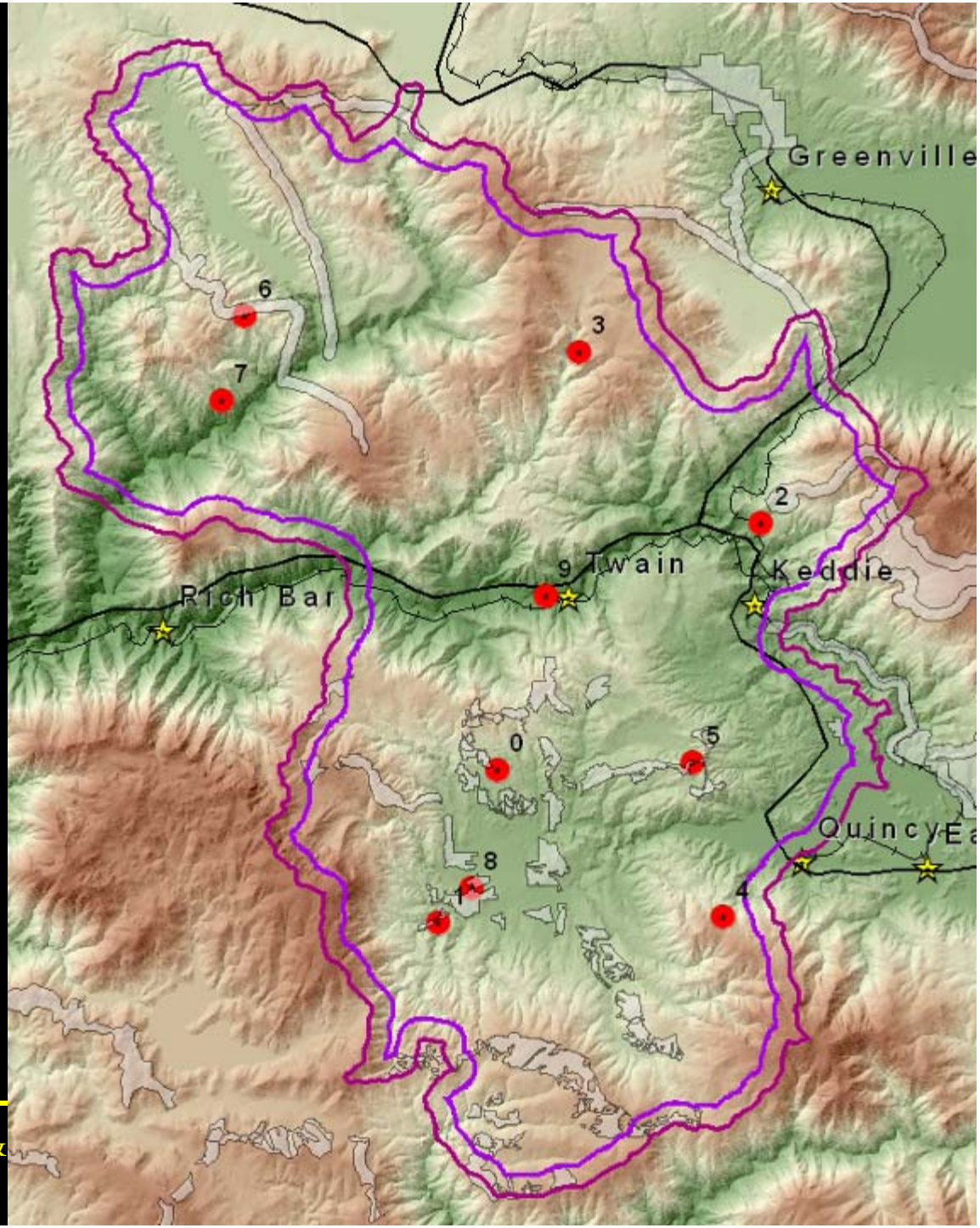


Ignitions Modeled

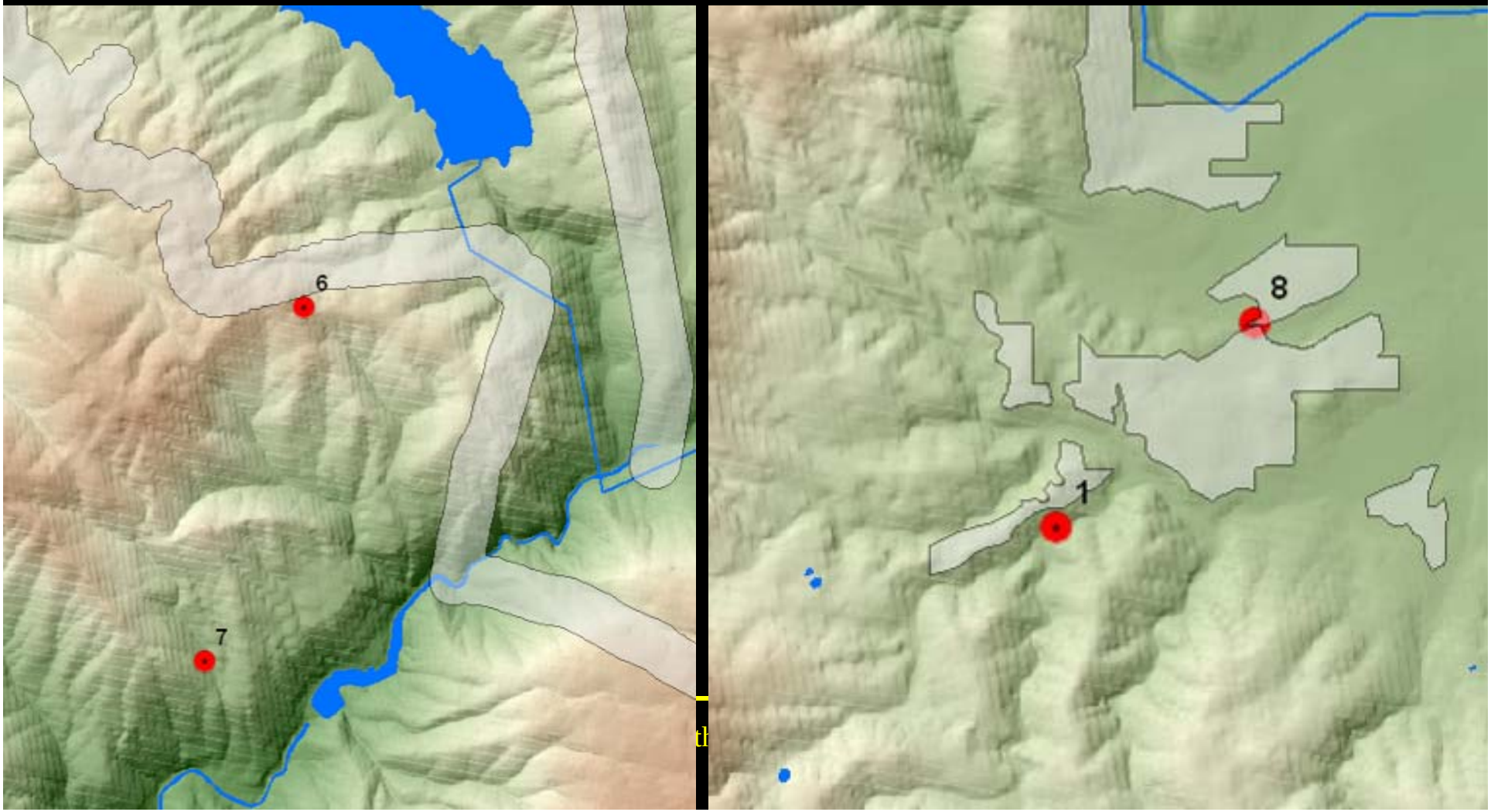
- Ten ignitions randomly sampled from candidate list

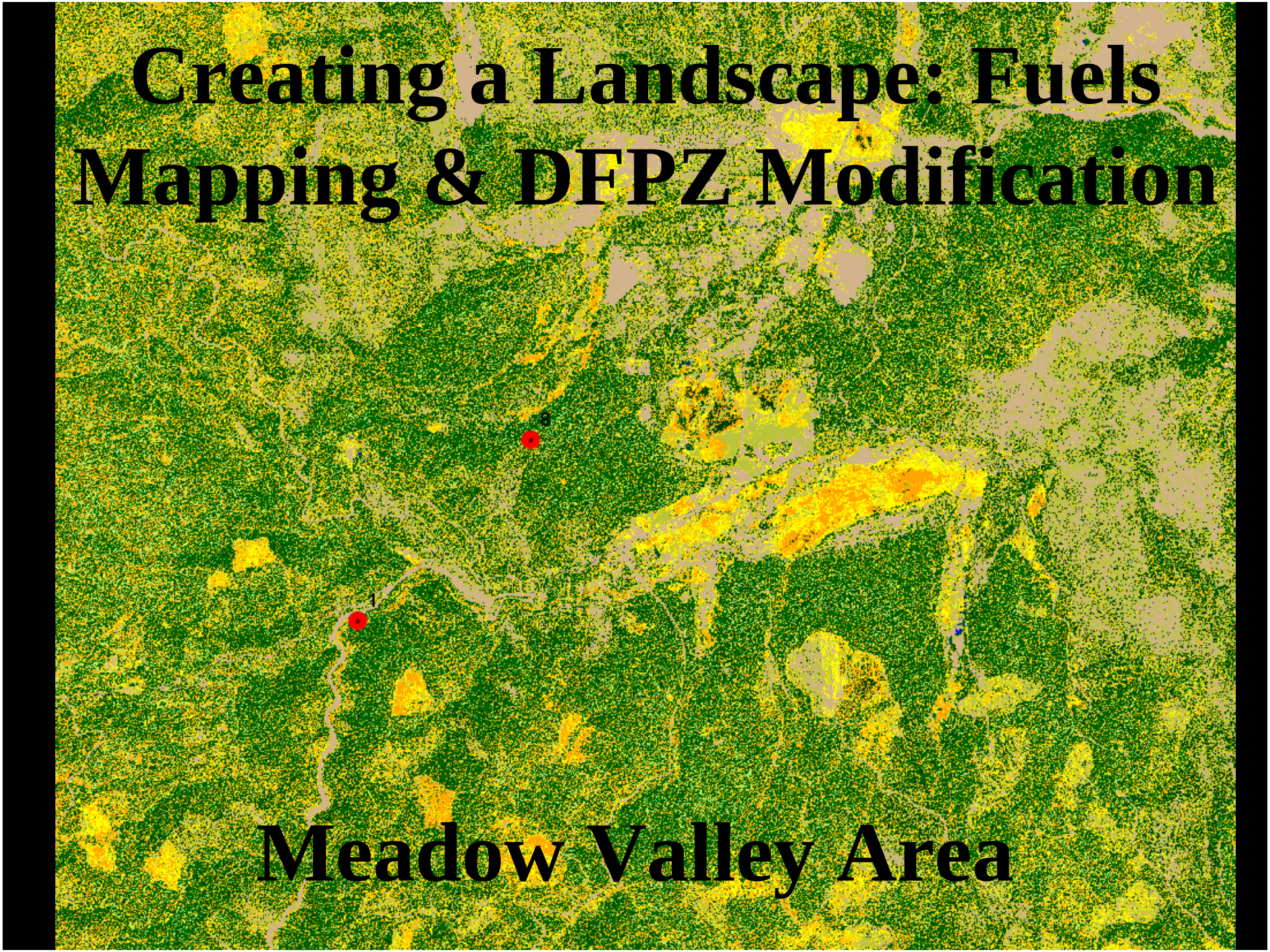
Ignitions and DFPZs

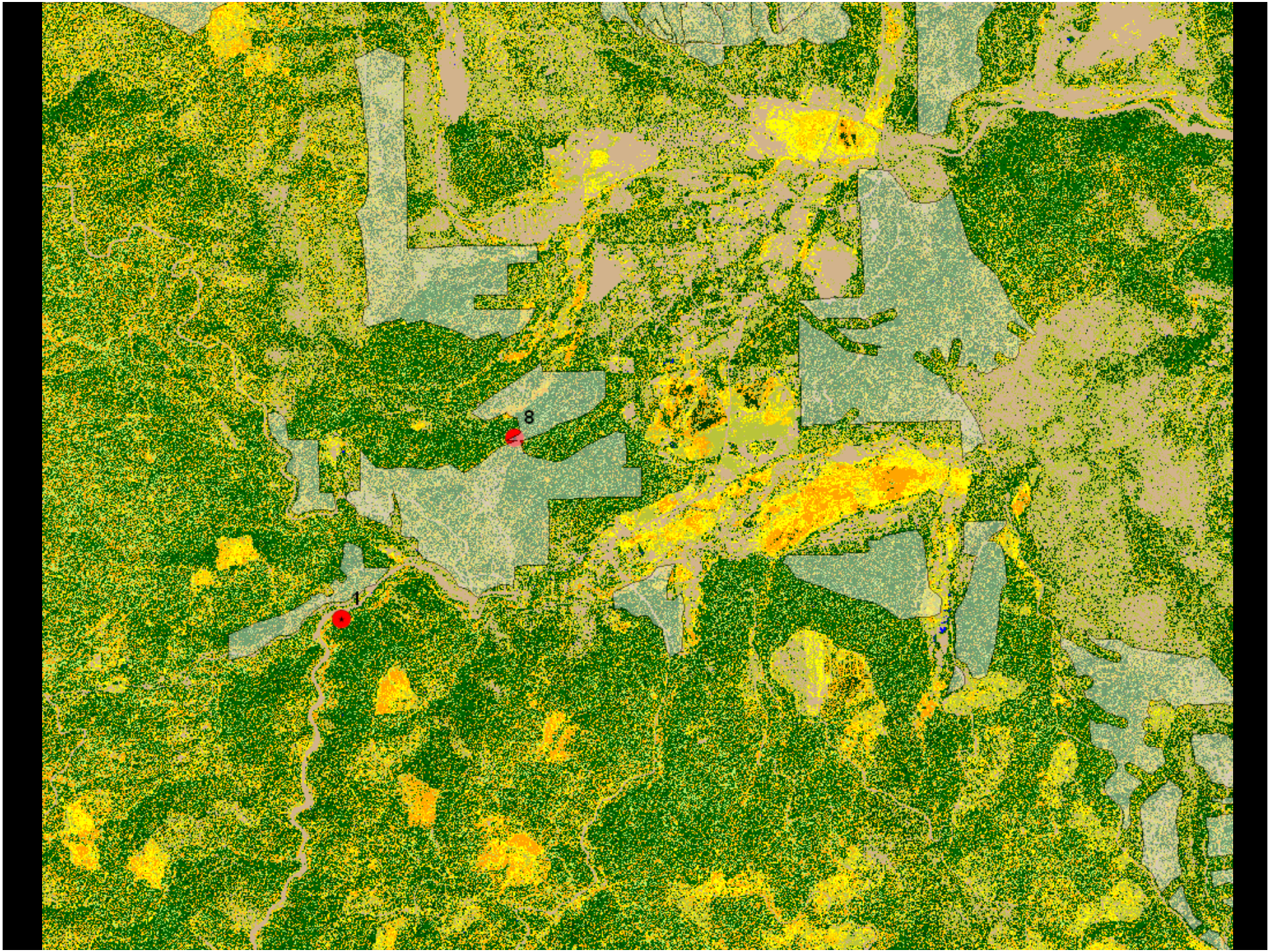
- Some ignitions that should be affected by DFPZs
- Some won't

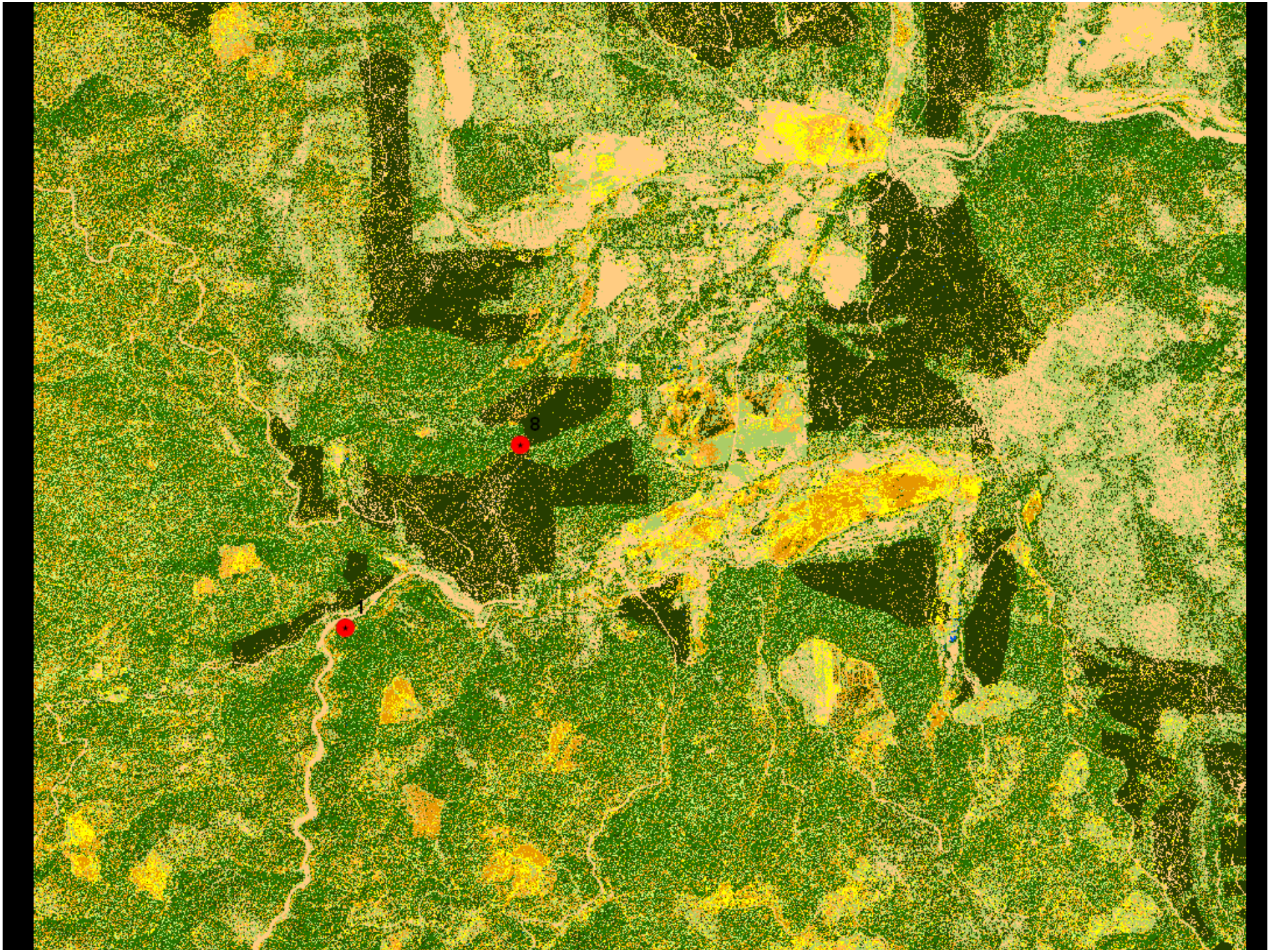


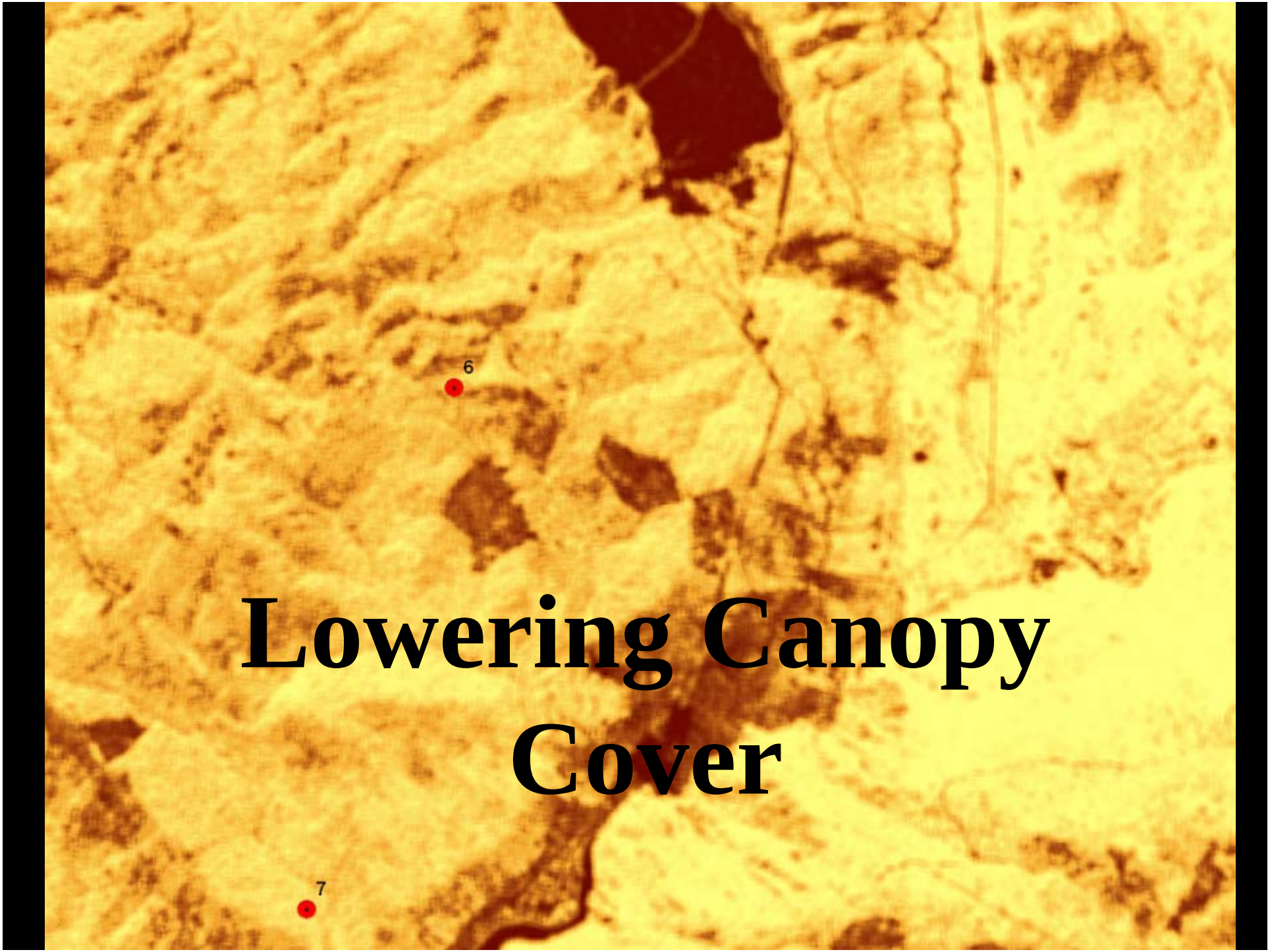
Ignitions near DFPZs (Butt Valley Res, Meadow Valley)



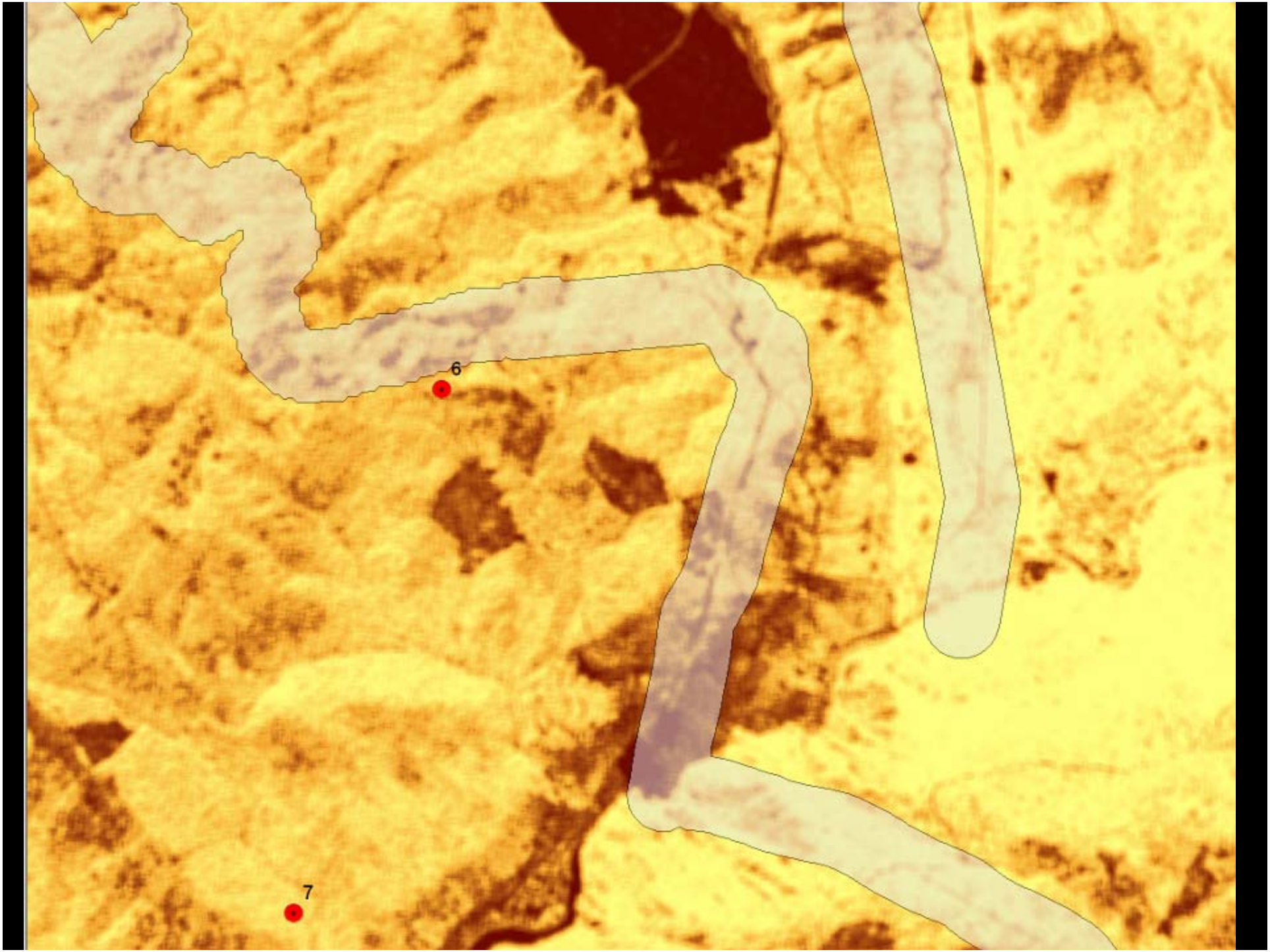

Creating a Landscape: Fuels Mapping & DFPZ Modification
8
1
Meadow Valley Area

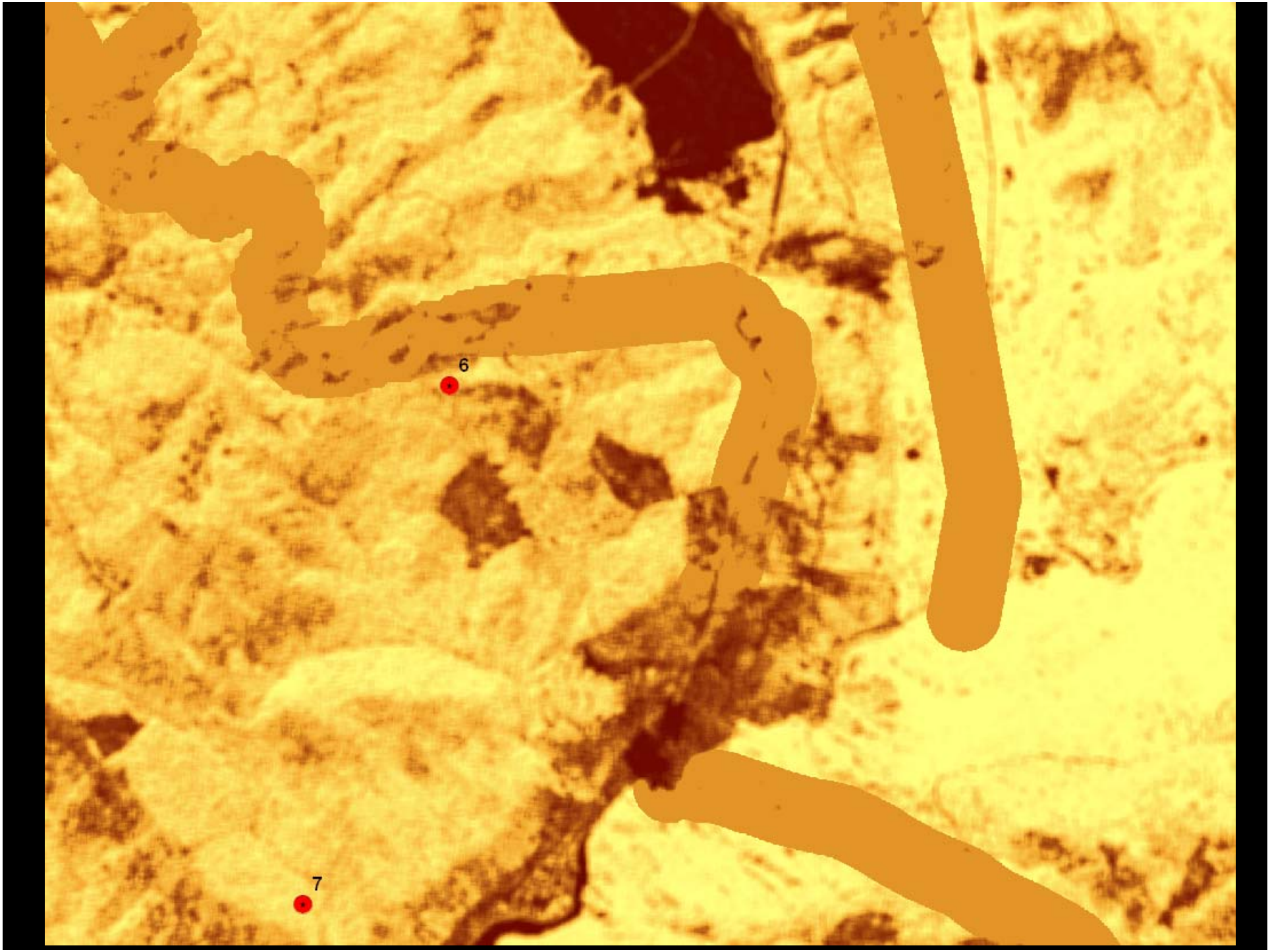

8
1


8
1



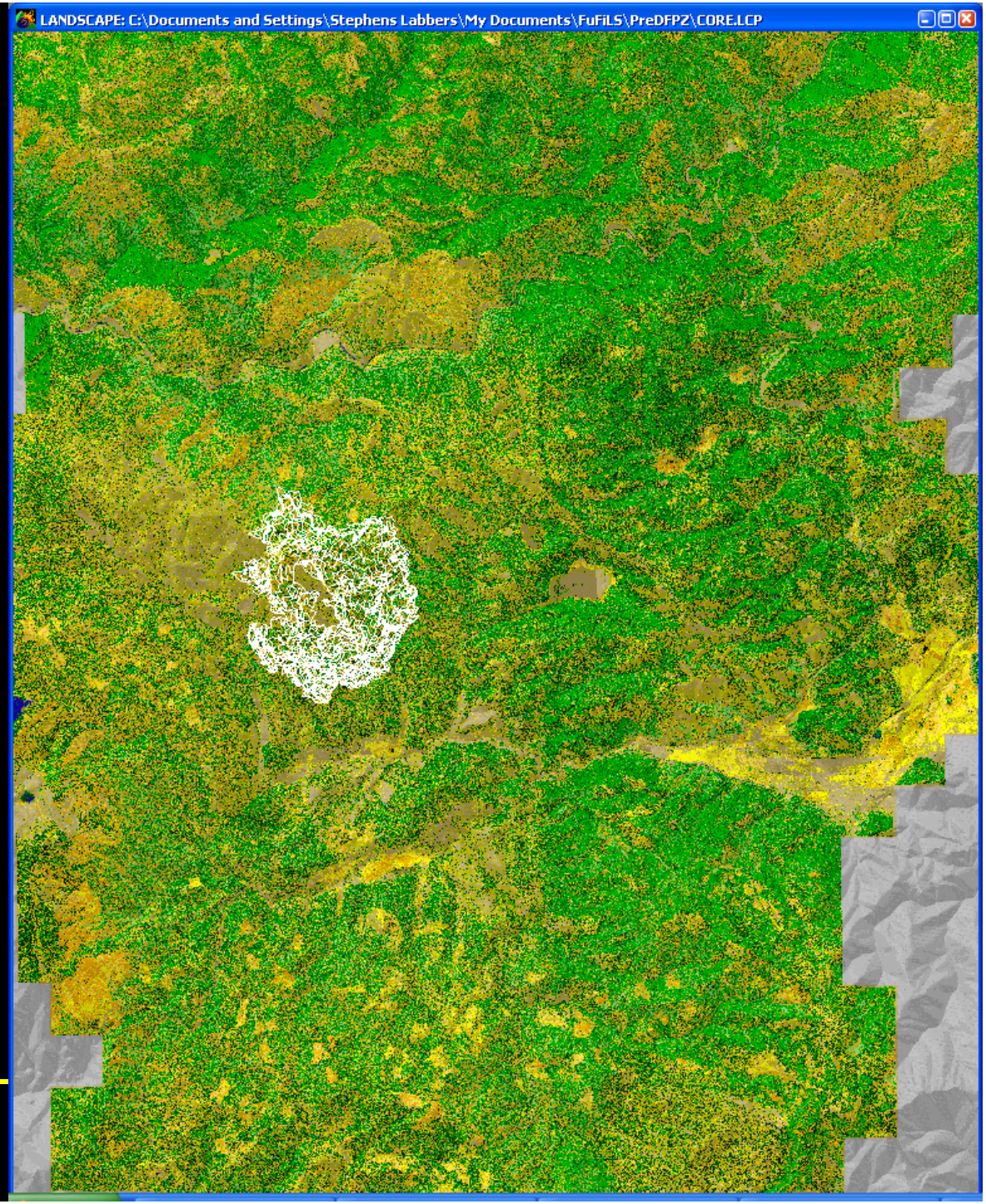
Lowering Canopy Cover


6
7


6
7


Twain
No fire barriers
…just low fuel spots

Ignition 100 Moderate Weather Pre-DFPZ



Stephens & Menning

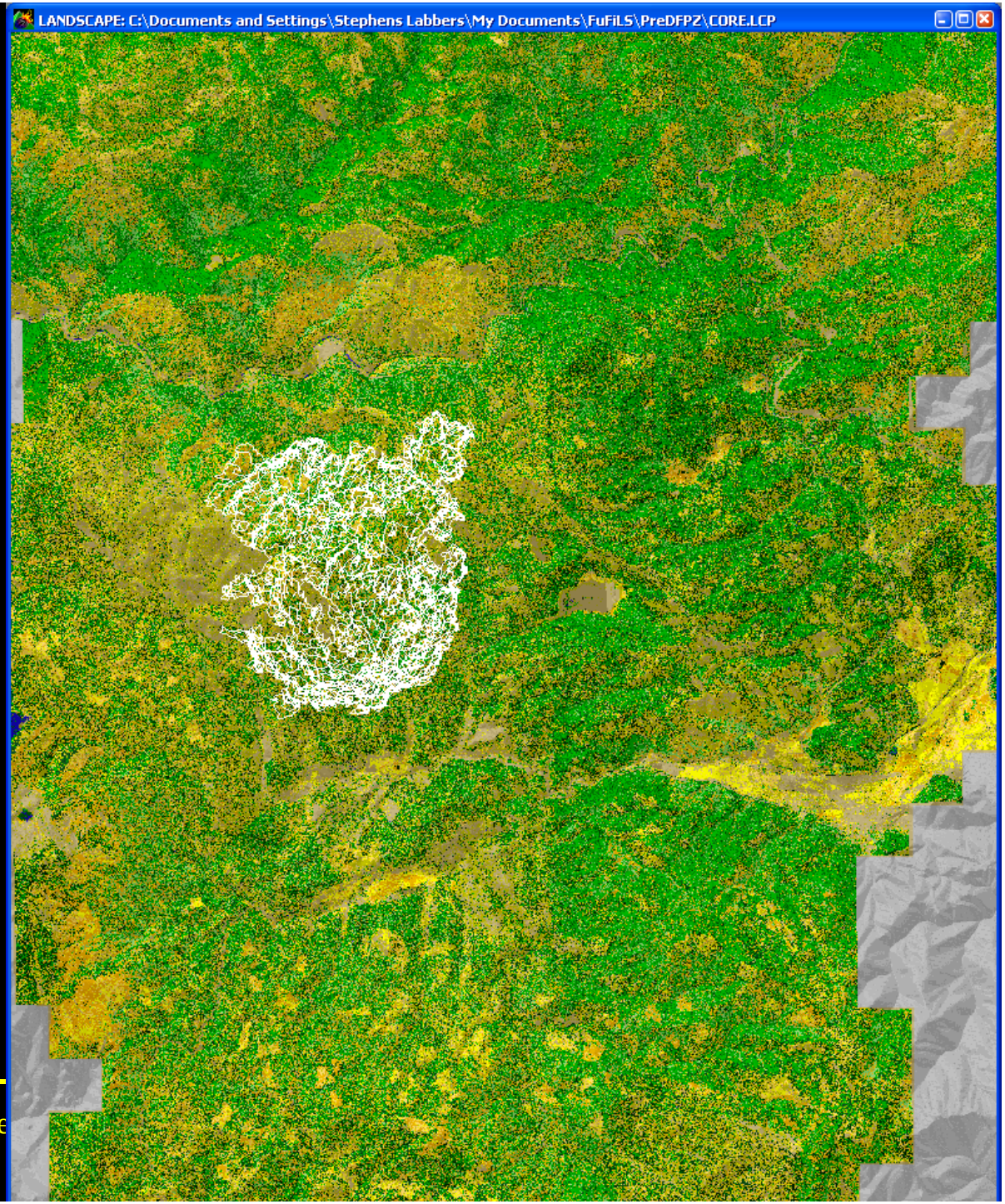
Fuel

Ignition 100 Severe Weather Pre-DFPZ

Stephens & Menning

Fuel

Ignition 100 Extreme Weather Pre-DFPZ



Stephens & Menning

Fue

Ignition 100 Moderate Weather Post-DFPZ

Ignition 100 Severe Weather Post-DFPZ

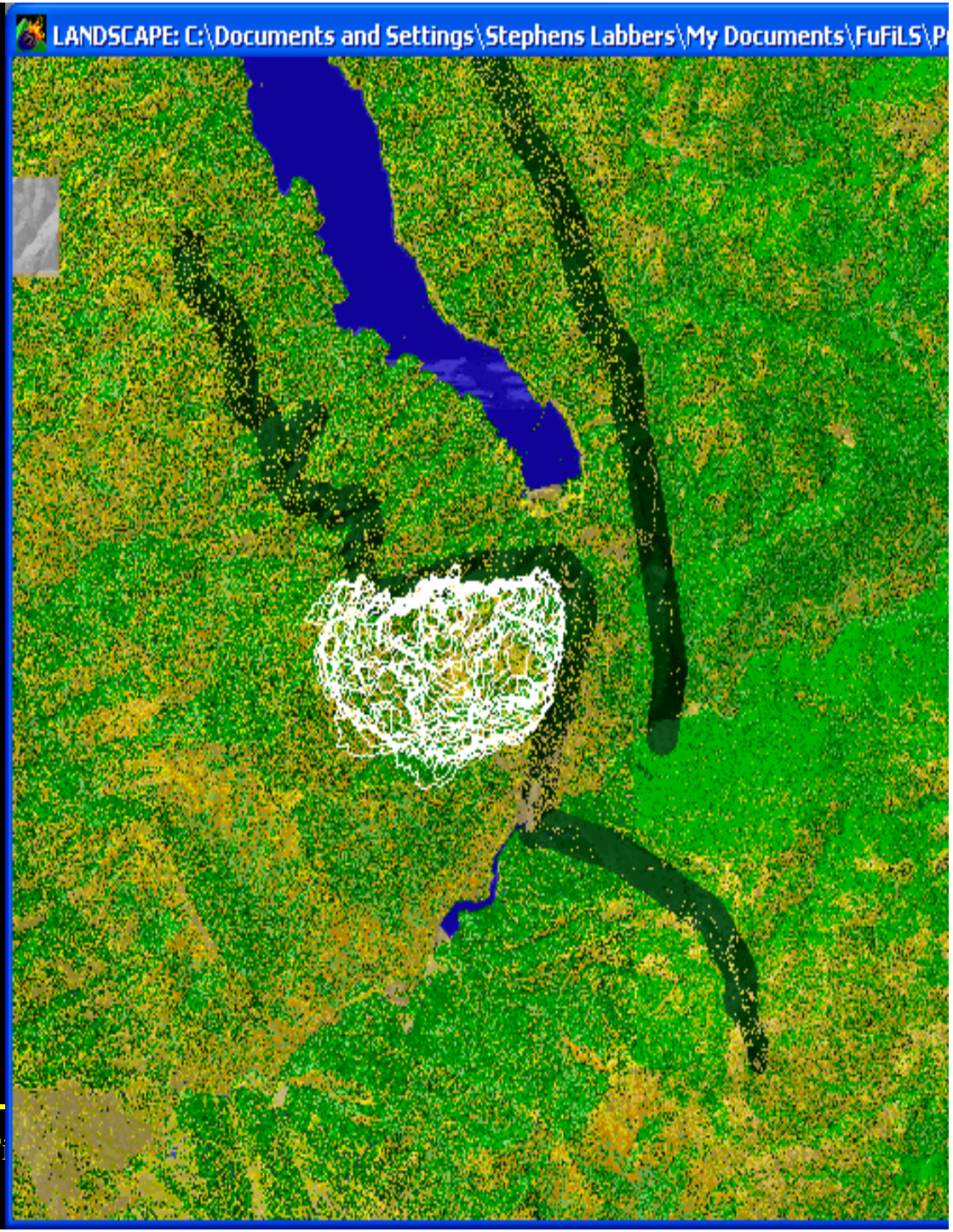
Stephens & Menning

Fuel

Ignition 100 Extreme Weather Post-DFPZ

Stephens & Menning Fuel

Ignition 106 Moderate Weather Post-DFPZ



Ignition 106 Severe Weather Post-DFPZ

Ignition 106 Extreme Weather Post-DFPZ

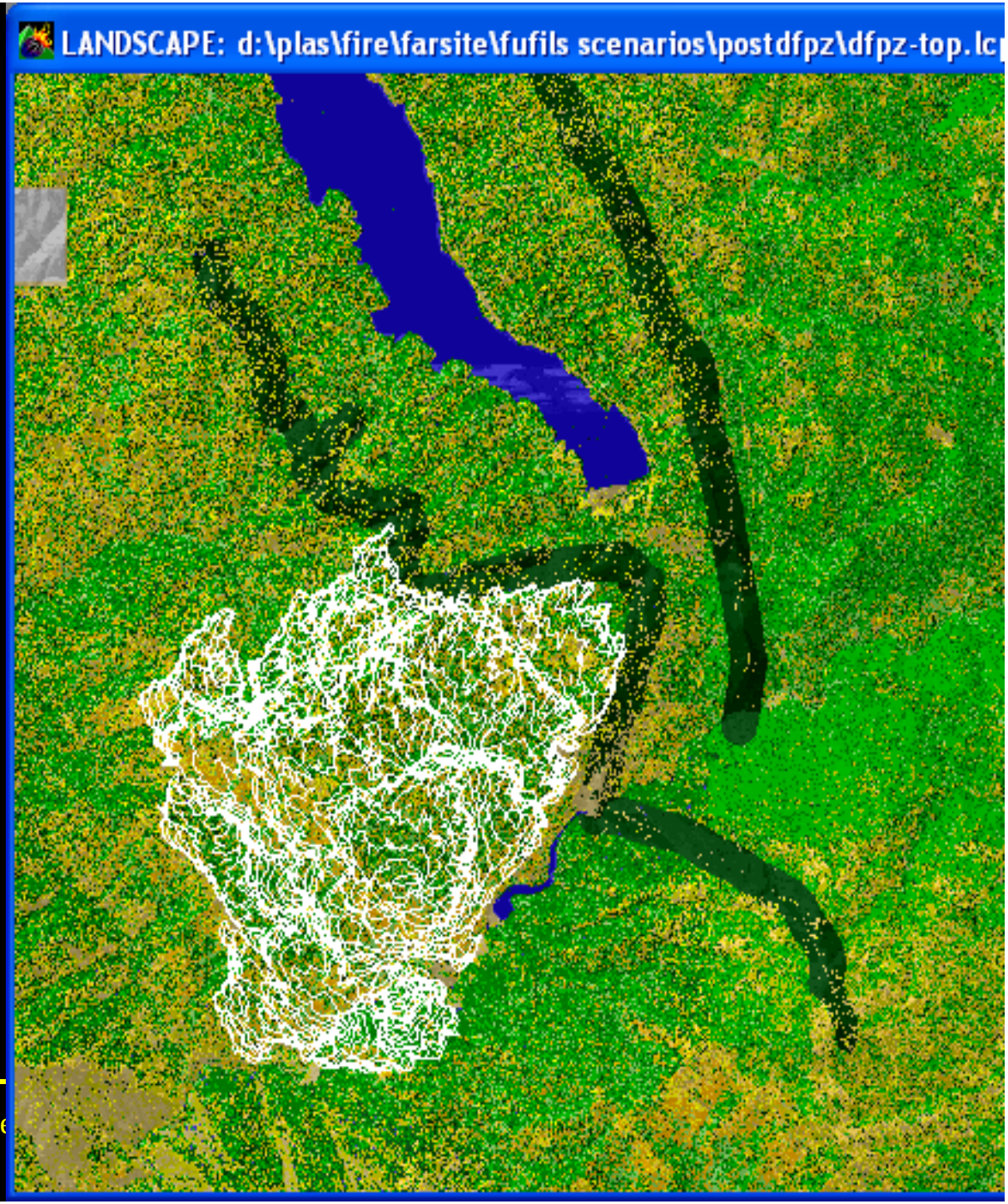
Stephens & Menning

Fuel &

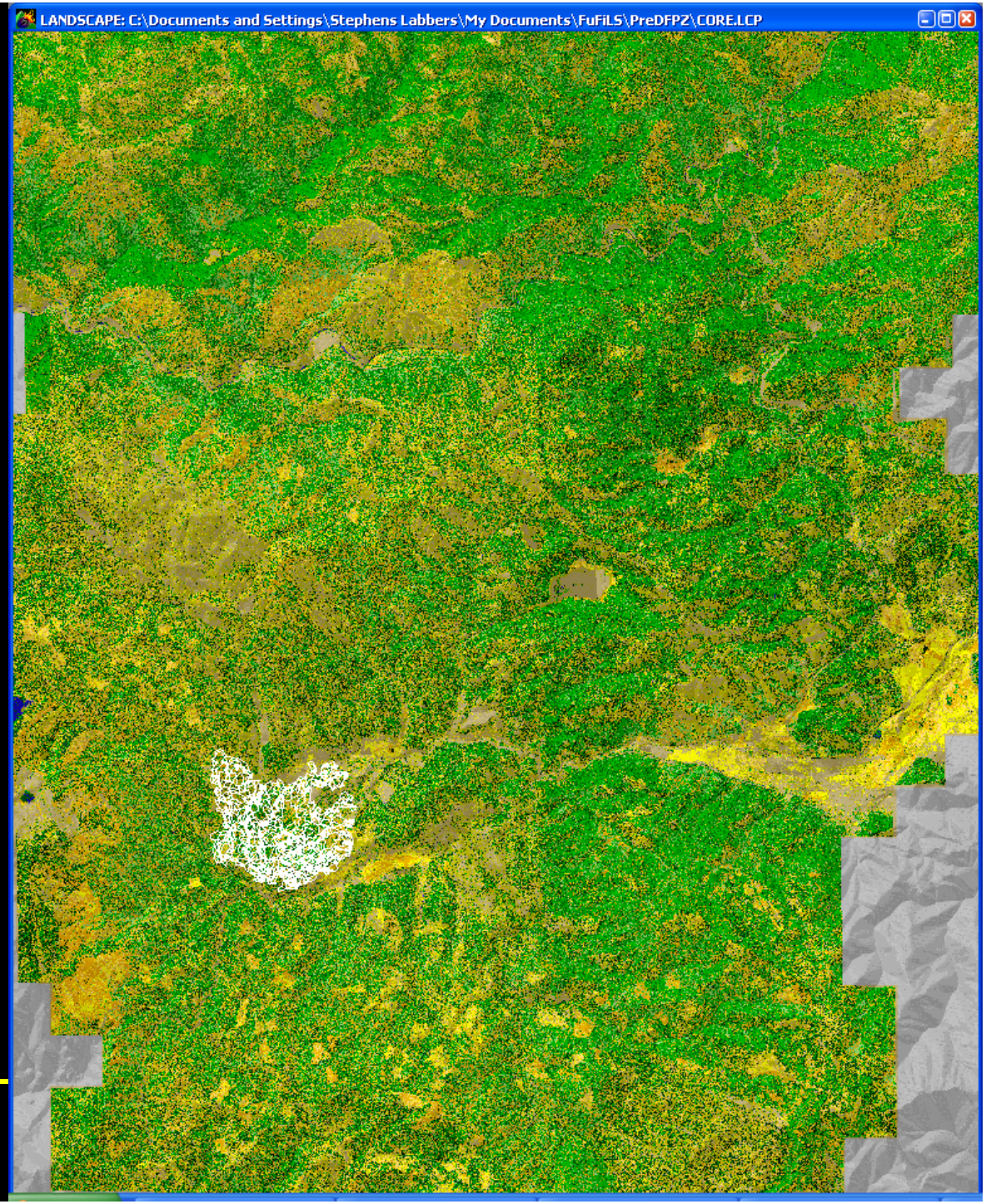
Ignition 107

Extreme Weather

Post-DFPZ



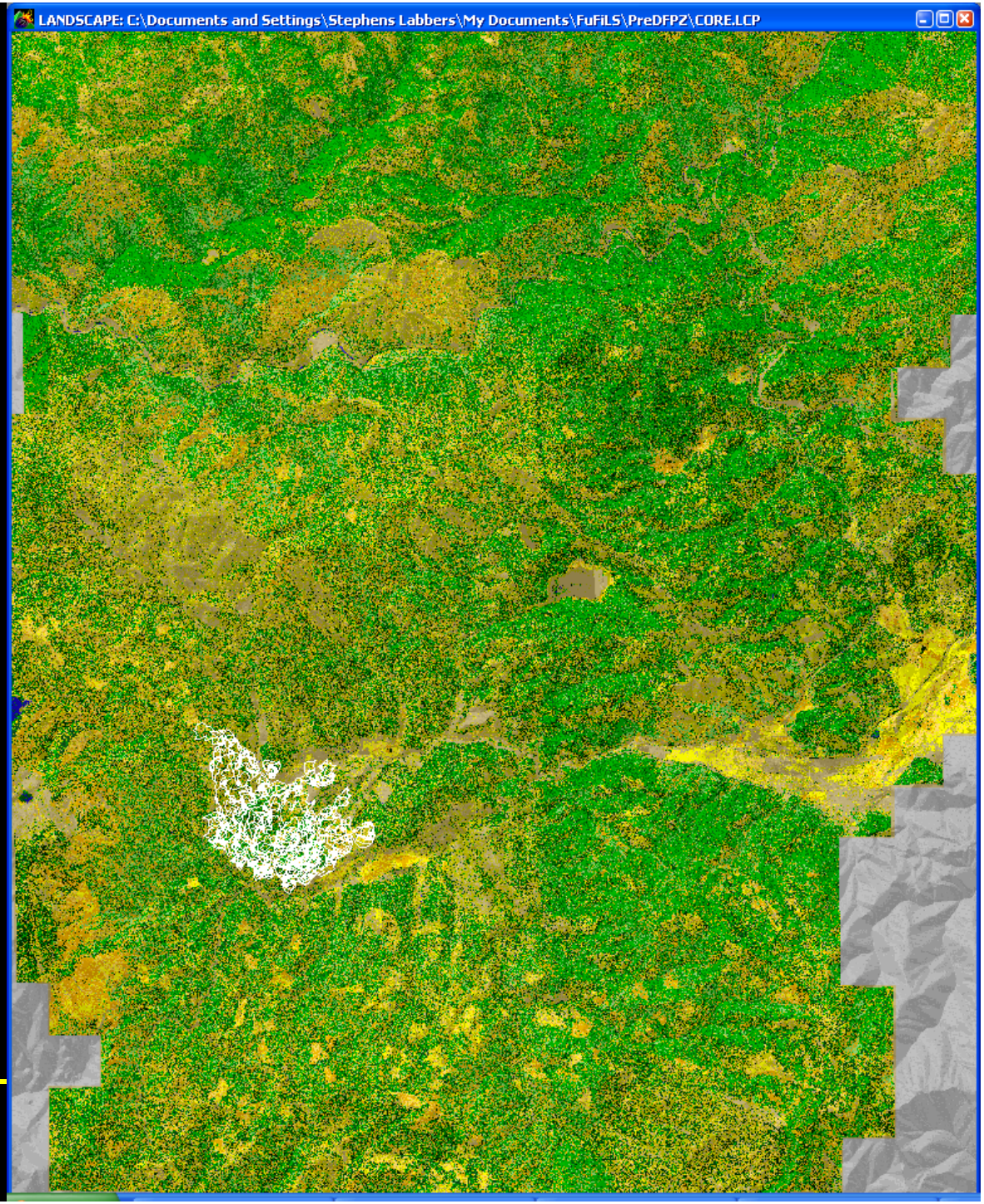
Ignition 108 Moderate Weather Pre-DFPZ



Stephens & Menning

Fuel

Ignition 108 Severe Weather Pre-DFPZ



Stephens & Menning

Fuel

Ignition 108 Extreme Weather Pre-DFPZ

Stephens & Menning

Fuel

Ignition 108 Moderate Weather Post-DFPZ

Stephens & Menning Fuel

Ignition 108 Severe Weather Post-DFPZ

Stephens & Menning

Fuel

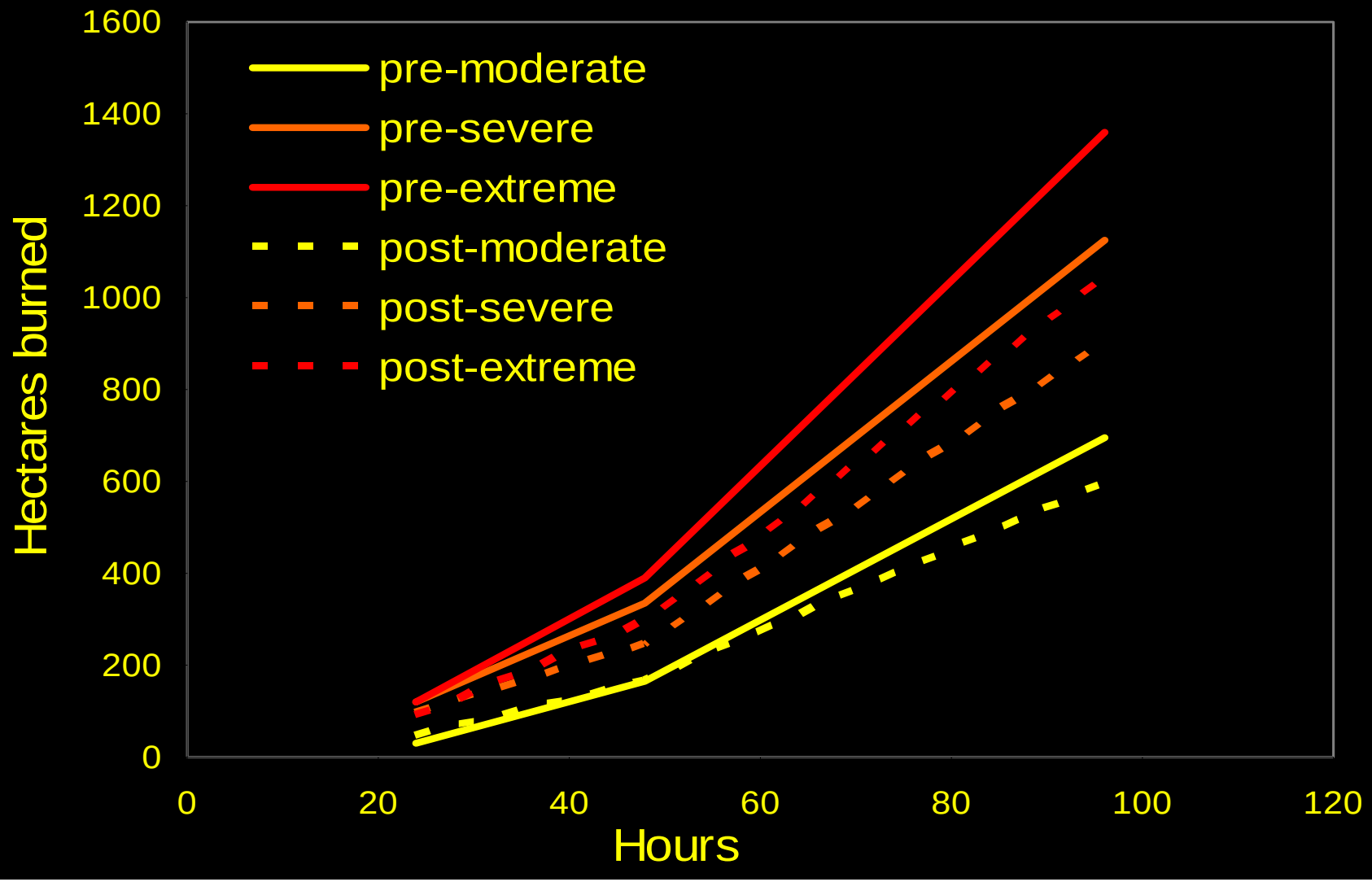
Ignition 108 Extreme Weather Post-DFPZ

Stephens & Menning

Fuel

Burn extent

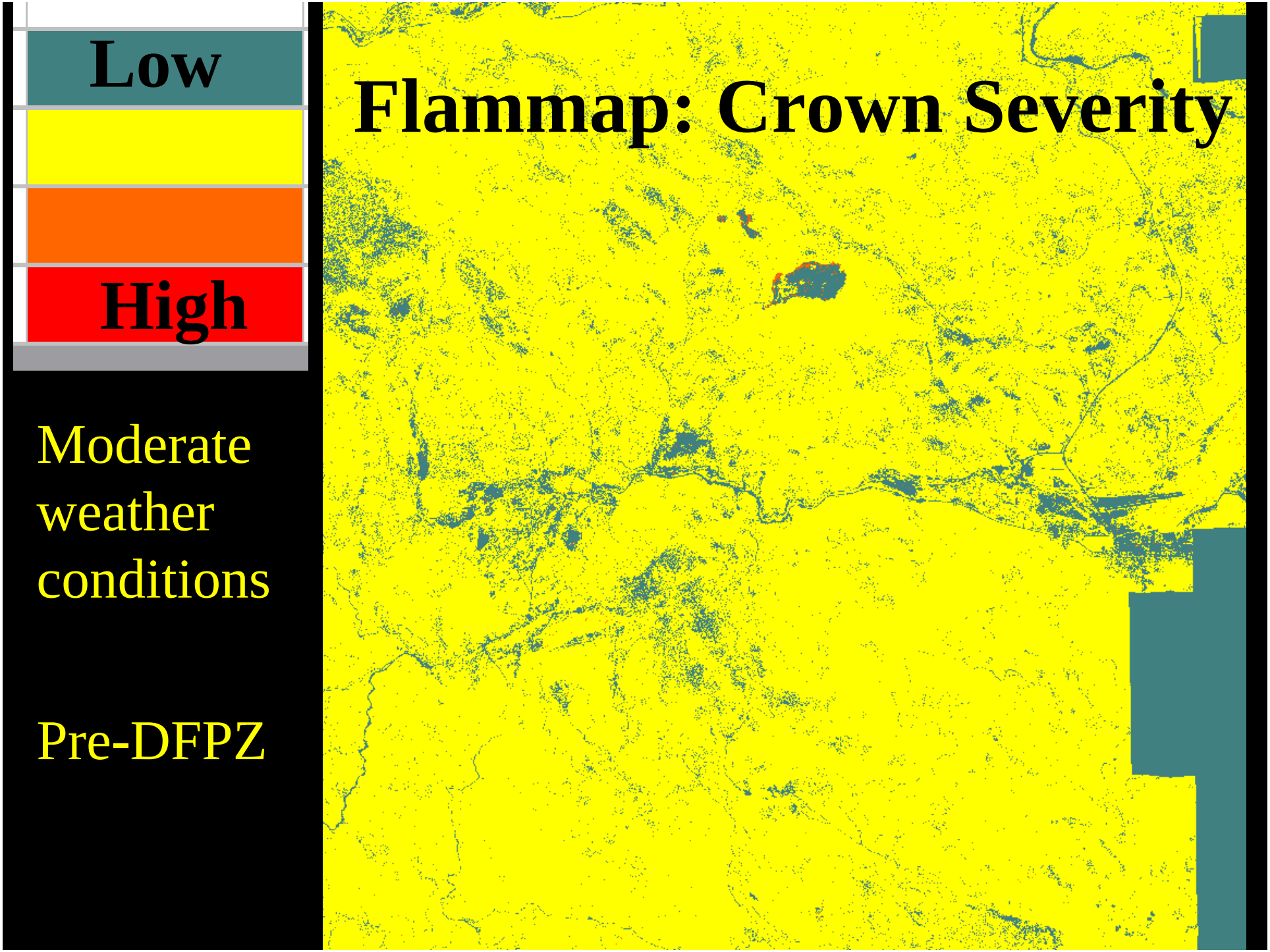
by time, DFPZ presence and Weather



Farsite Simulation Data

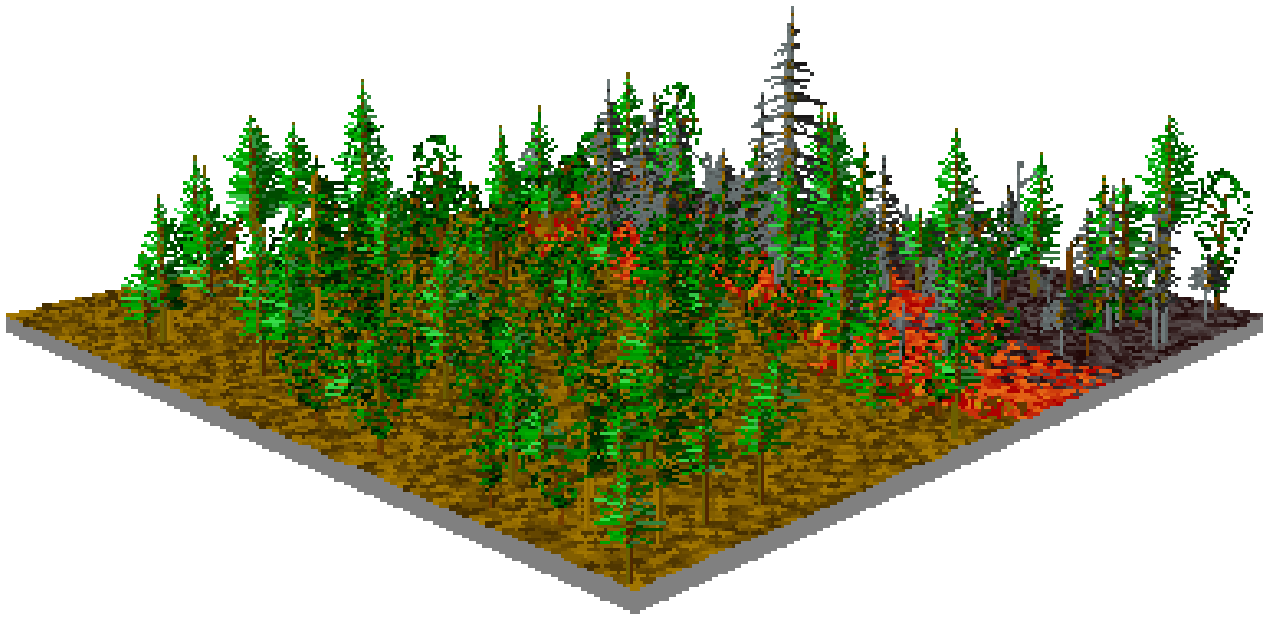
	burn hours	moderate	severe	extreme
Pre-DFPZ	24	31	119	123
	48	163	333	389
	96	697	1126	1362
Post-DFPZ	24	44	93	92
	48	163	244	296
	96	594	905	1045
Post-DFPZ as percent	24	1.41	0.78	0.75
	48	1.00	0.73	0.76
	96	0.85	0.80	0.77

Flammap: Crown Severity



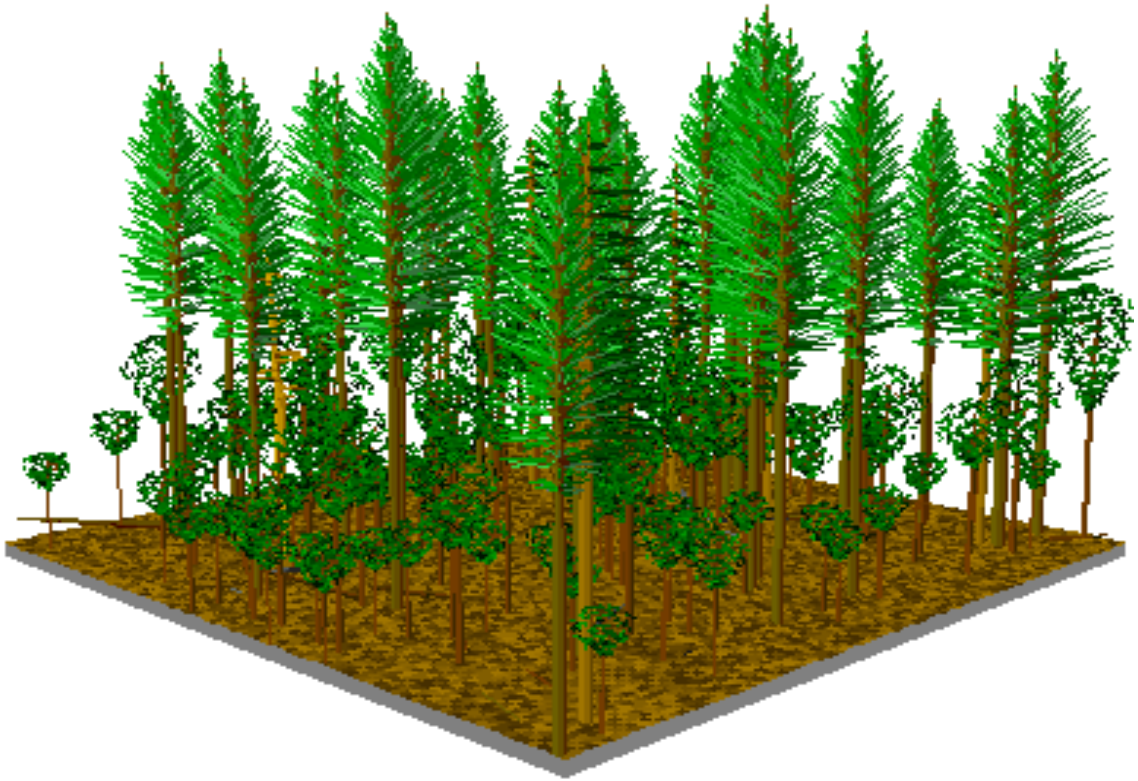
Moderate weather conditions

Pre-DFPZ



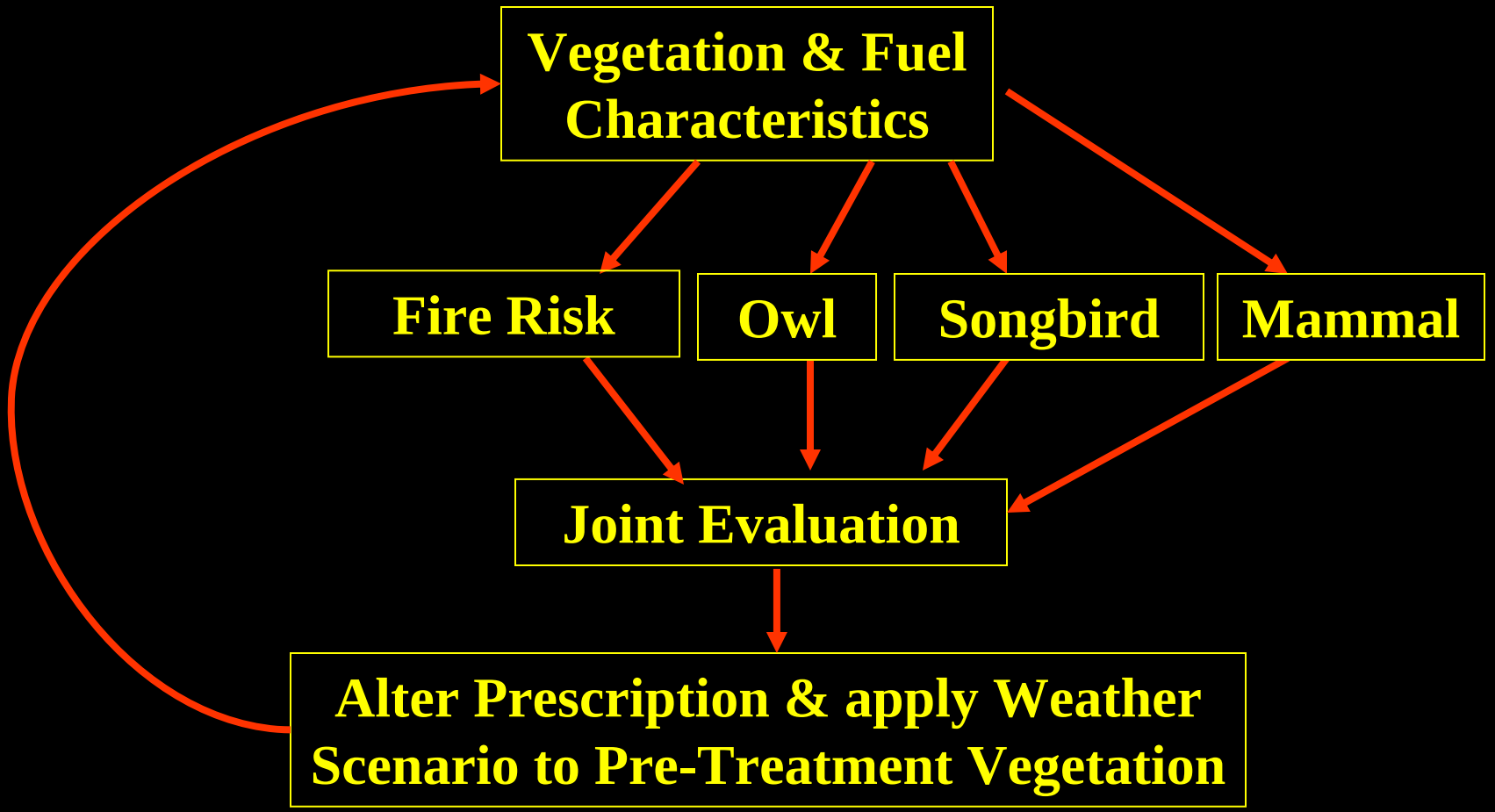
- Actual data from one plot (1172) inventoried in 2006
- Dense stand of young trees overtopped by a single larger tree.
- Bottom: Experiencing moderately severe fire.

- Plot 1172
- Grown 50 years
- Standard rates of growth for this region of the Plumas

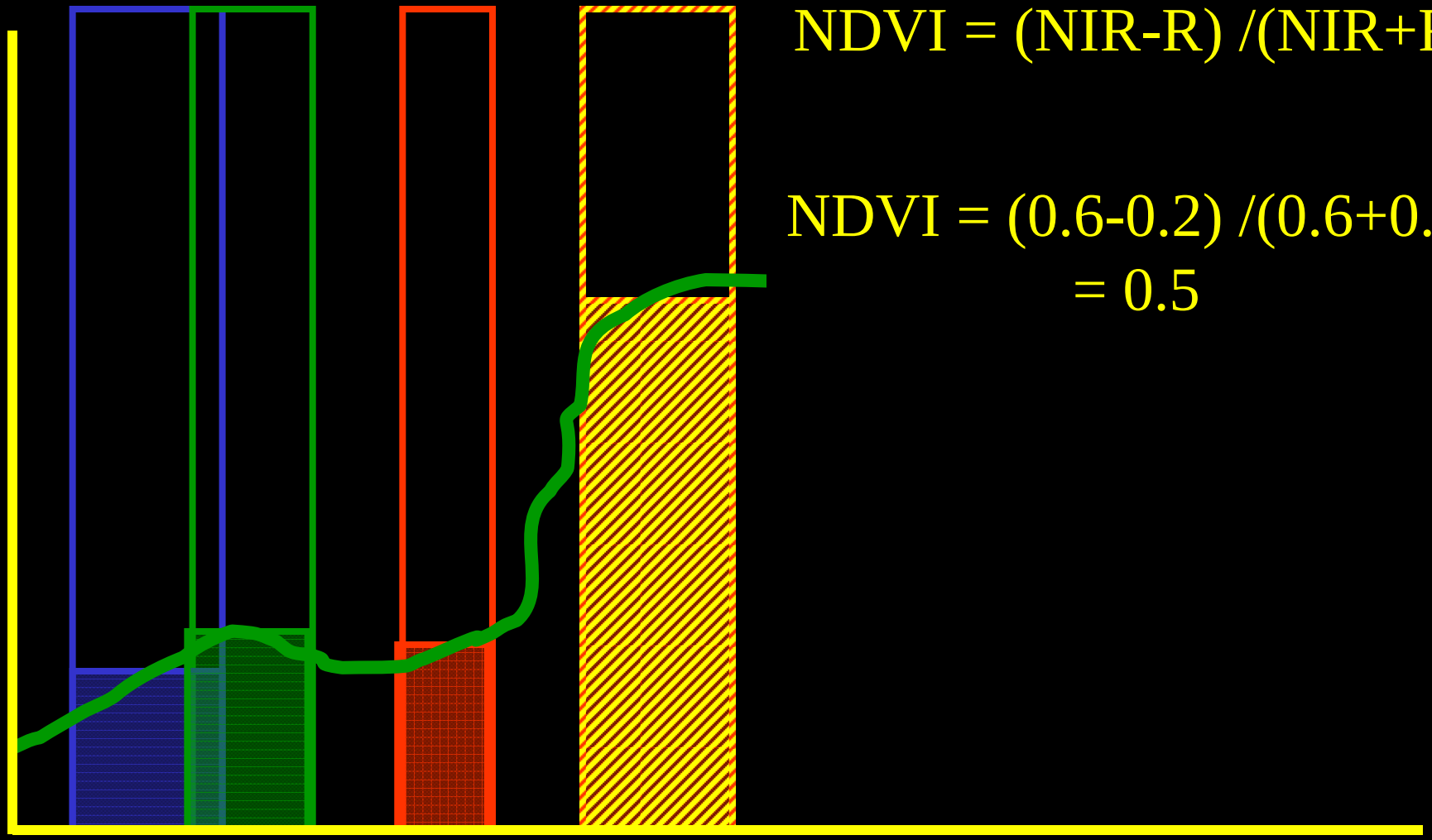



Integrative Wildlife
Assessment

Landscape vegetation, fire, and habitat model integration and projection



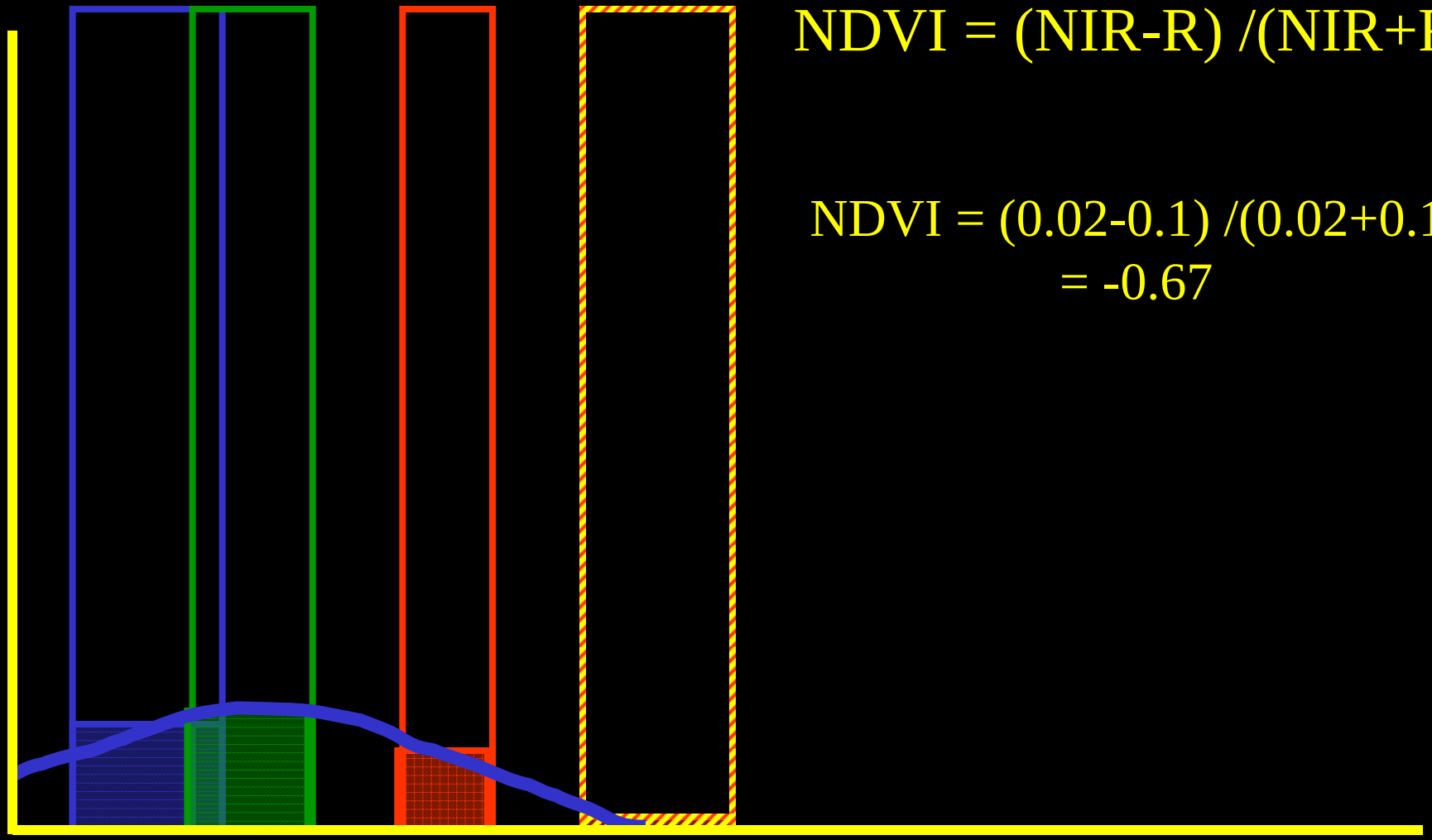
Spectral bands and NDVI: Vegetation



NDVI = (NIR-R) /(NIR+R)

NDVI = (0.6-0.2) /(0.6+0.2)
= 0.5

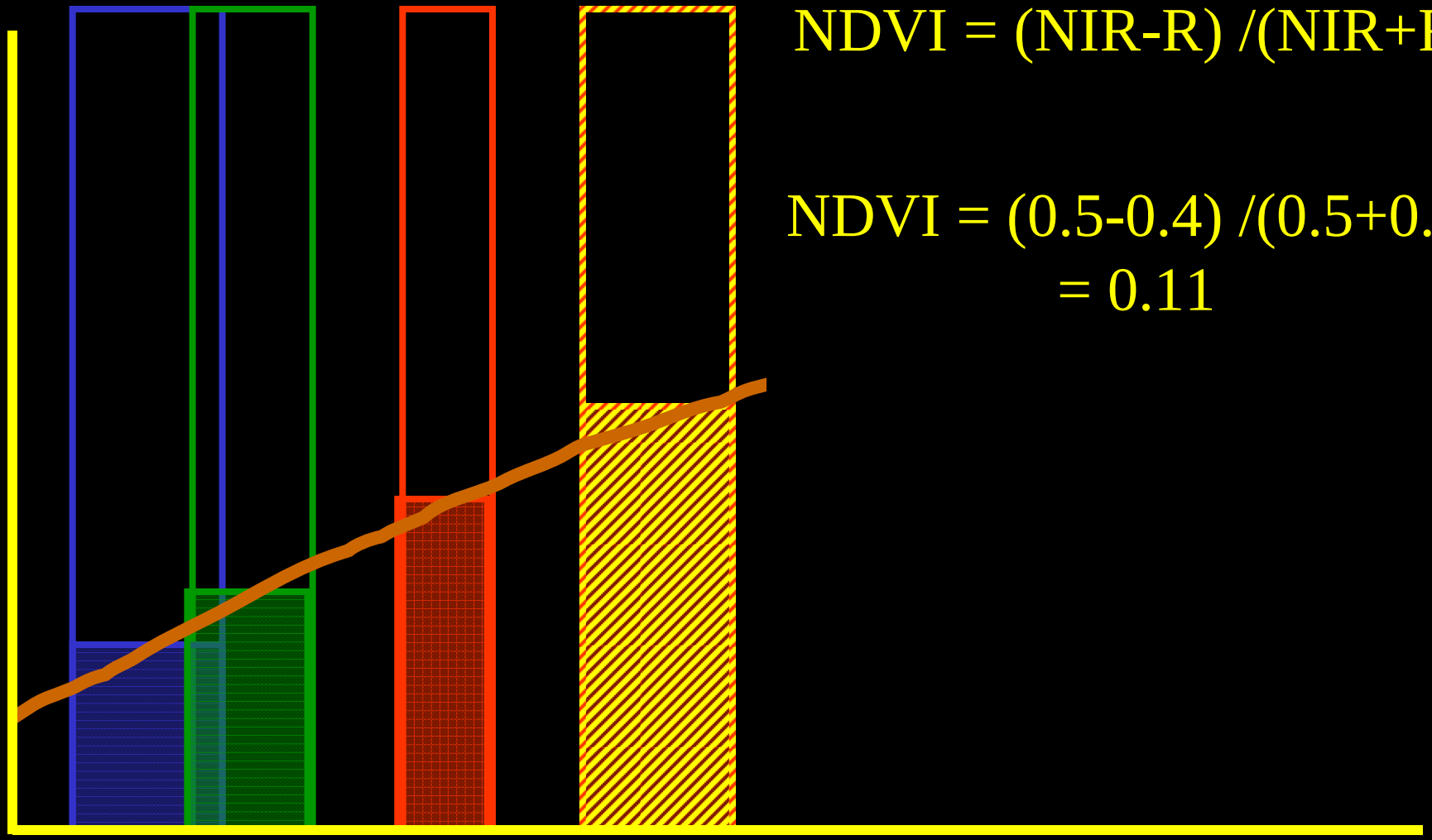
Spectral bands and NDVI: Water



NDVI = (NIR-R) /(NIR+R)

NDVI = (0.02-0.1) /(0.02+0.1)
= -0.67

Spectral bands and NDVI: Soil



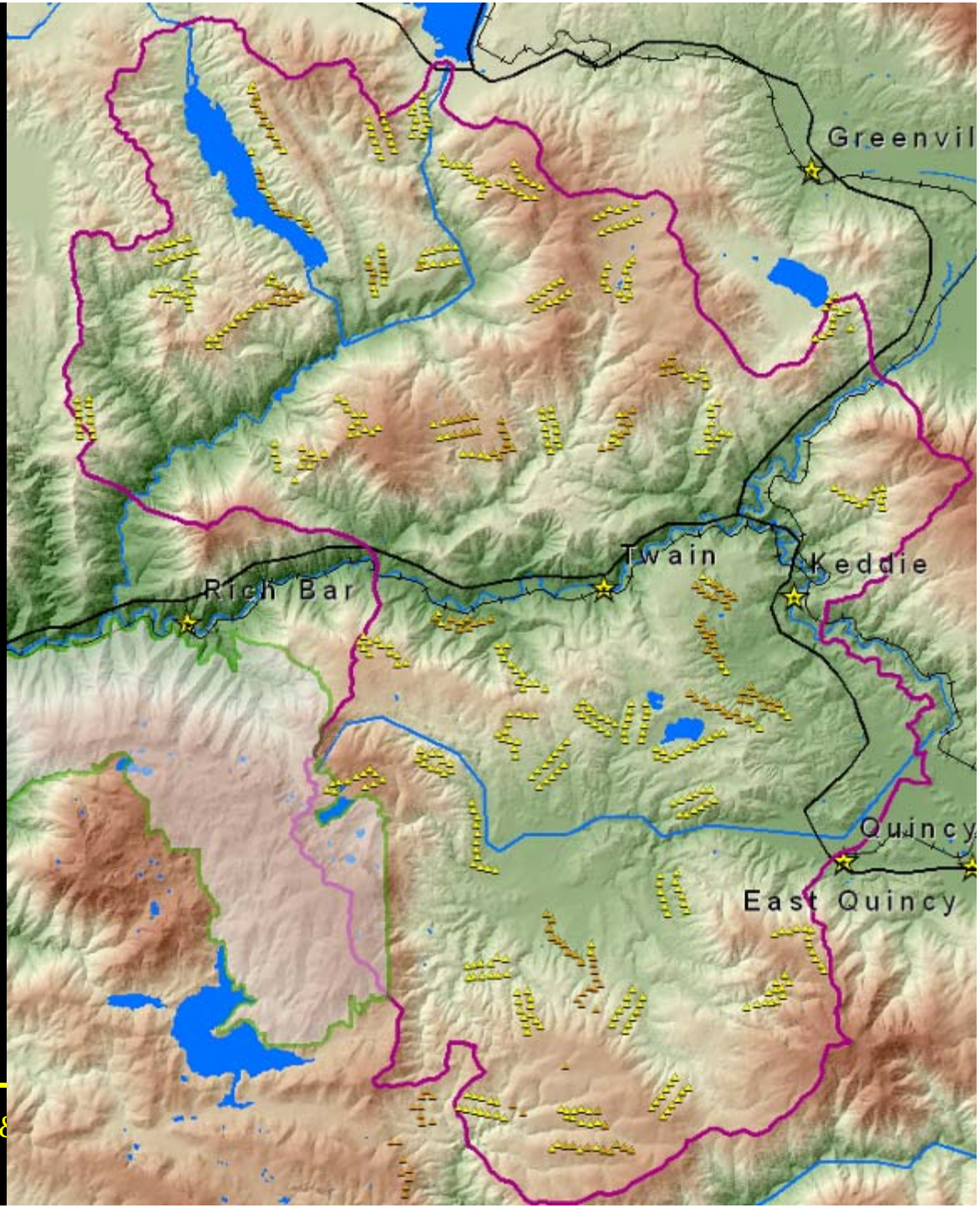
NDVI = (NIR-R) /(NIR+R)

NDVI = (0.5-0.4) /(0.5+0.4)
= 0.11

NDVI & Heterogeneity in NDVI: SpEDCDA

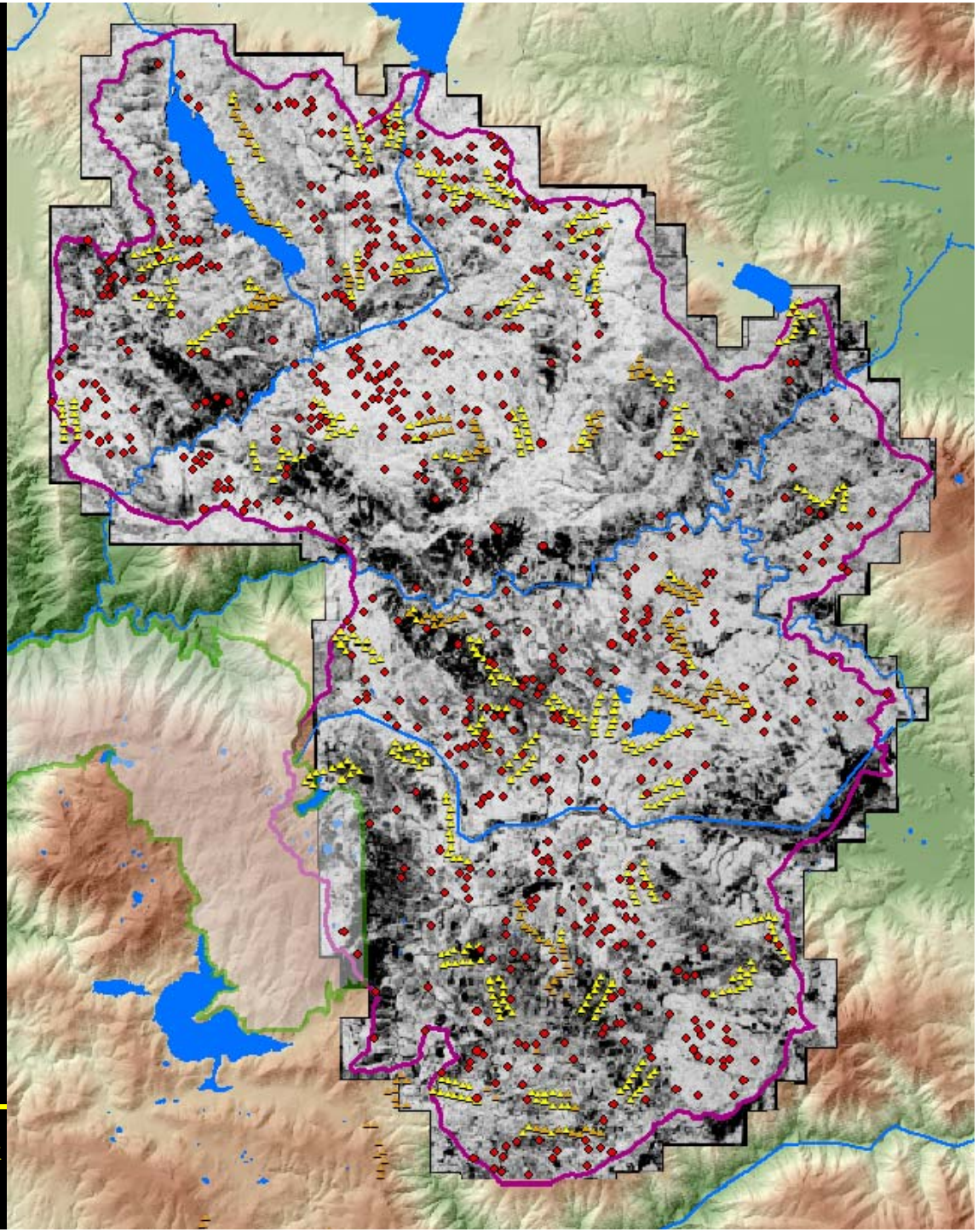
Mammals & Birds

- Hundreds of observation sites
- Species occurrence, diversity and richness



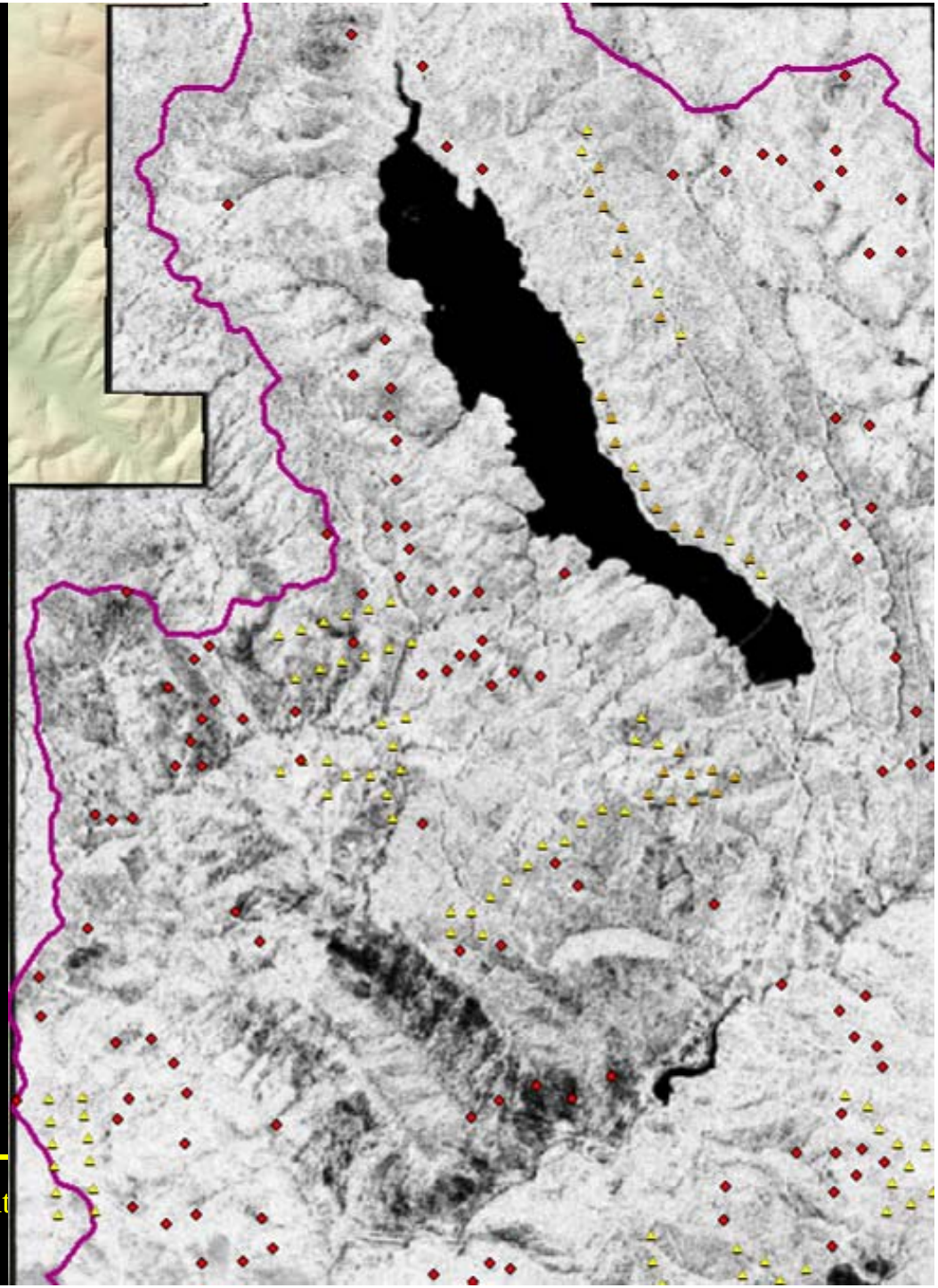
Study Sampling Sites

- Fuels & Fire
- Mammals
- Birds
- Owls?

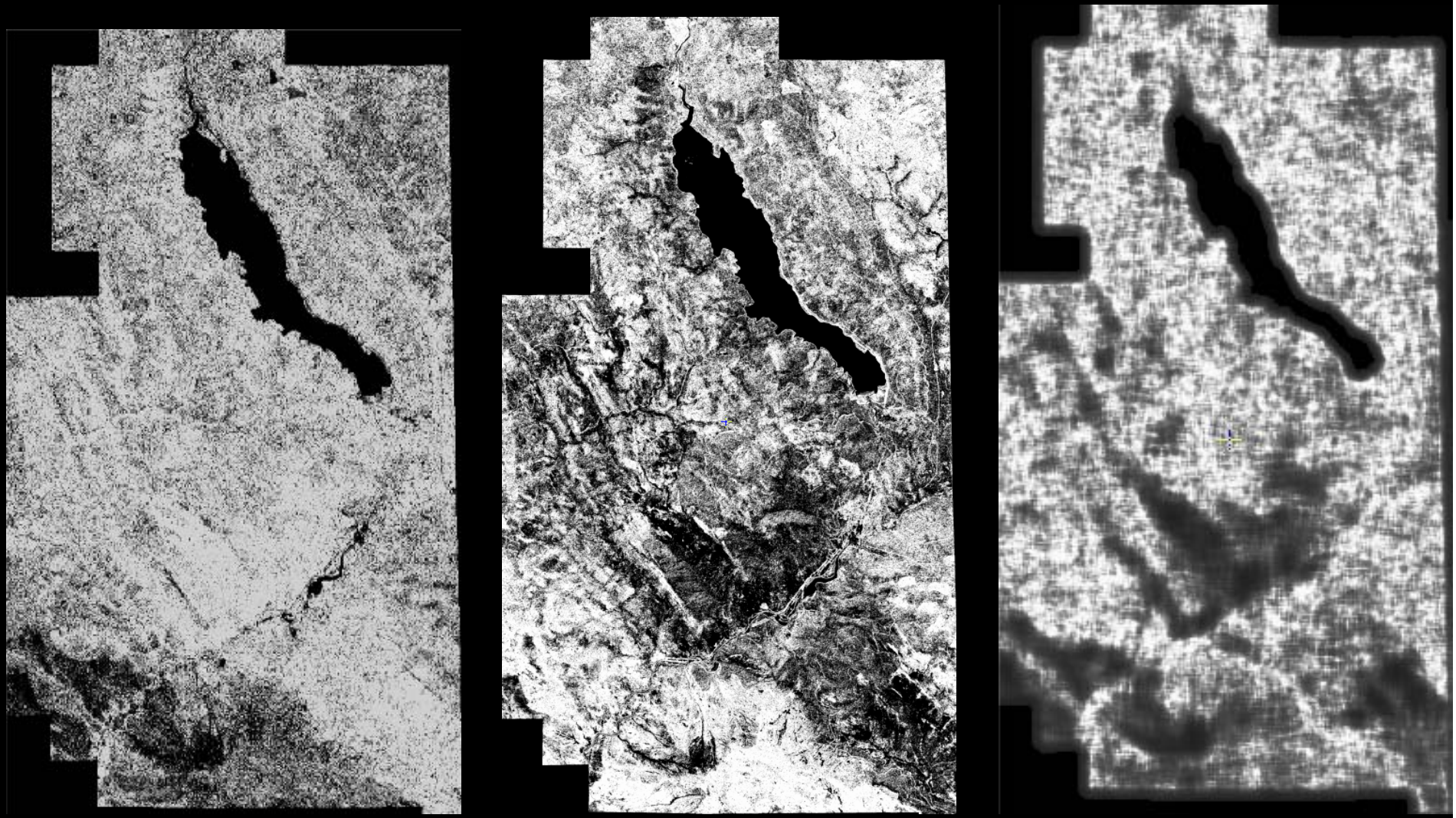


NDVI & SpECDA

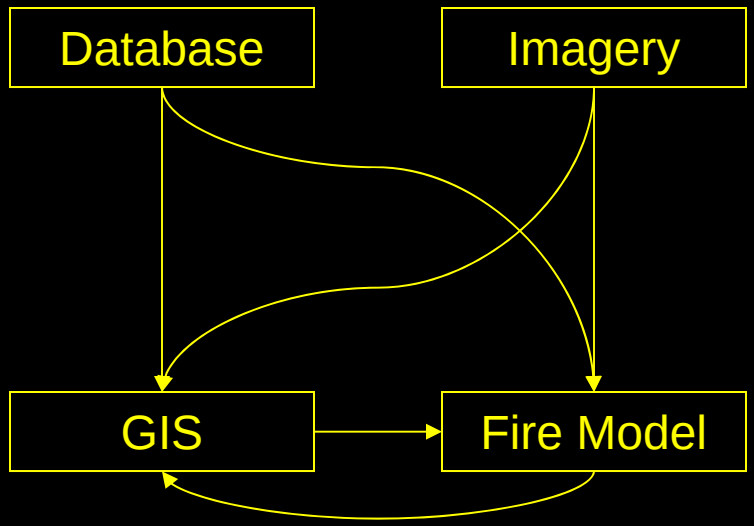
- Plot-scale:
- Best prediction: presence/absence of dusky footed woodrat
- Other scales?



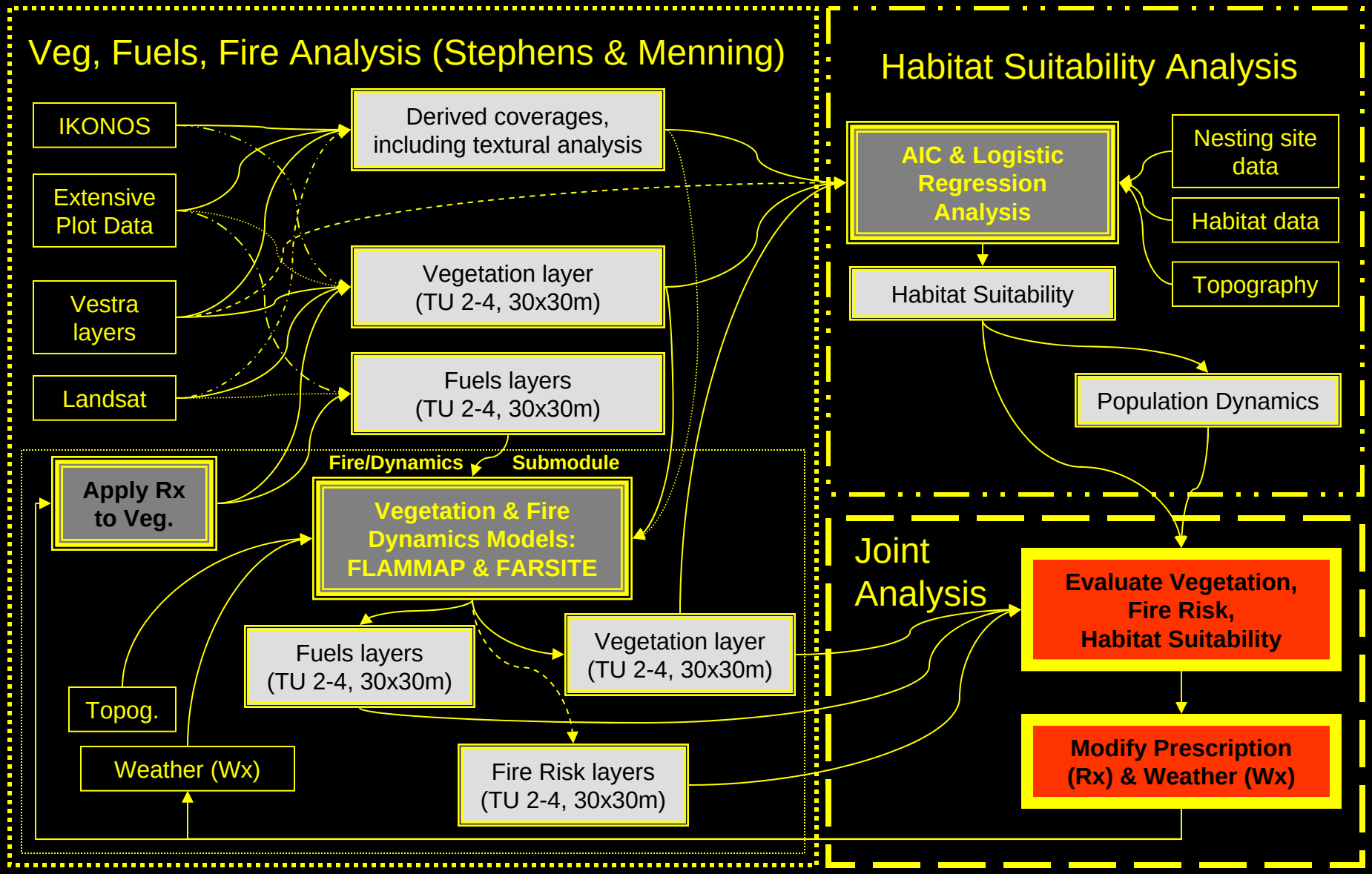
NDVI, SpECDA & SpECDA @ Landscape Scale



Analytical System



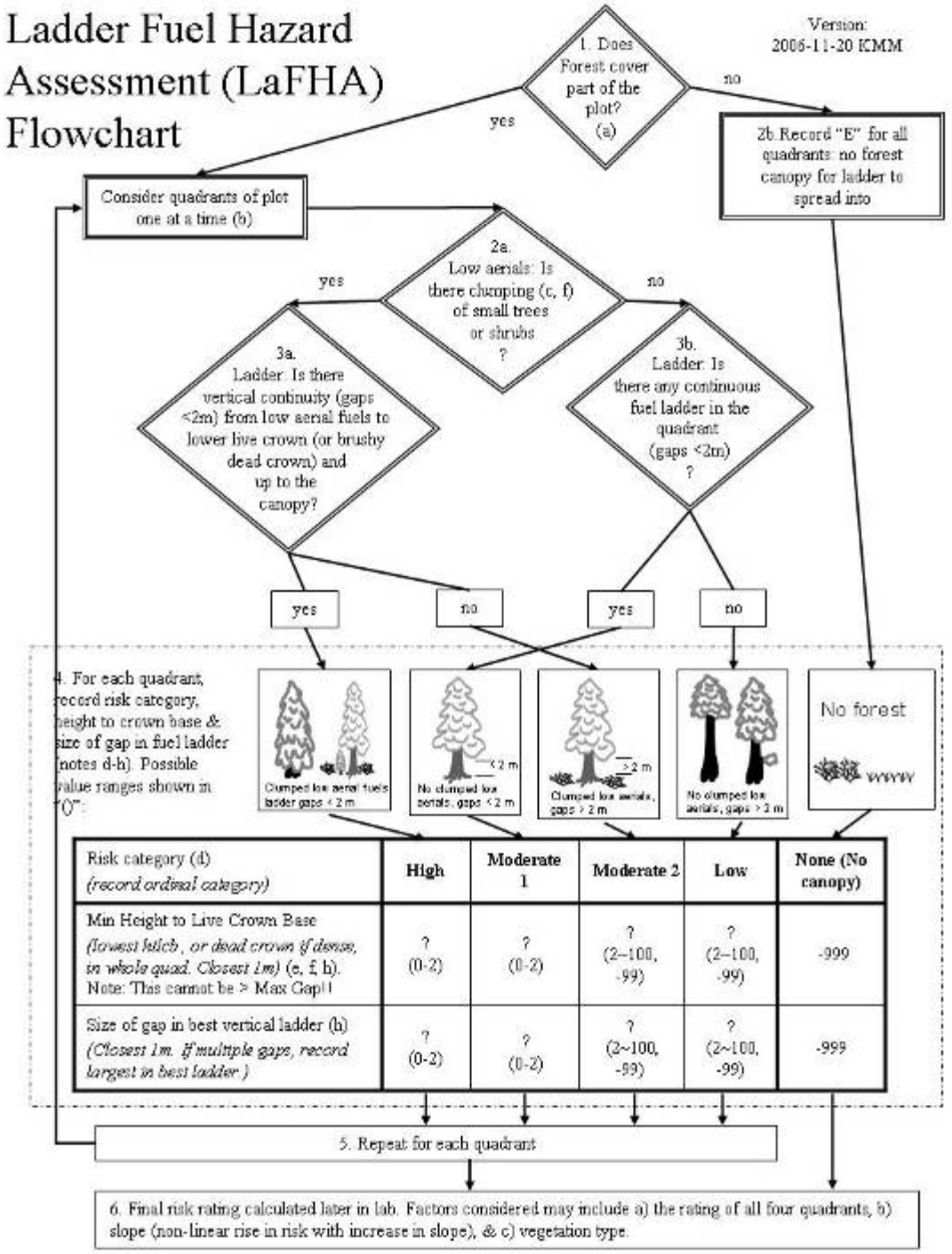
PLAS Landscape Vegetation, Fire and Habitat Integration and Projection



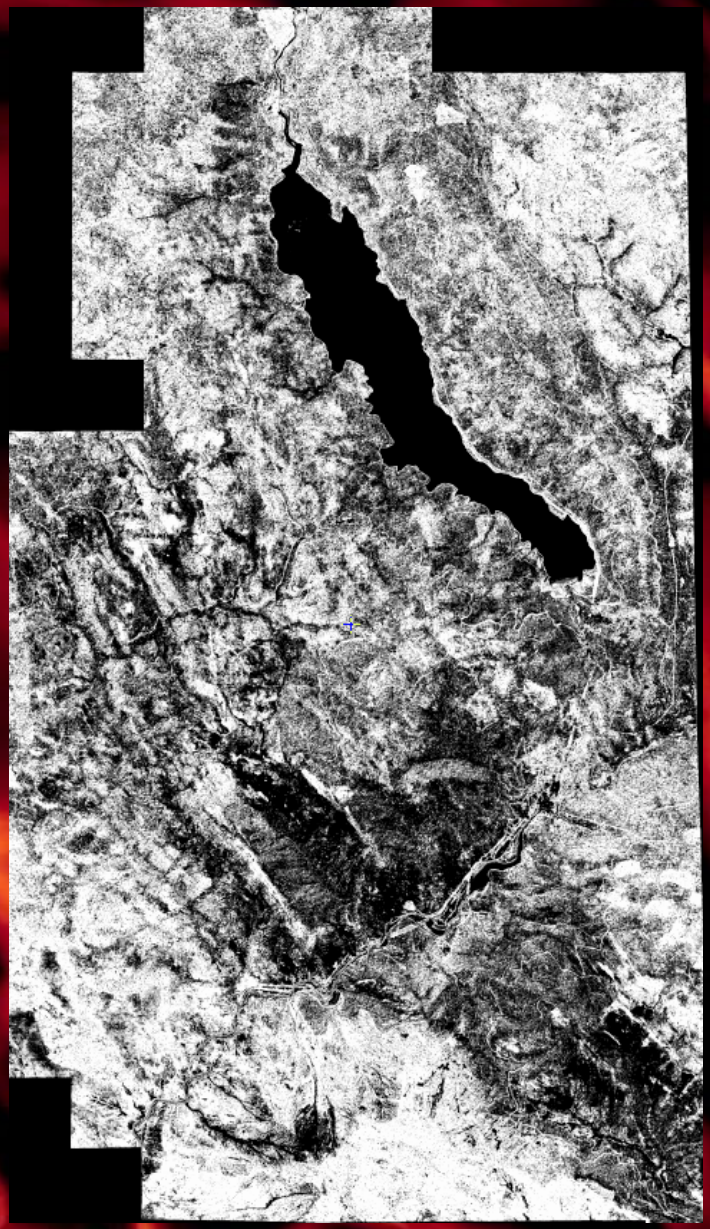
Key: white boxes = data sources; light grey = derived products or layers; dark grey = dynamics/analytical models; black = human evaluation & decision space

LaFHA

- Western Journal of Applied Forestry
- April 2007



Thanks!



Thanks to USDA Forest Service Pacific Southwest Research Station, Plumas National Forest, UC Forestry Camp, & many, many field workers.

stephens@nature.berkeley.edu
kmenning@nature.berkeley.edu
510-643-4773