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Landscape Planning for Fuel Reduction and Forest Restoration

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Landscape Planning Process

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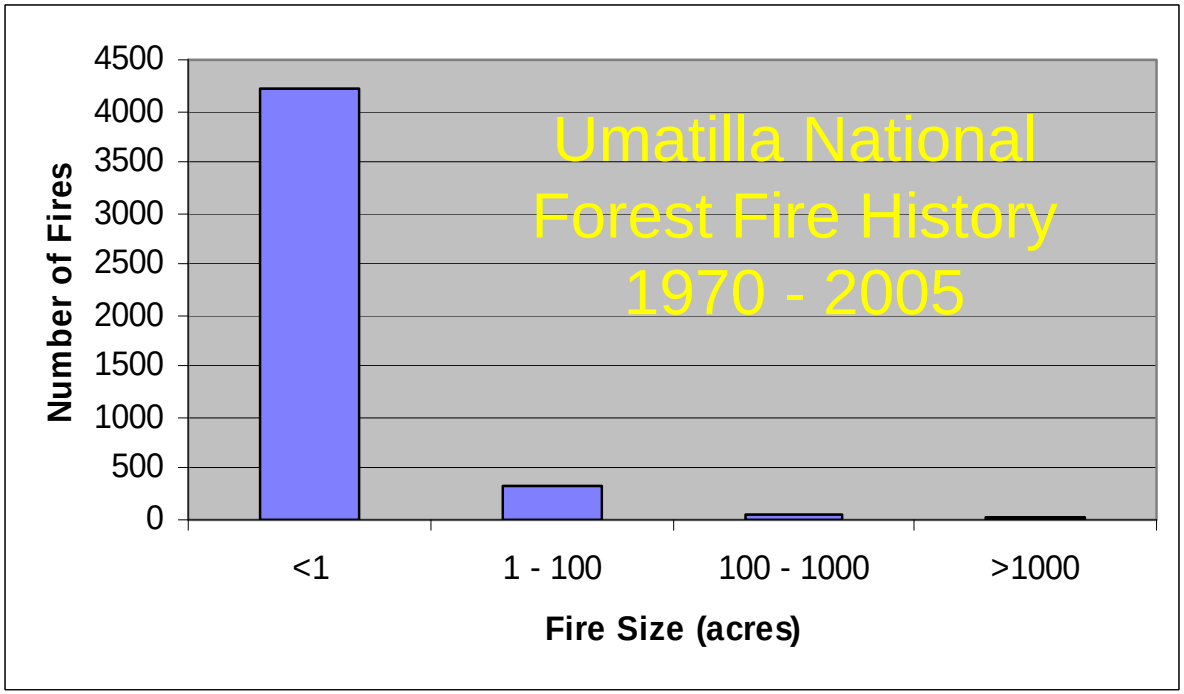
1. Define restoration and protection framework and goals
2. Quantify wildfire risk and prioritize landscapes for management activities
3. Design projects and specific treatment alternatives
4. Examine treatment effectiveness

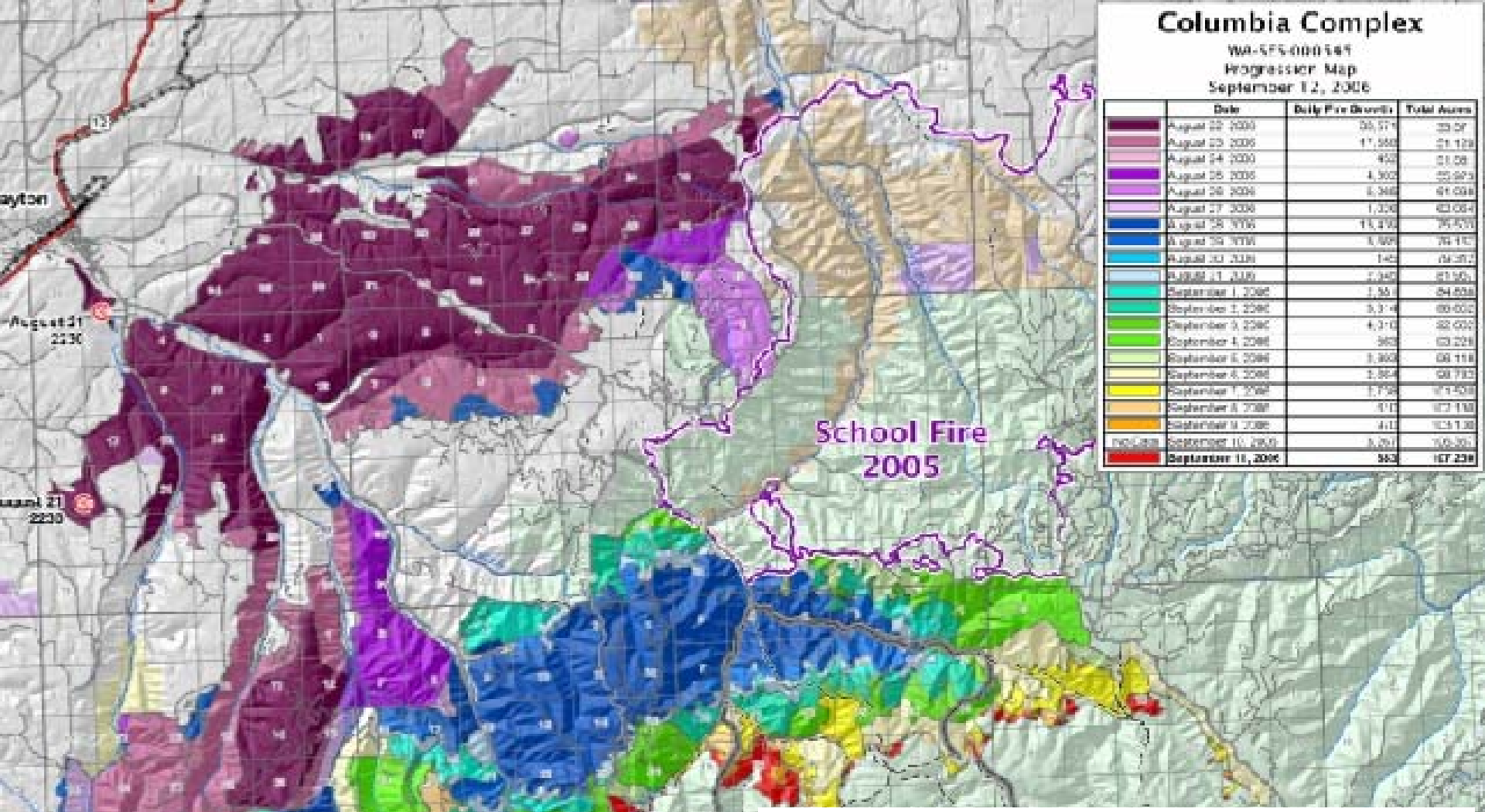
Key Metric: Wildfire Risk

- Risk = wildfire probability x consequence
- Wildfire probability is driven by a series of events
  - Ignition
  - Weather and fuels conditions conducive to spread
  - Escape initial attack (10 AM rule)
  - Weather and fuel conditions favor rapid spread
  - Subsequent suppression fails
  - Large fire event
- Probability of a point burning on a landscape
  - $p(F_{xyt}) = p(I) + p(W,F) + p(Sp) + p(Su) + \text{interactions}$
- Extensive literature for all these components
- Too complicated for operational planning

Relatively few large fires account for most of the acres burned

Nationally, 99 percent of wildland fires are contained to < 300 acres acres or





And, escaped fires grow in a few large spread events where suppression is ineffective

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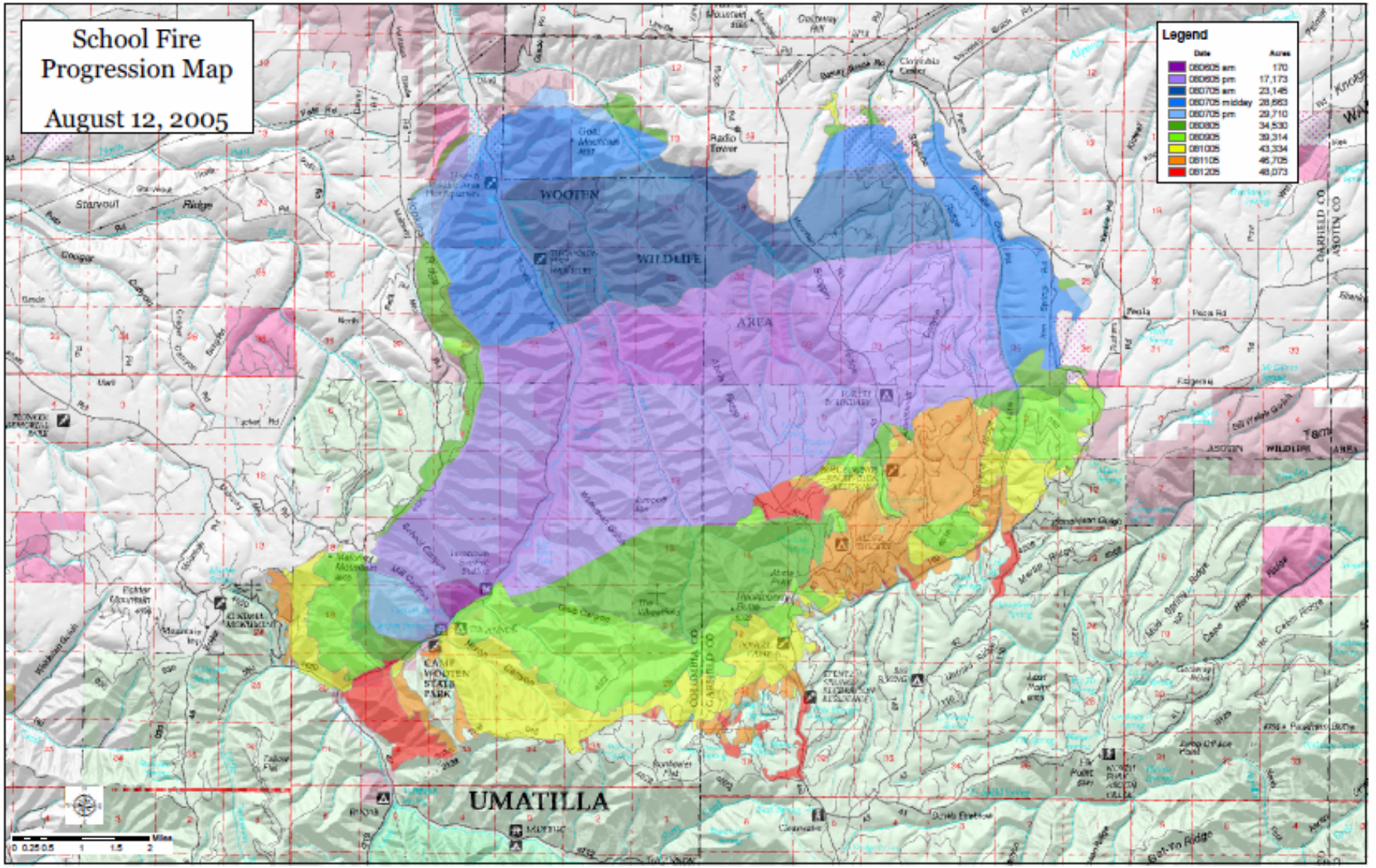
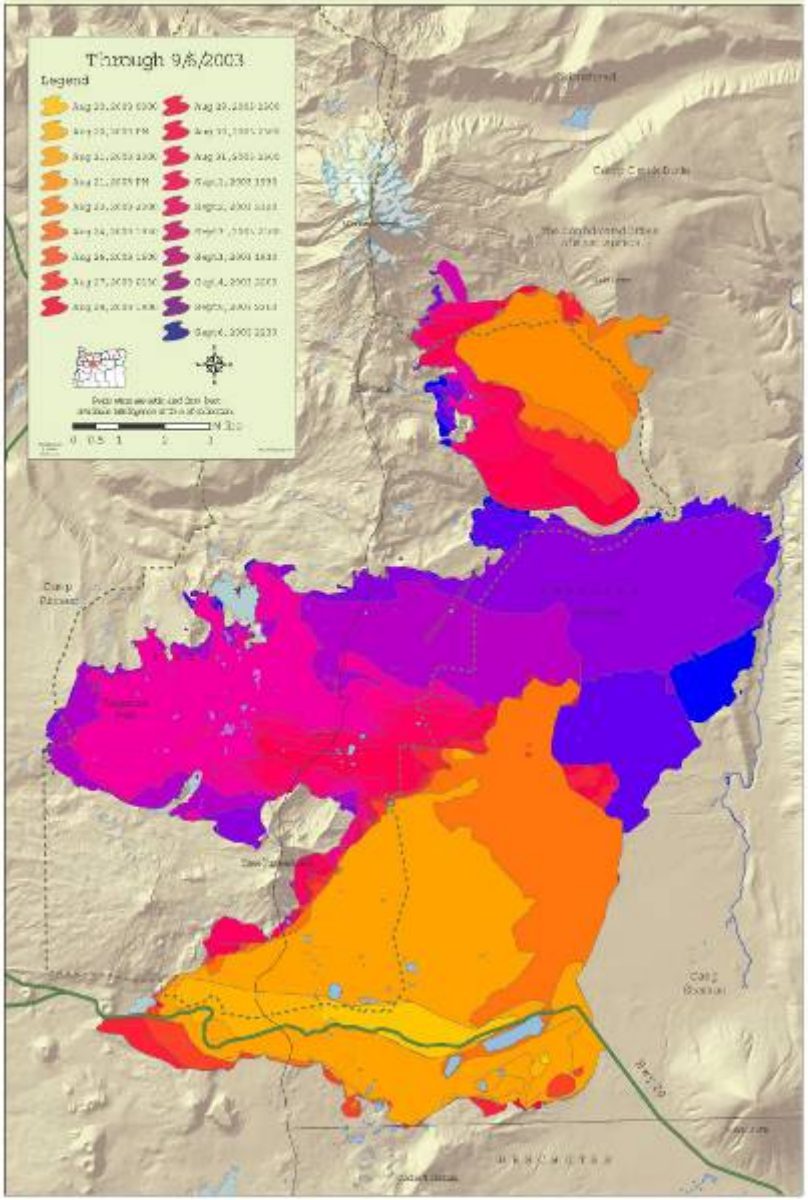


Fire Progression B & B Complex



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Several inferences from wildfire statistics

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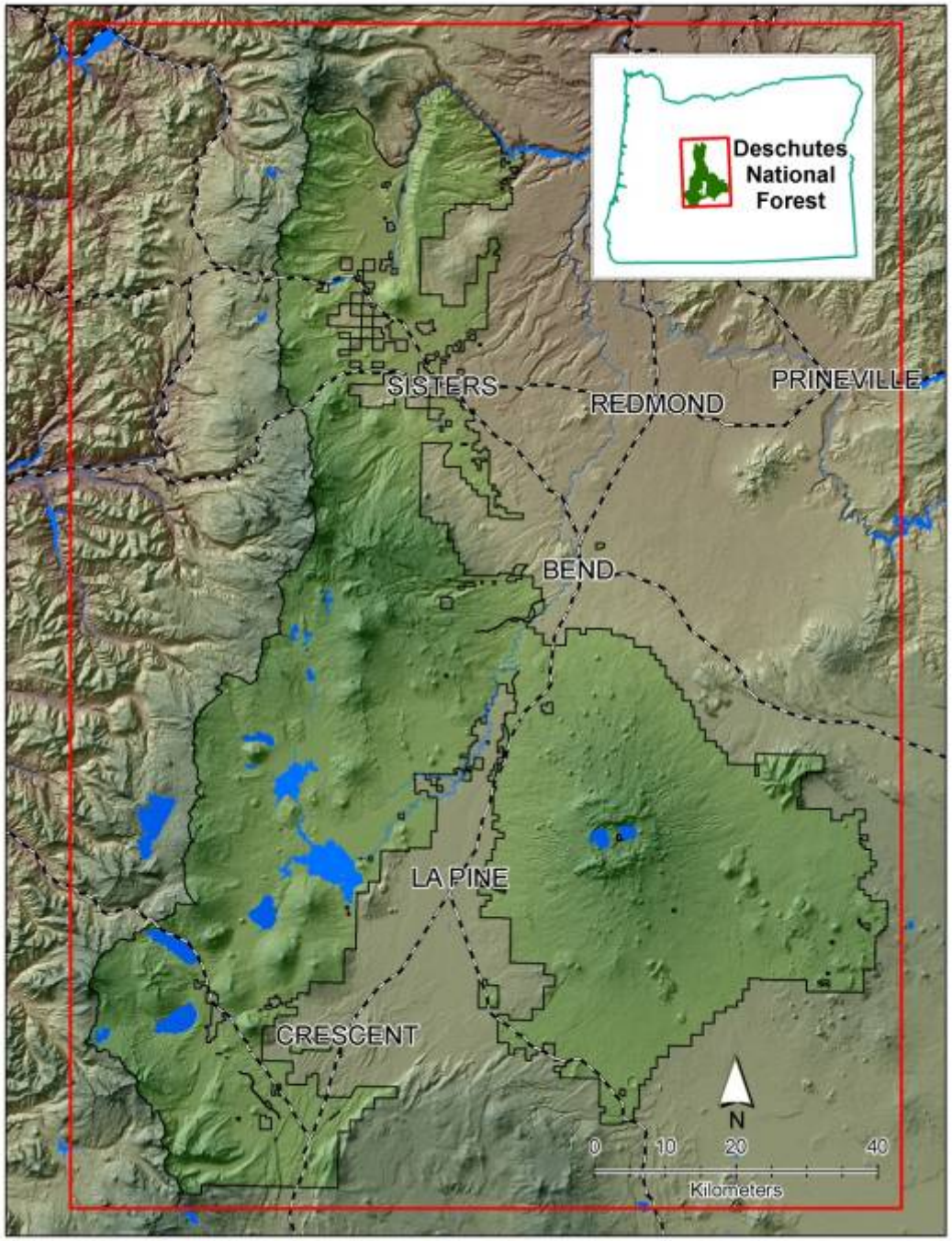
- Wildfire spread during large fire events is the primary contributor to wildfire risk
- We can model wildfire risk by just considering the burn events, i.e. we do not need to simulate complex multi-day wildfire events with ignition grids, suppression, changing weather etc.
- By simulating lots of burn events we can estimate conditional burn probabilities for risk analyses



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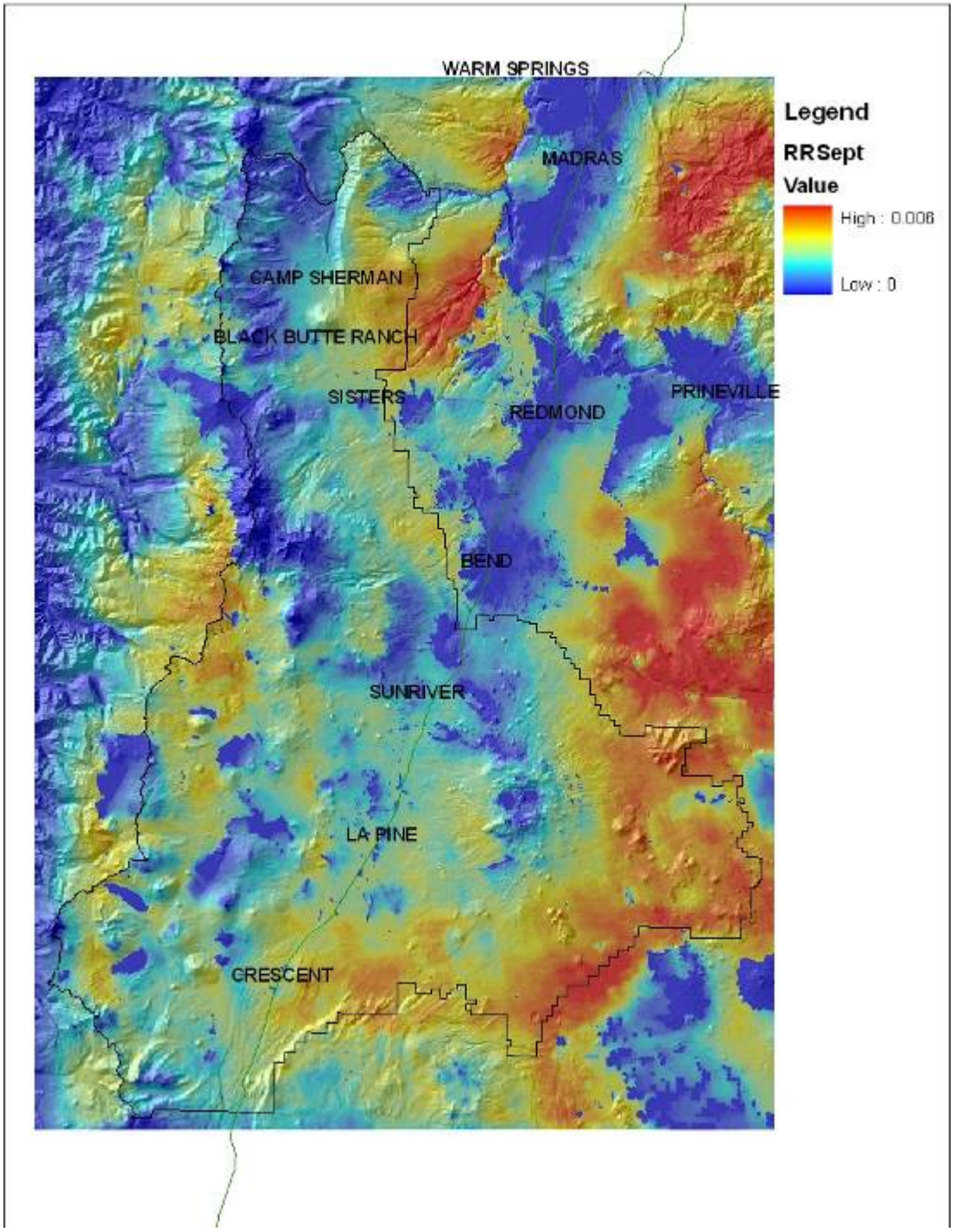
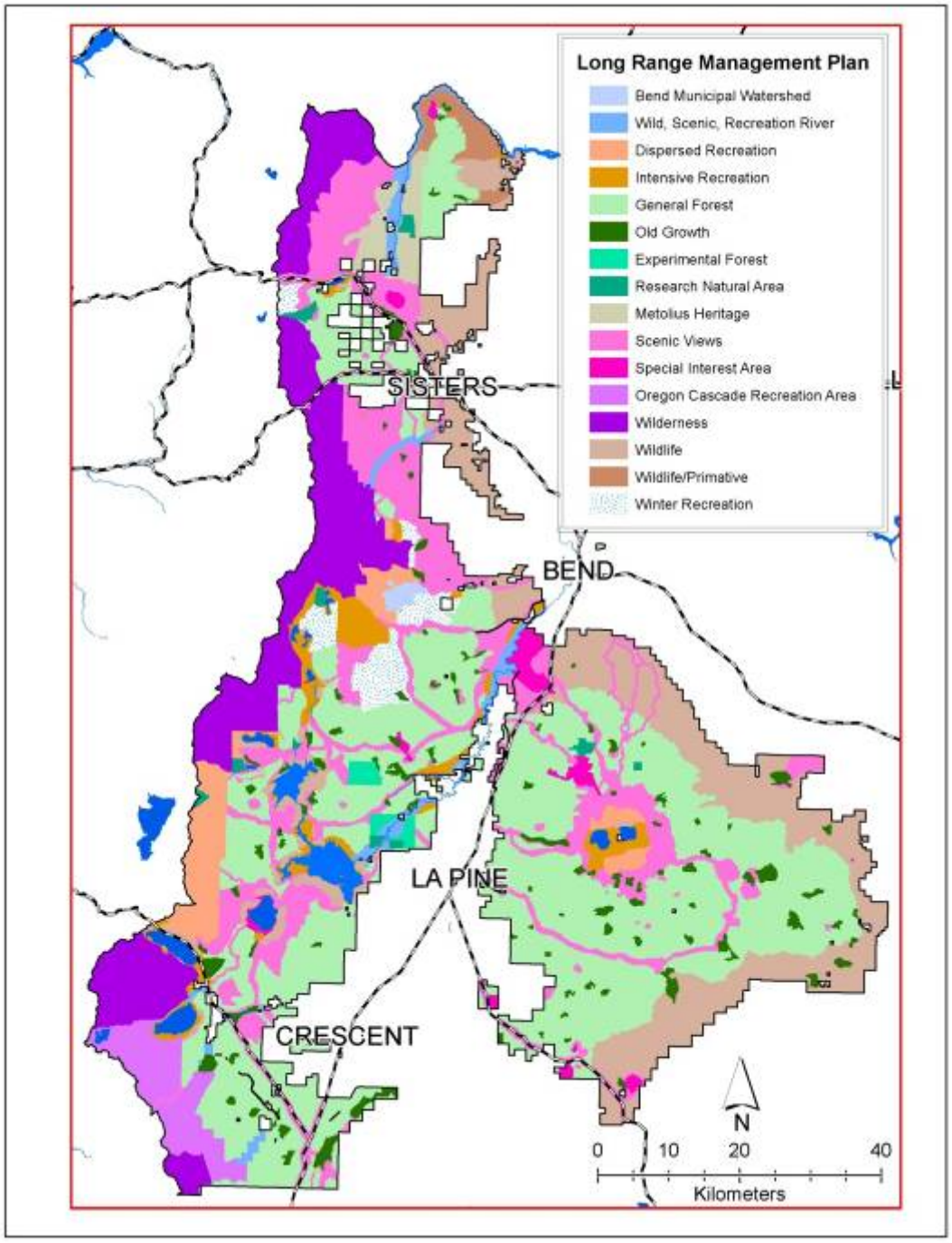
Burn probability analysis

- 50,000 burn periods
- Weather conditions mimic recent severe wildfire events
- Random ignition location
- BP = probability of a pixel burning given one ignition and a severe burn event
- Fire intensity and fire size outputs also generated





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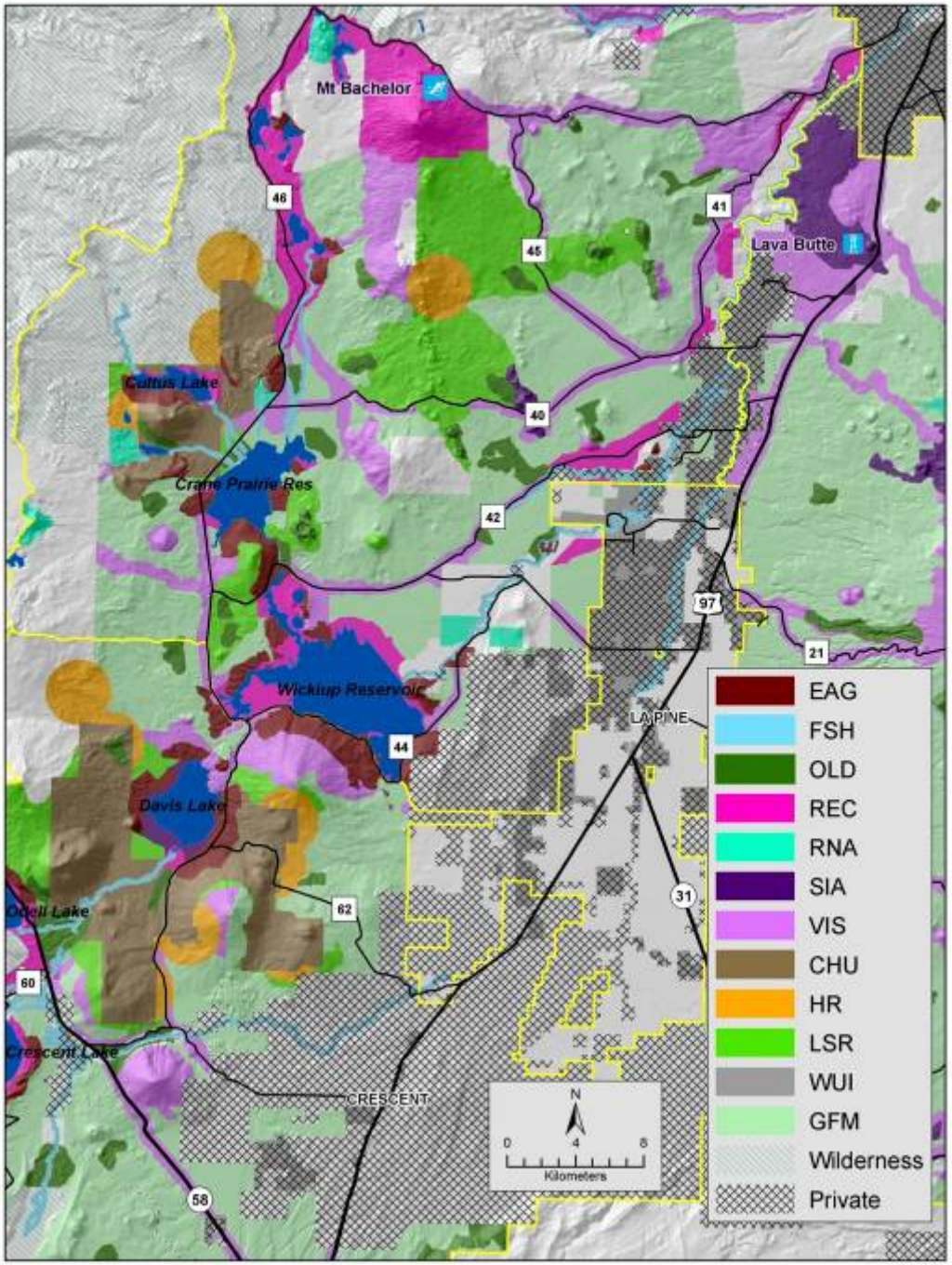

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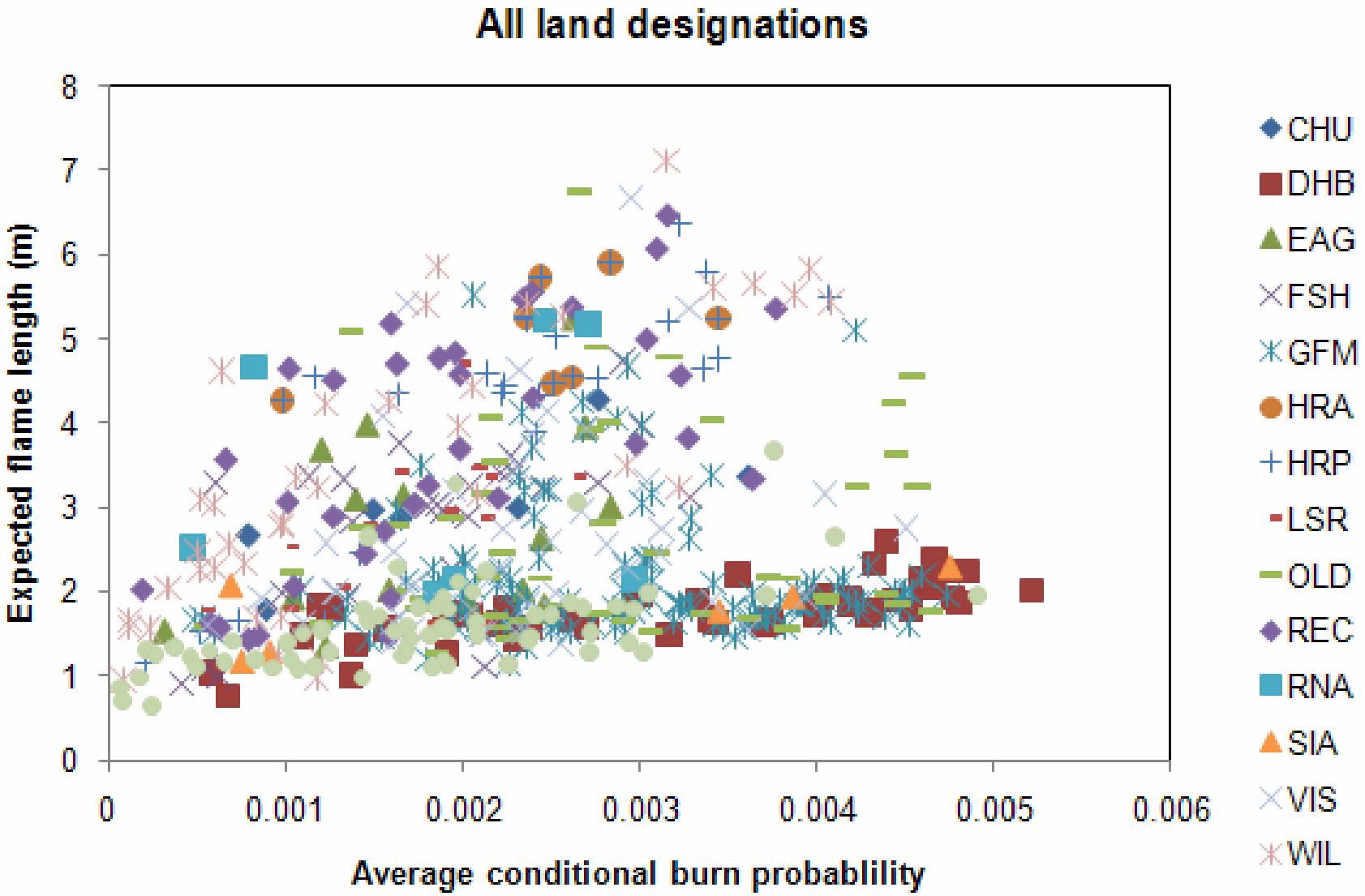
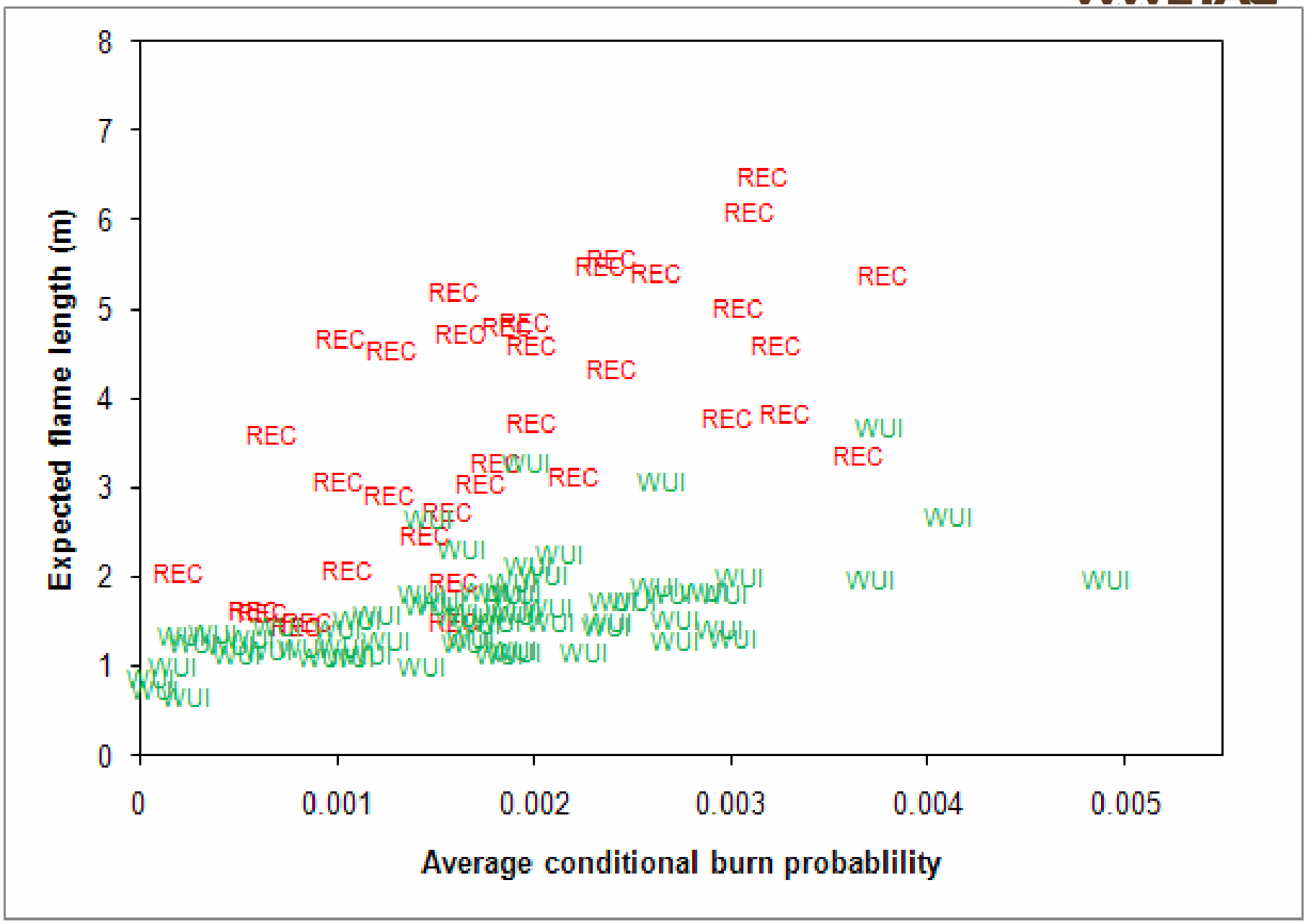
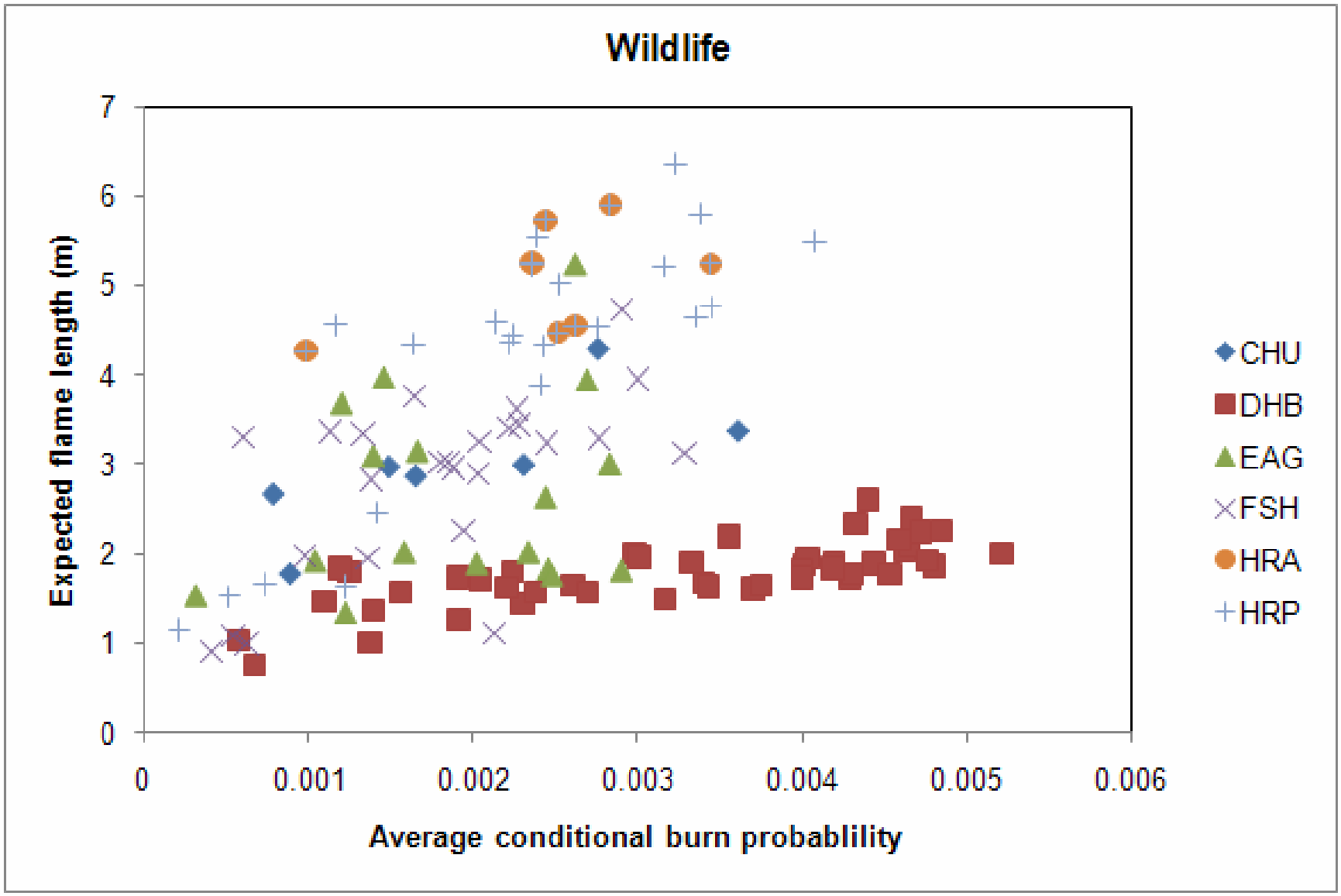



Expected flame length (m)
Average conditional burn probablility
0
1
2
3
4
5
6
7
8
0
0.001
0.002
0.003
0.004
0.005
REC
WUI


Wildlife
Expected flame length (m)
0
1
2
3
4
5
6
7
0
0.001
0.002
0.003
0.004
0.005
0.006
Average conditional burn probablility
CHU
DHB
EAG
FSH
HRA
HRP

Project Planning – Five Buttes

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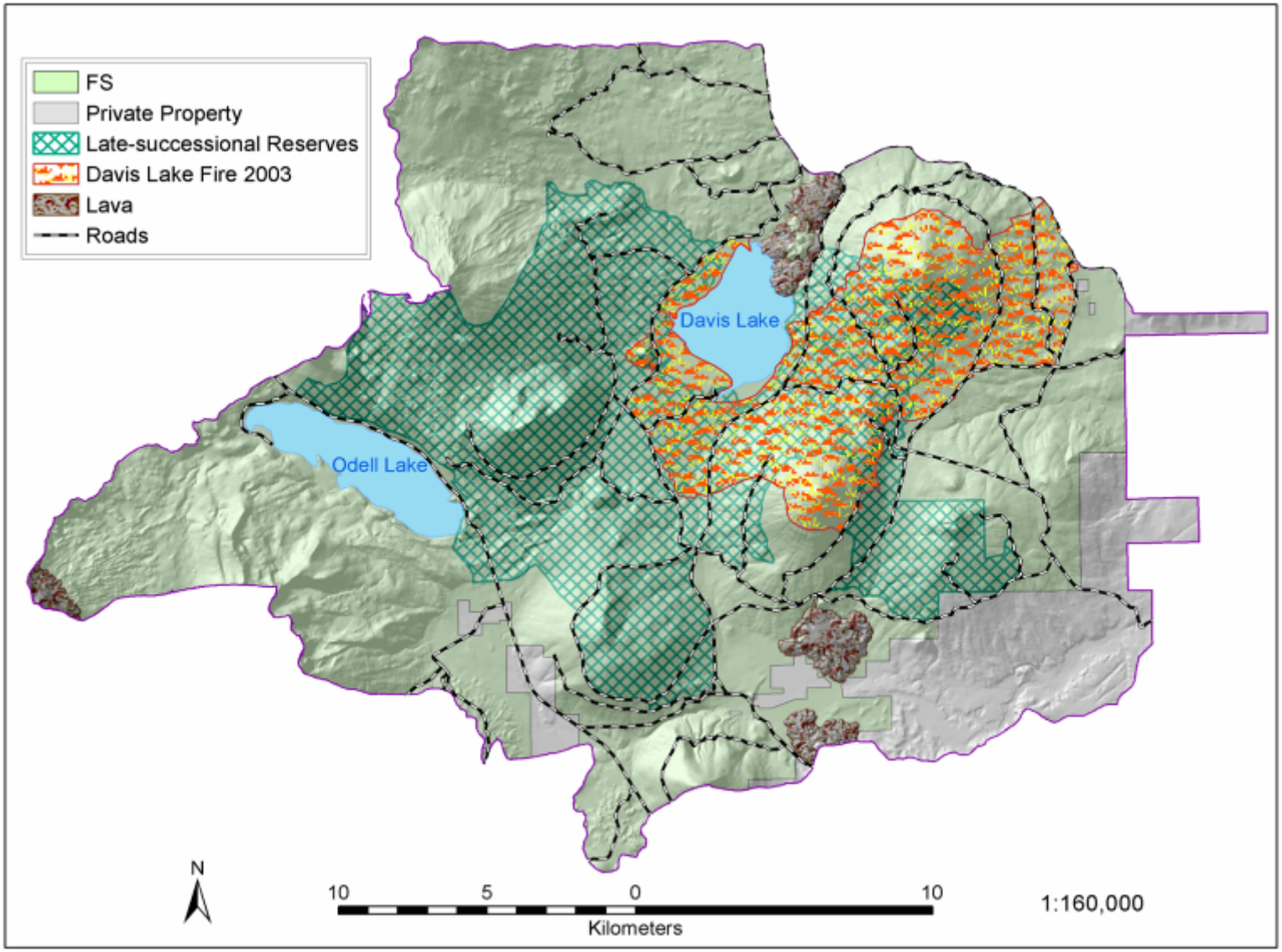

Burn Probability

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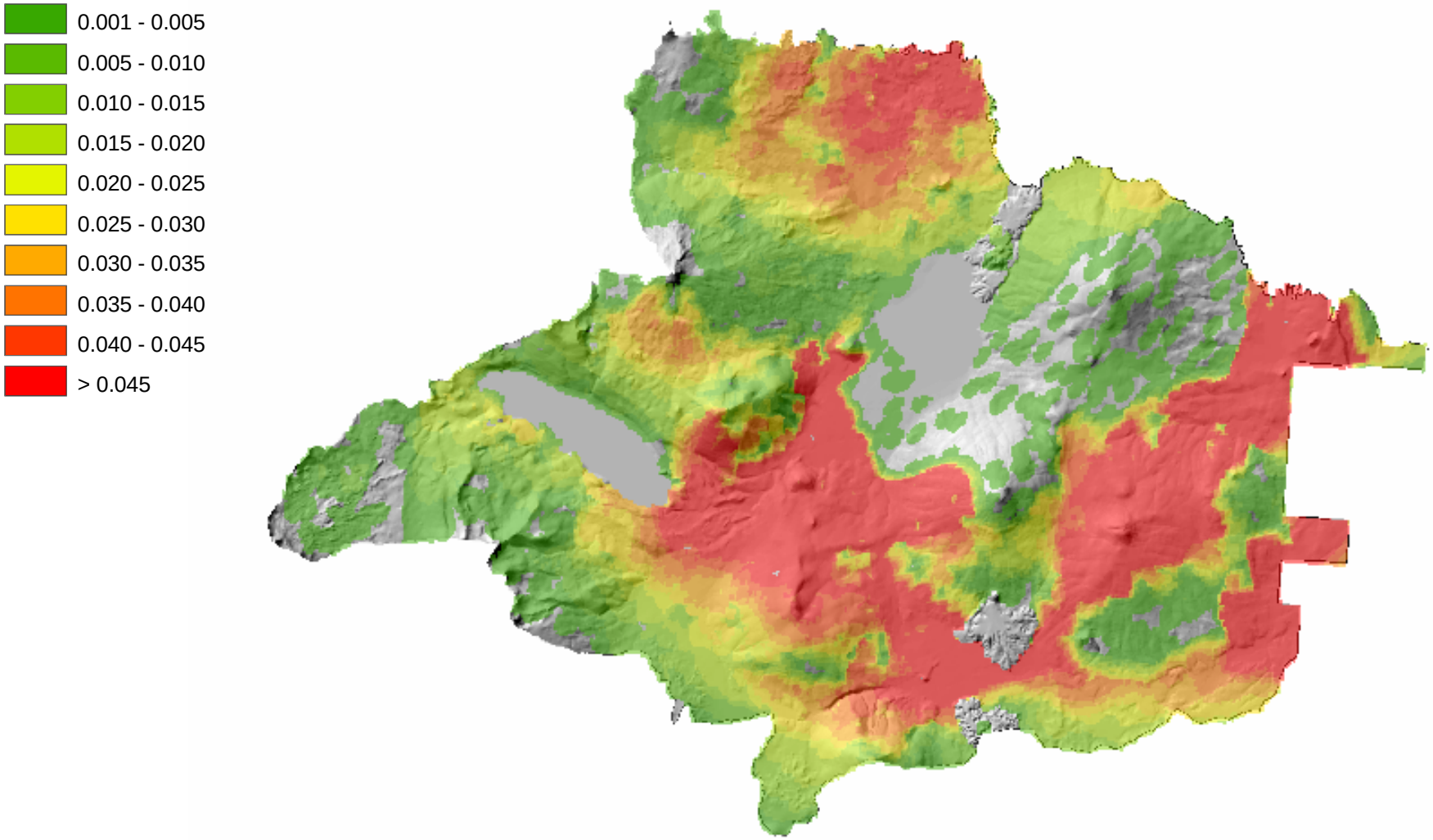

Minimum travel time routes

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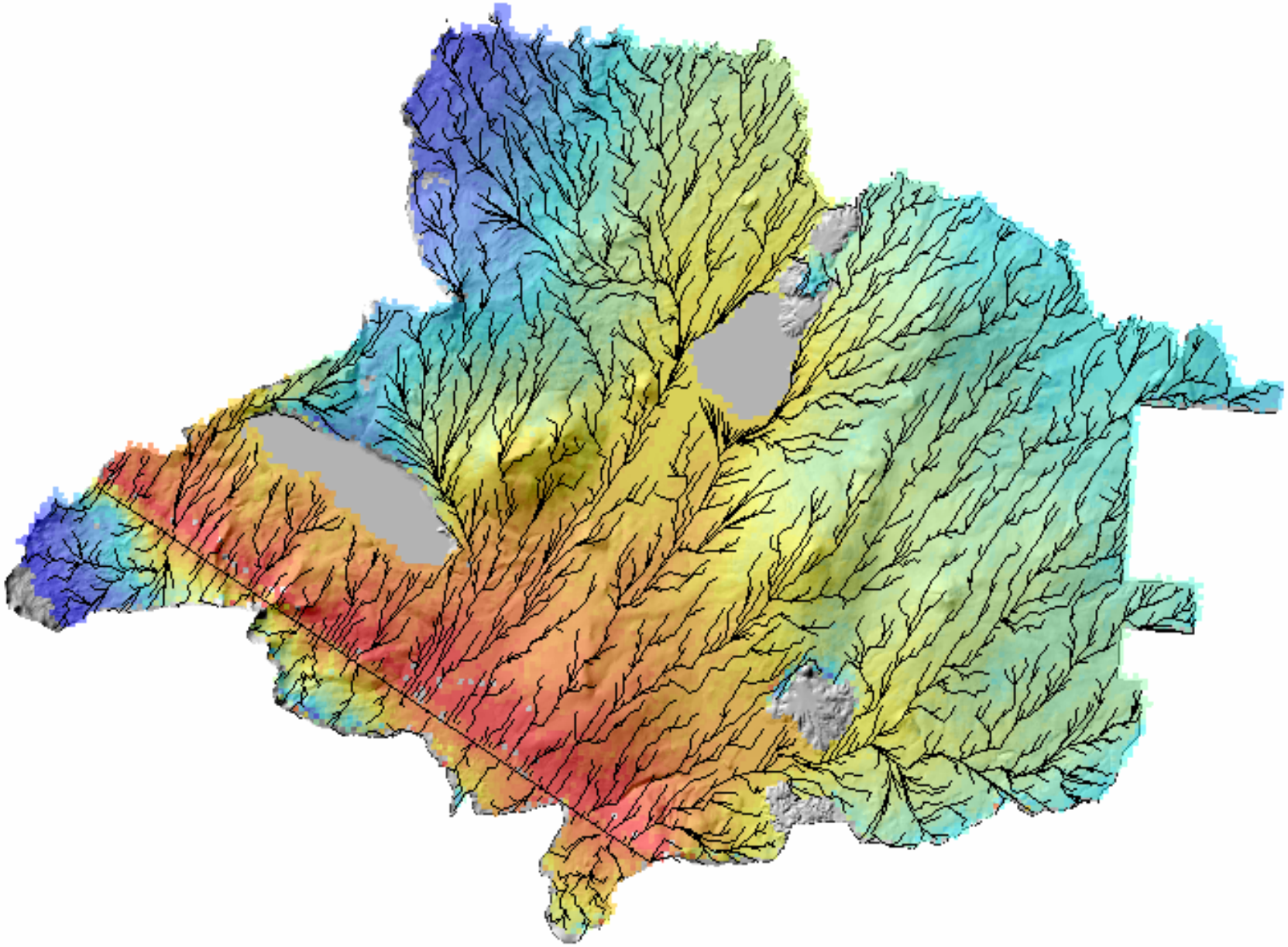

Fire size

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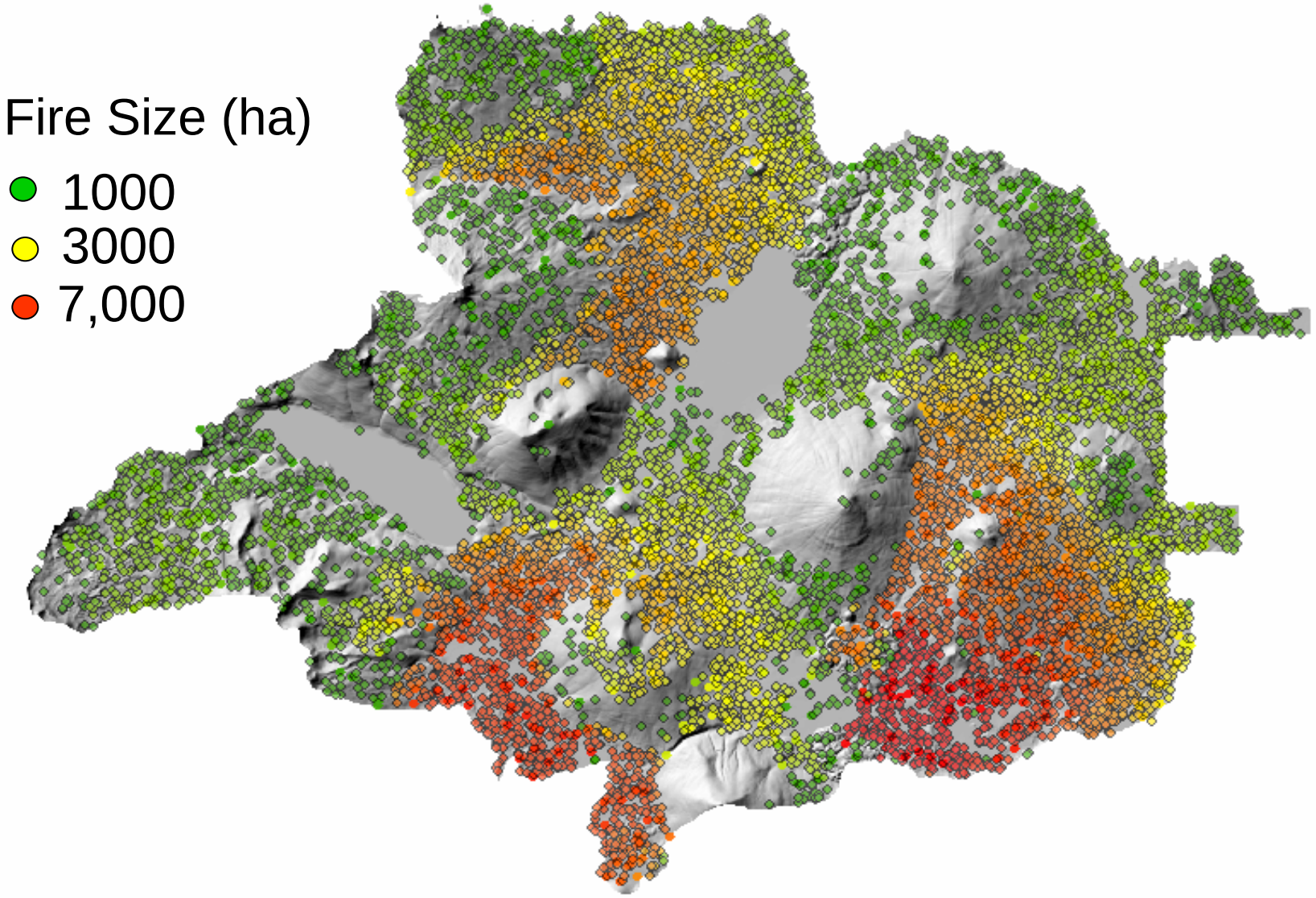

Strategic fuel treatments

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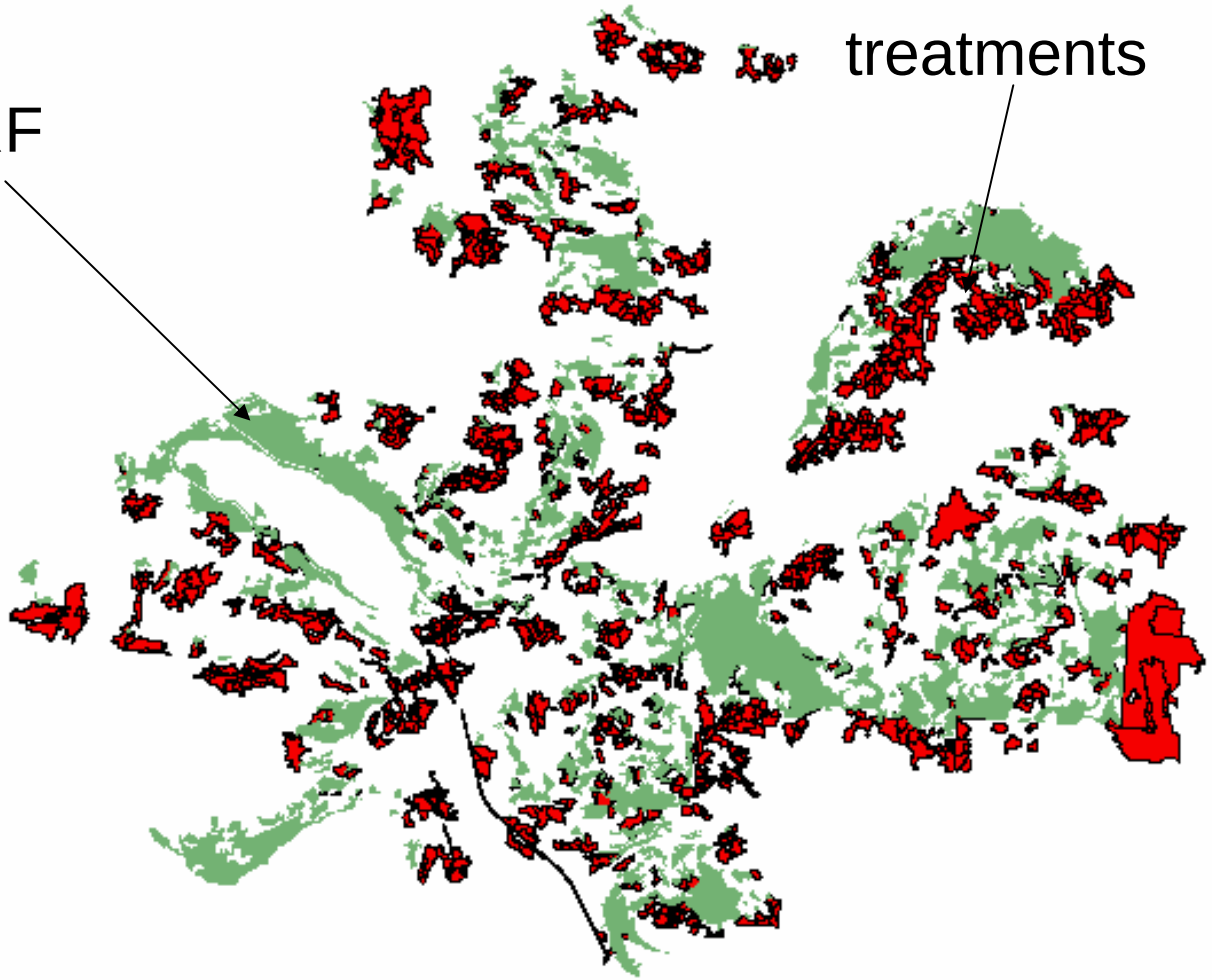
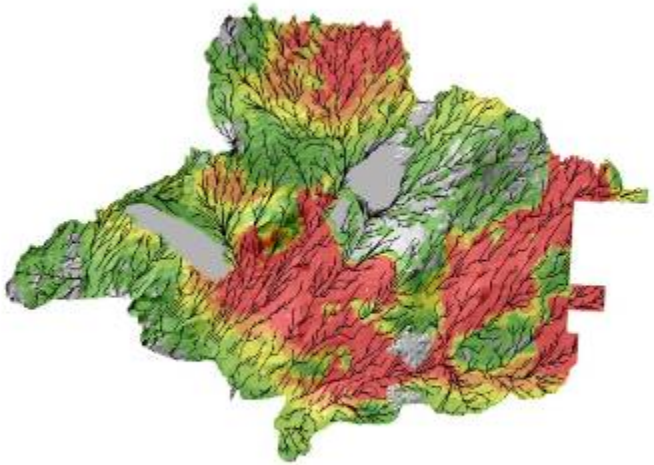
Treat 20% of the landscape to protect NERF

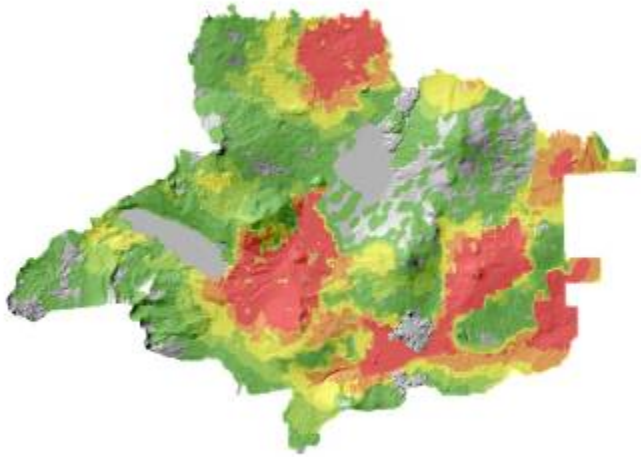


Burn probability for 3 treatment levels

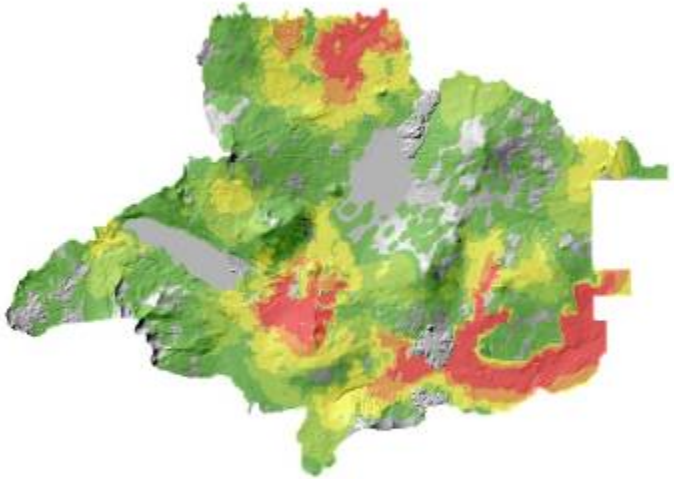
0% treatment



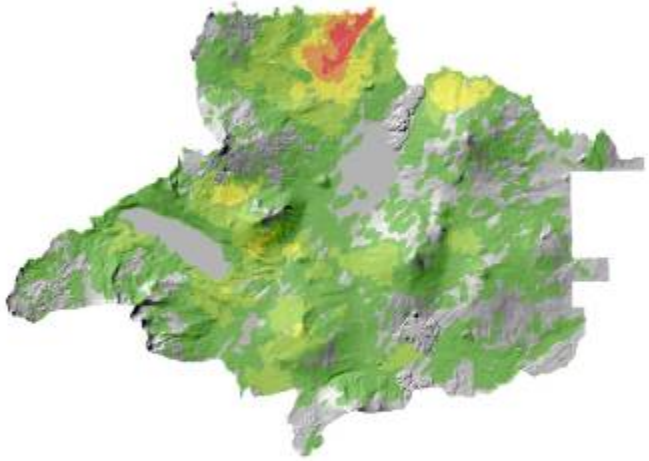
10% treatment



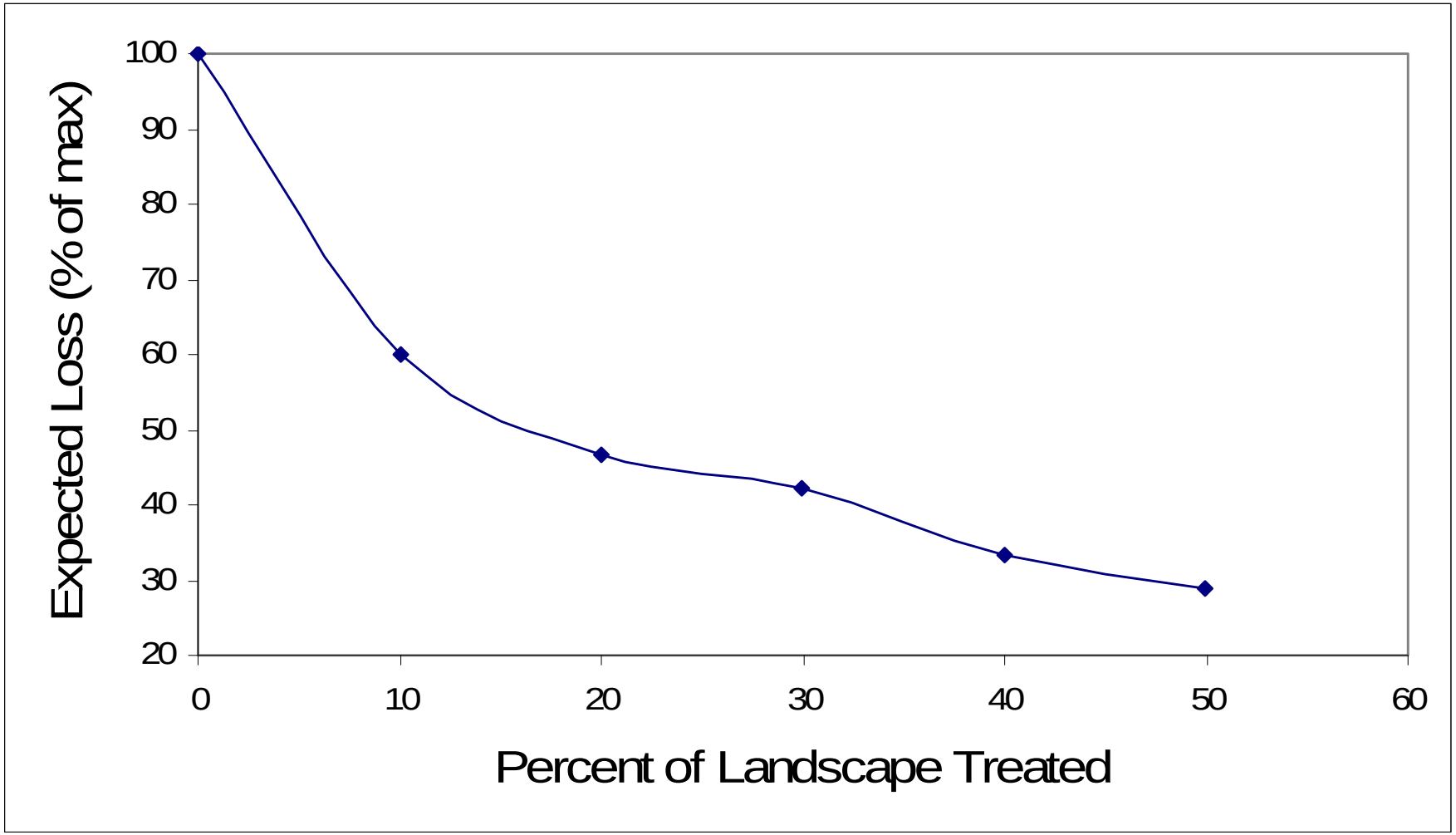
20% treatment



50% treatment



Expected Loss of Spotted Owl Habitat for 6 Treatment Intensities



EXF Project

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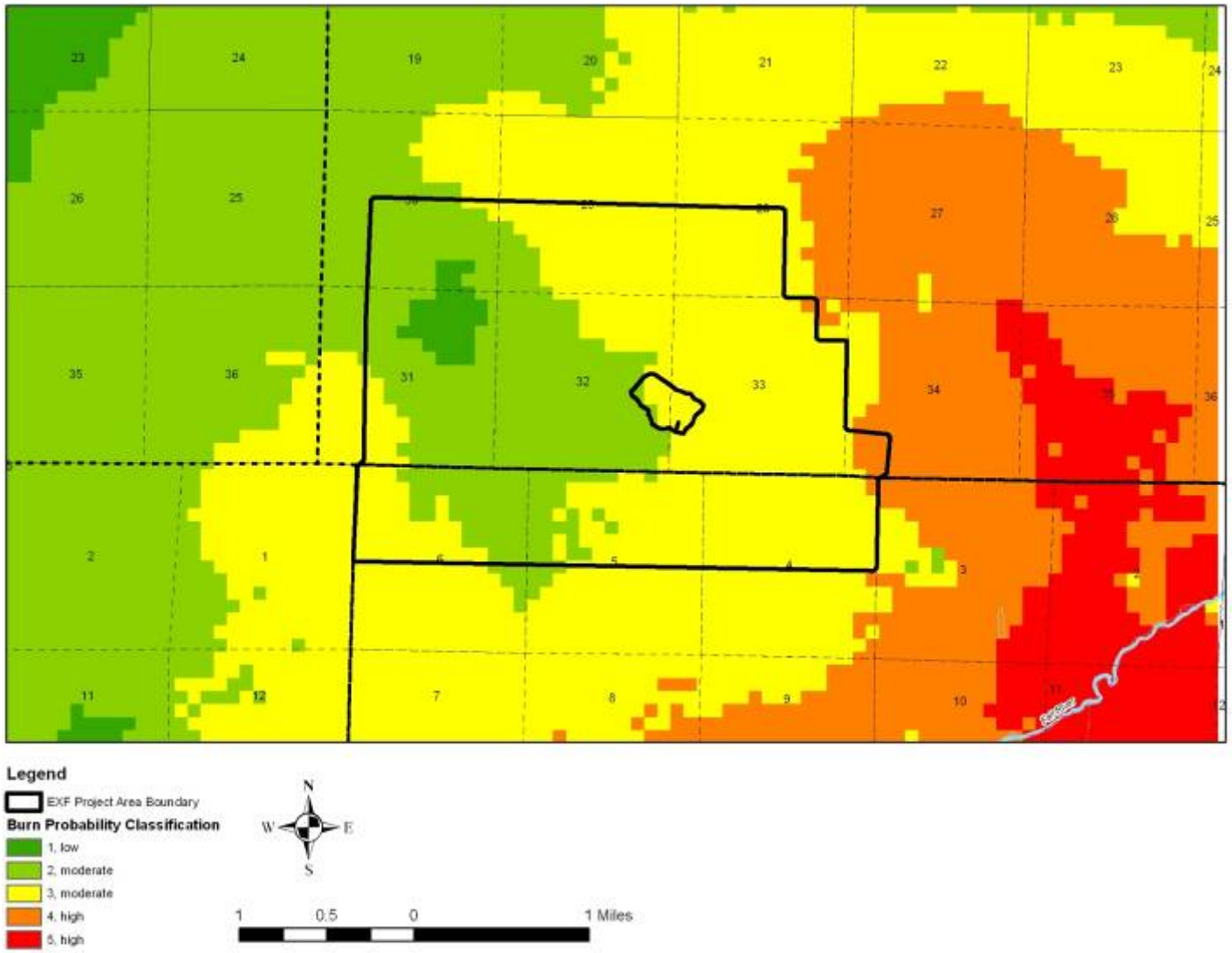

SPOTS

Strategic Placement Of TreatmentS

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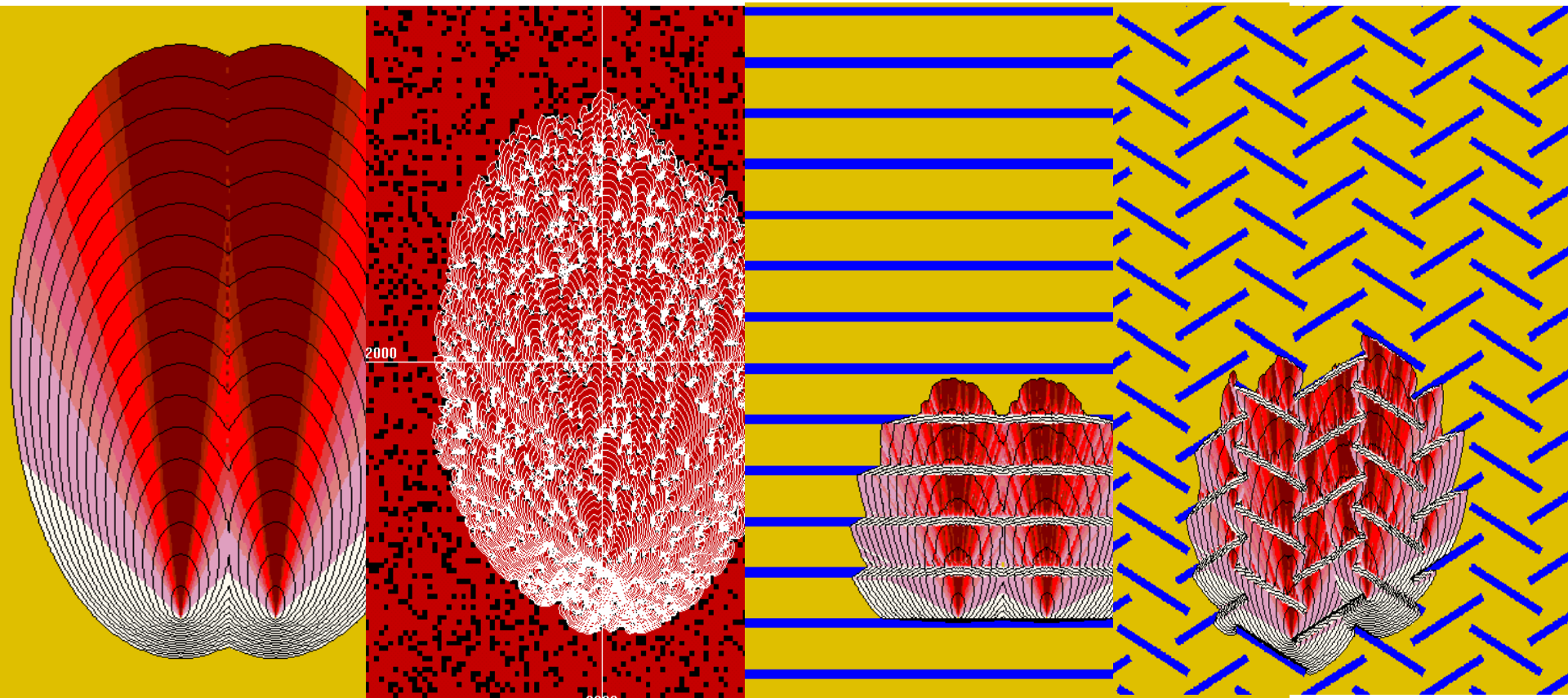
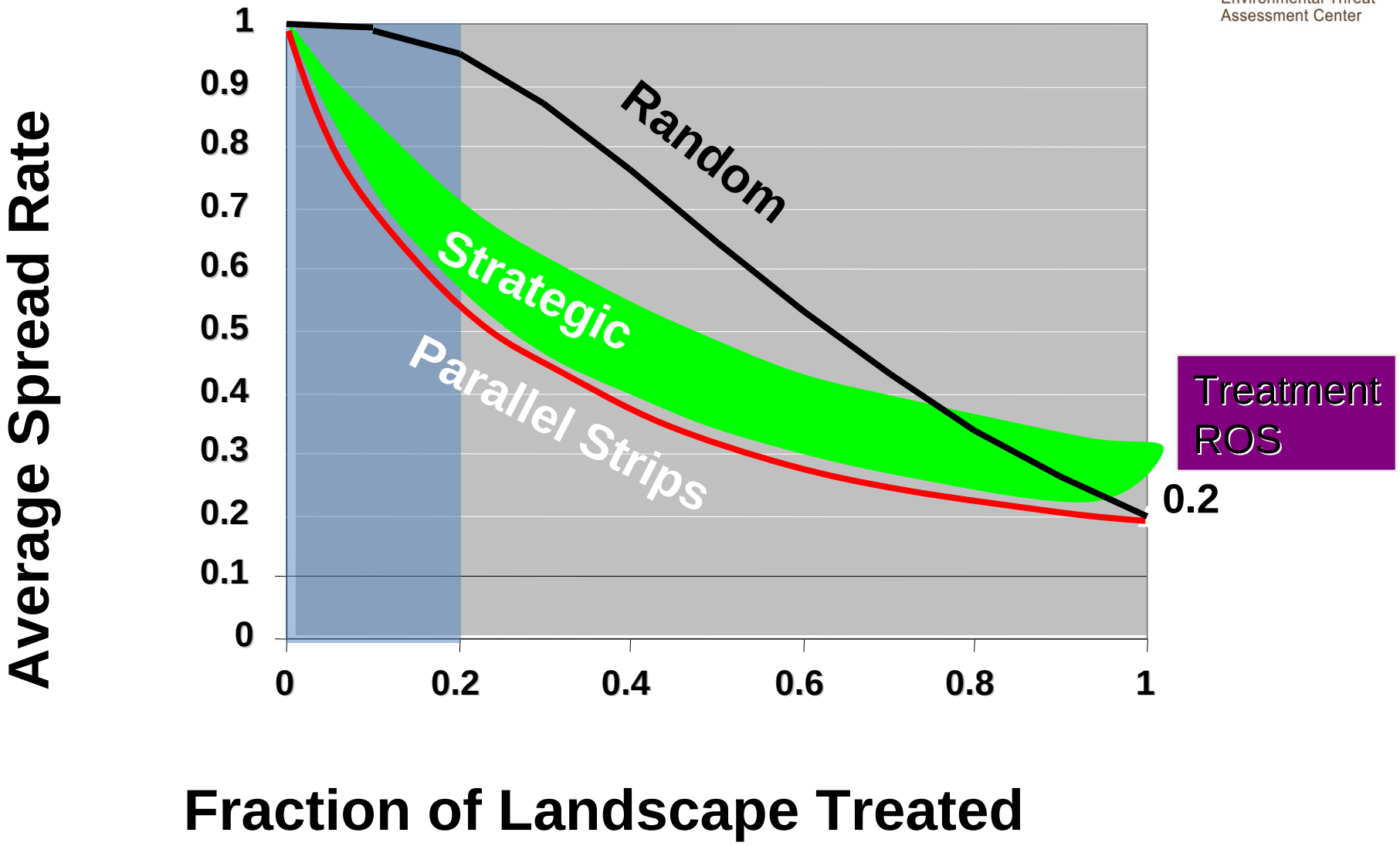
~20% of landscape treated

No Treatment | Random | Strips | Strategic



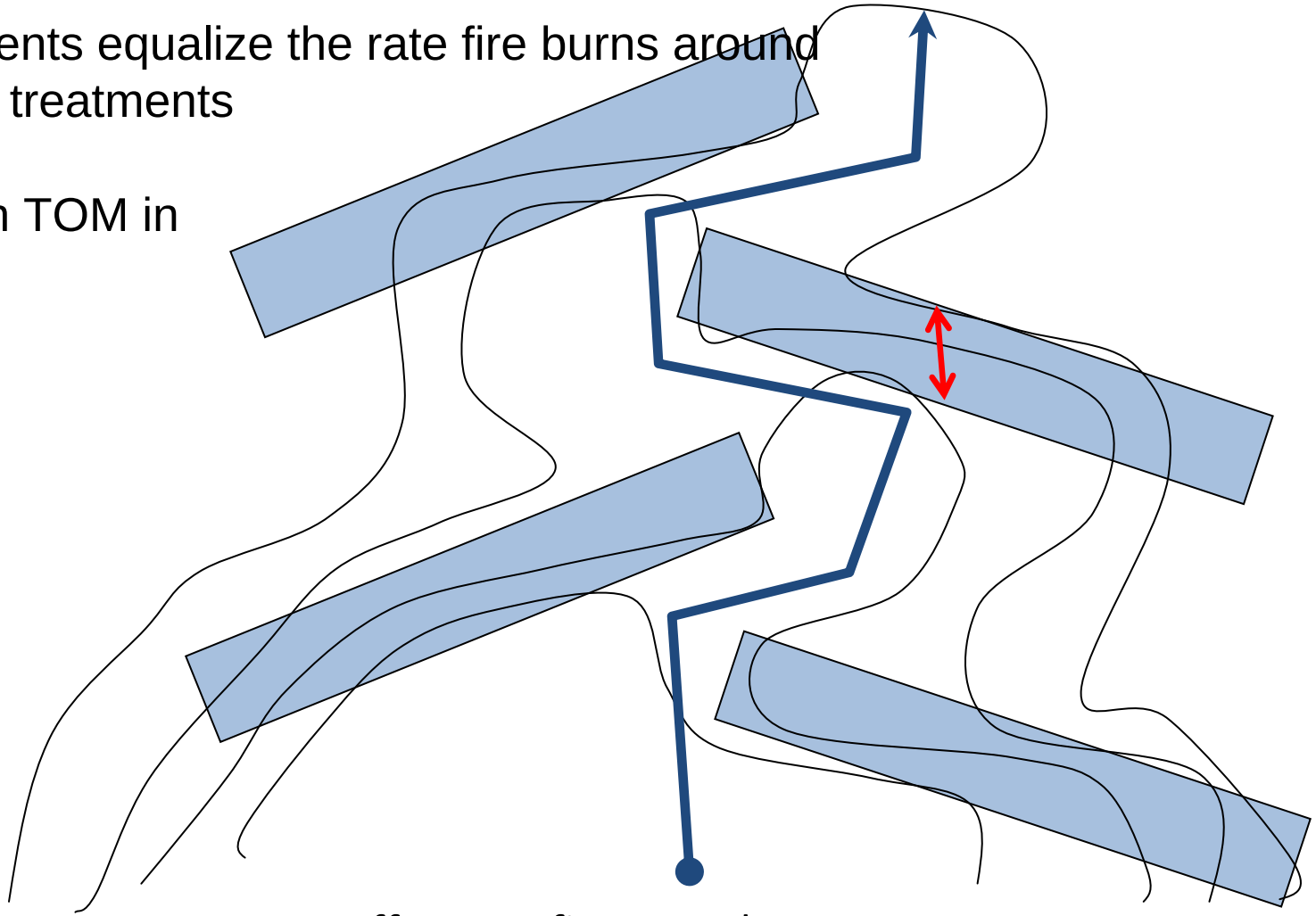

Average Spread Rate
1
0.9
0.8
0.7
0.6
0.5
0.4
0.3
0.2
0.1
0
0
0.2
0.4
0.6
0.8
1
Random
Strategic
Parallel Strips
Treatment
ROS
0.2
Fraction of Landscape Treated

SPOTS is a design concept

Both spatial pattern and treatments dimensions are important

Optimal treatments equalize the rate fire burns around versus through treatments

Automated with TOM in FlamMap 3



Treatment effects on fire growth

Gil Dustin, Salt Lake City BLM

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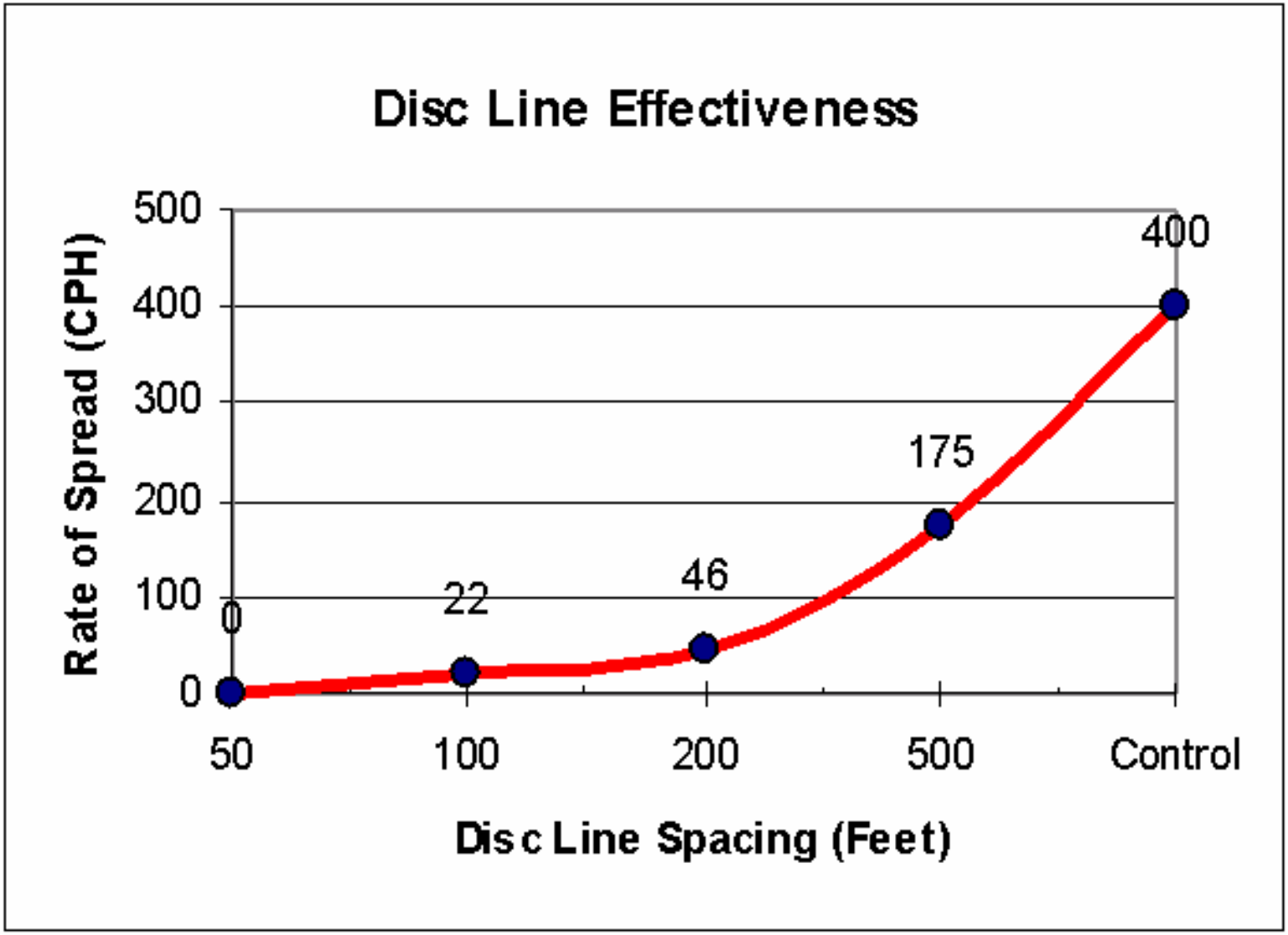
Gil Dustin, BLM Salt Lake City UT


Disc Line Effectiveness
Rate of Spread (CPH)
500
400
300
200
100
0
0
22
46
175
400
50
100
200
500
Control
Disc Line Spacing (Feet)

SPOTS = Strategic fuel treatment strategy

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- SPOTS is an optimized strategic fuel treatment strategy
- Most effective when < 30% of the landscape is treated.
- Not effective when more than 40% - 60% of the project area is not available for locating treatments – options too limited
- Be based on a problem fire
- Leverage natural fire breaks and other expected fire behaviors
- Can be applied at multiple scales

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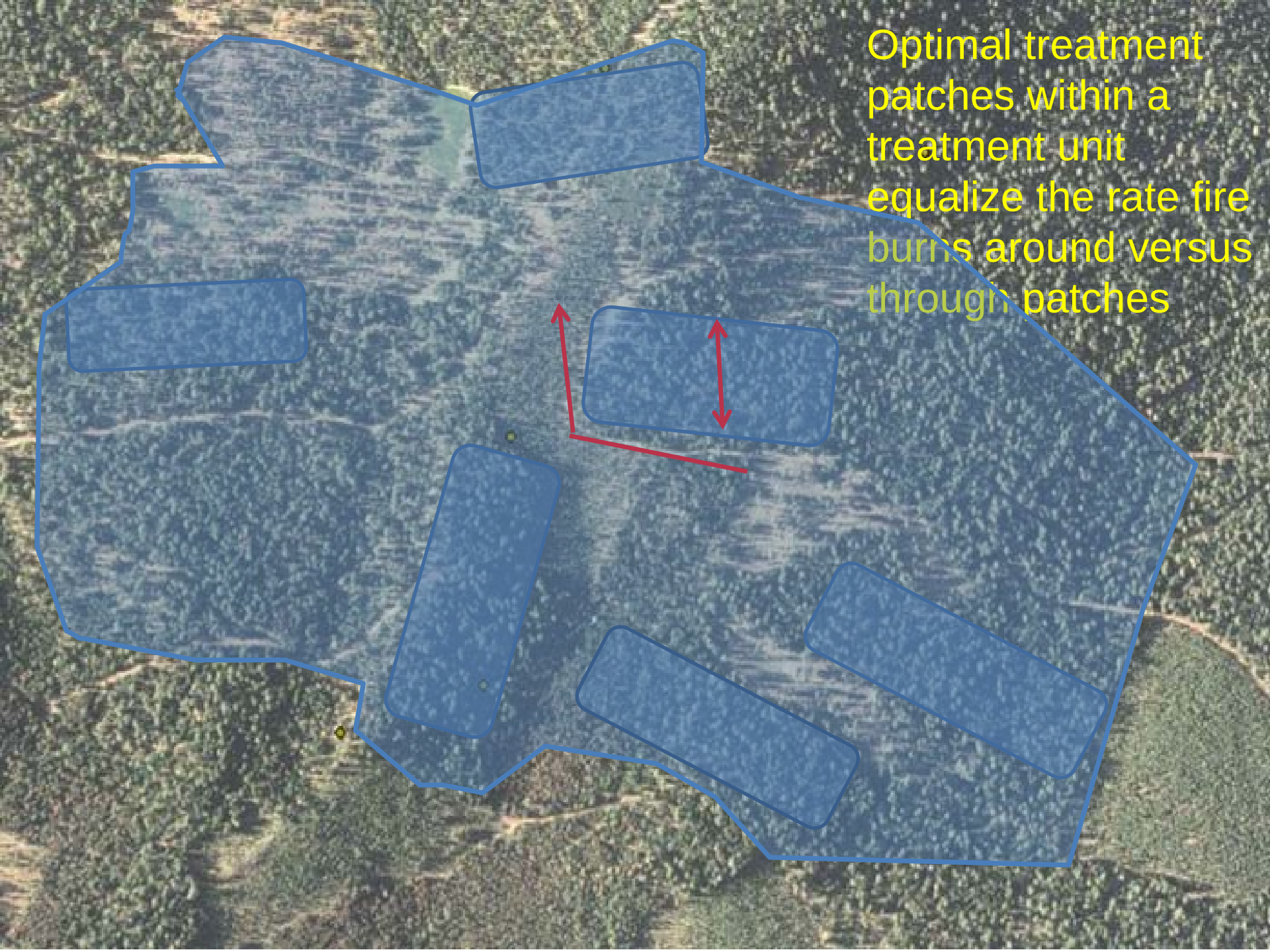
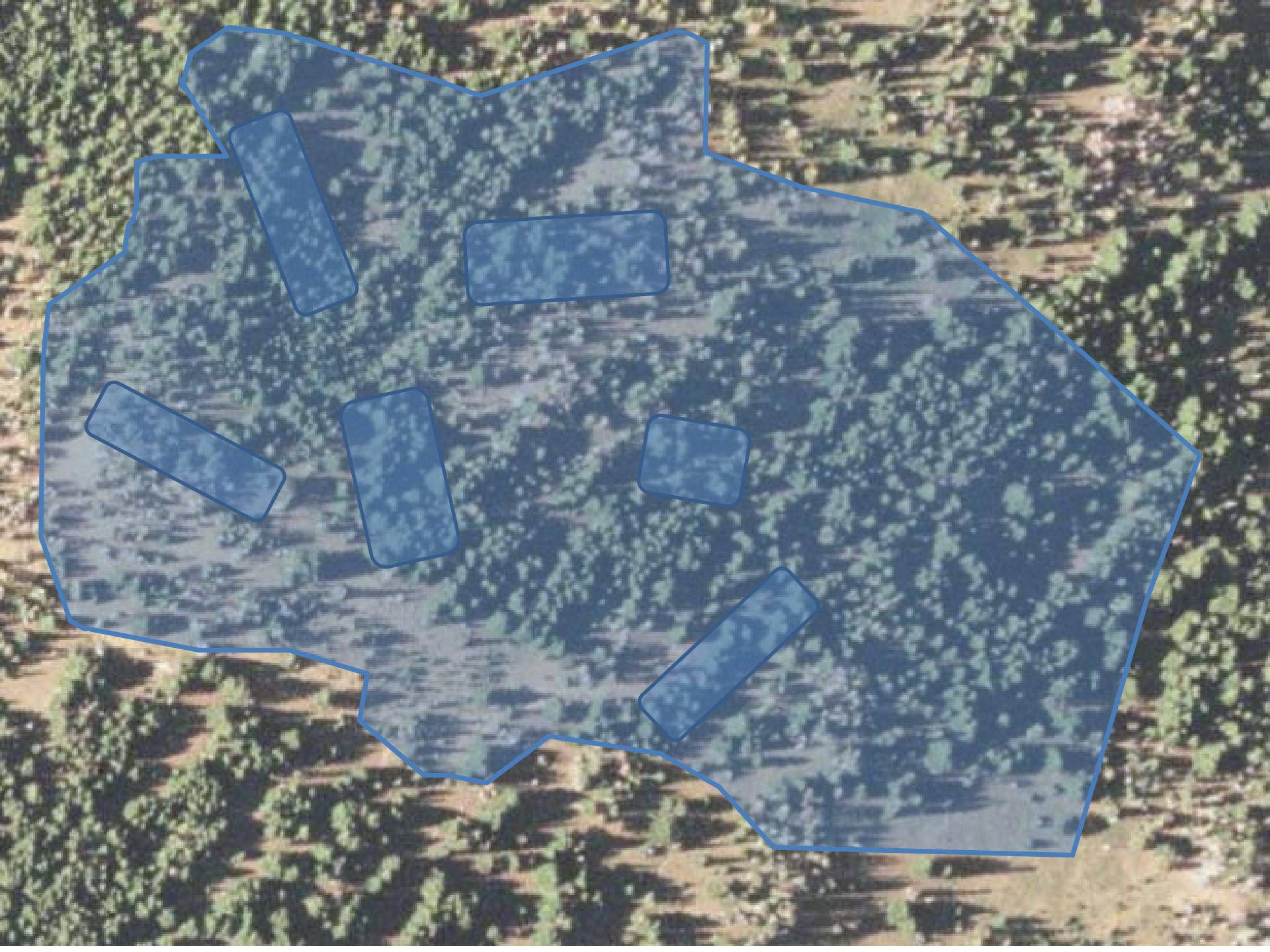

Optimal treatment patches within a treatment unit equalize the rate fire burns around versus through patches



Strategic fuel treatments and restoration projects

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- The original SPOTS concept is not applicable to landscape restoration projects where landscapes are being managed to resume natural fire regimes.
- Landscape restoration needs to create contiguous areas with acceptable fuel loads and fire behavior (not block the spread of a large fire) so that fires are not suppressed

Optimized fuel treatments for restoration

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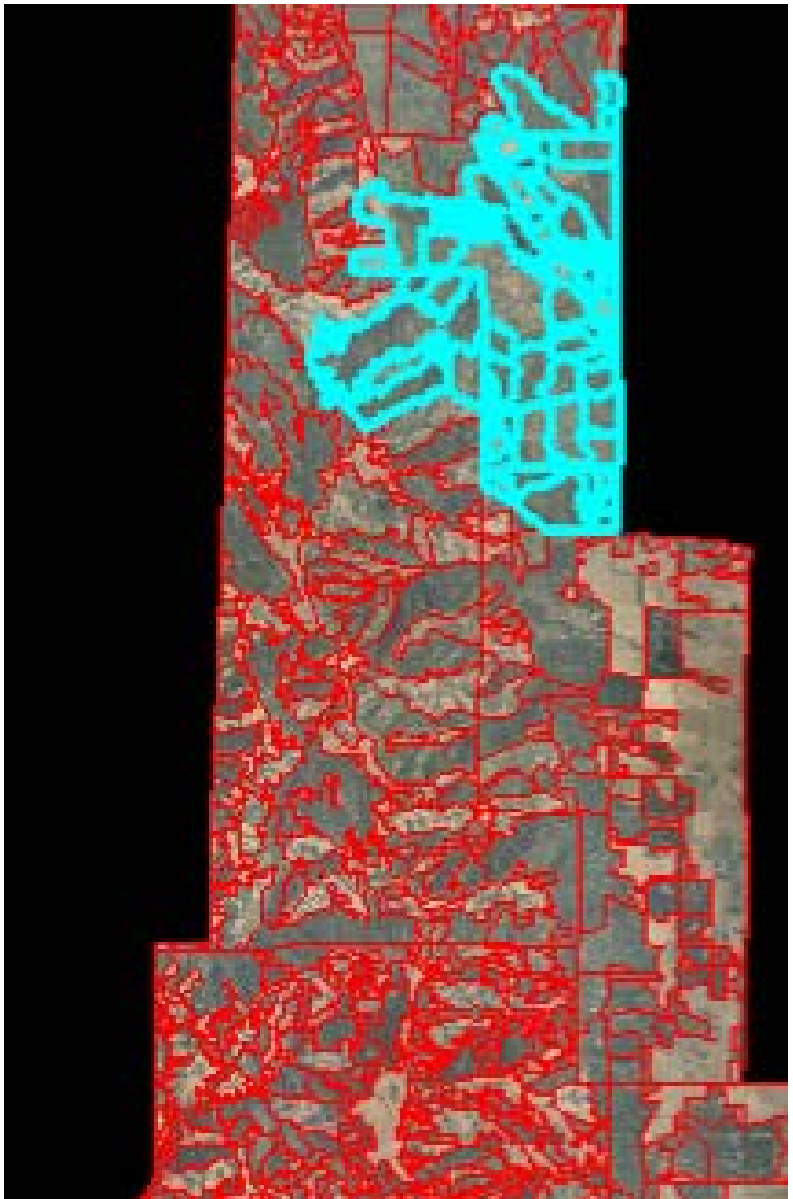
- Goal: Allocate treatments to build the largest possible contiguous area within which fire behavior does not exceed a specified threshold



The WUI Problem

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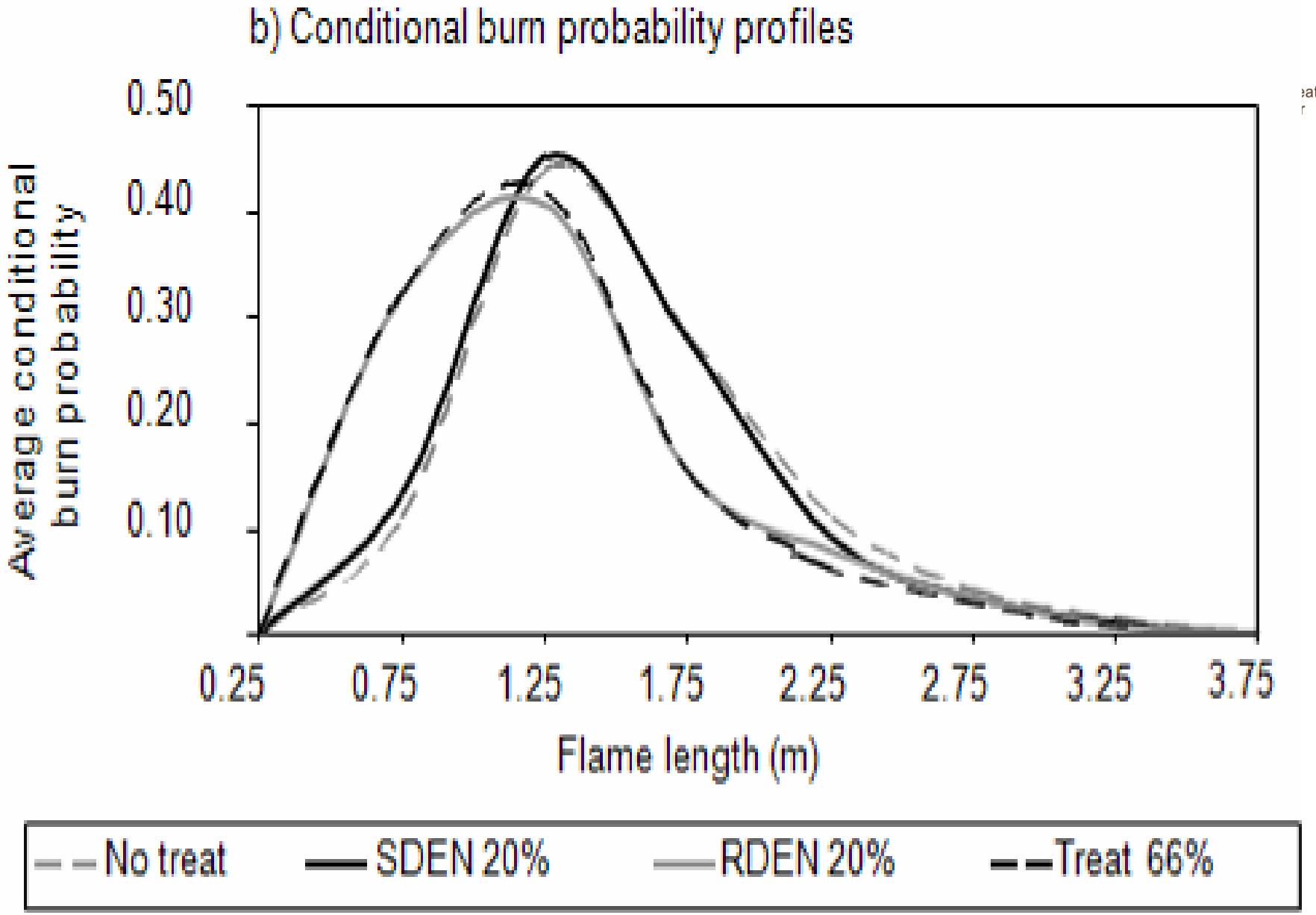
- Dynamics of home ignition are not incorporated into landscape fire spread models
- Home ignition dependent on microfuels around the home and building materials
- Other than ignition, landscape fire spread contributes little to home ignition event

Missionary Ridge Fire
June 2002


b) Conditional burn probability profiles
Average conditional burn probability
0.50
0.40
0.30
0.20
0.10
0.25
0.75
1.25
1.75
2.25
2.75
3.25
3.75
Flame length (m)
No treat
SDEN 20%
RDEN 20%
Treat 66%

ArcFuels www.wwetac.org/arcfuels

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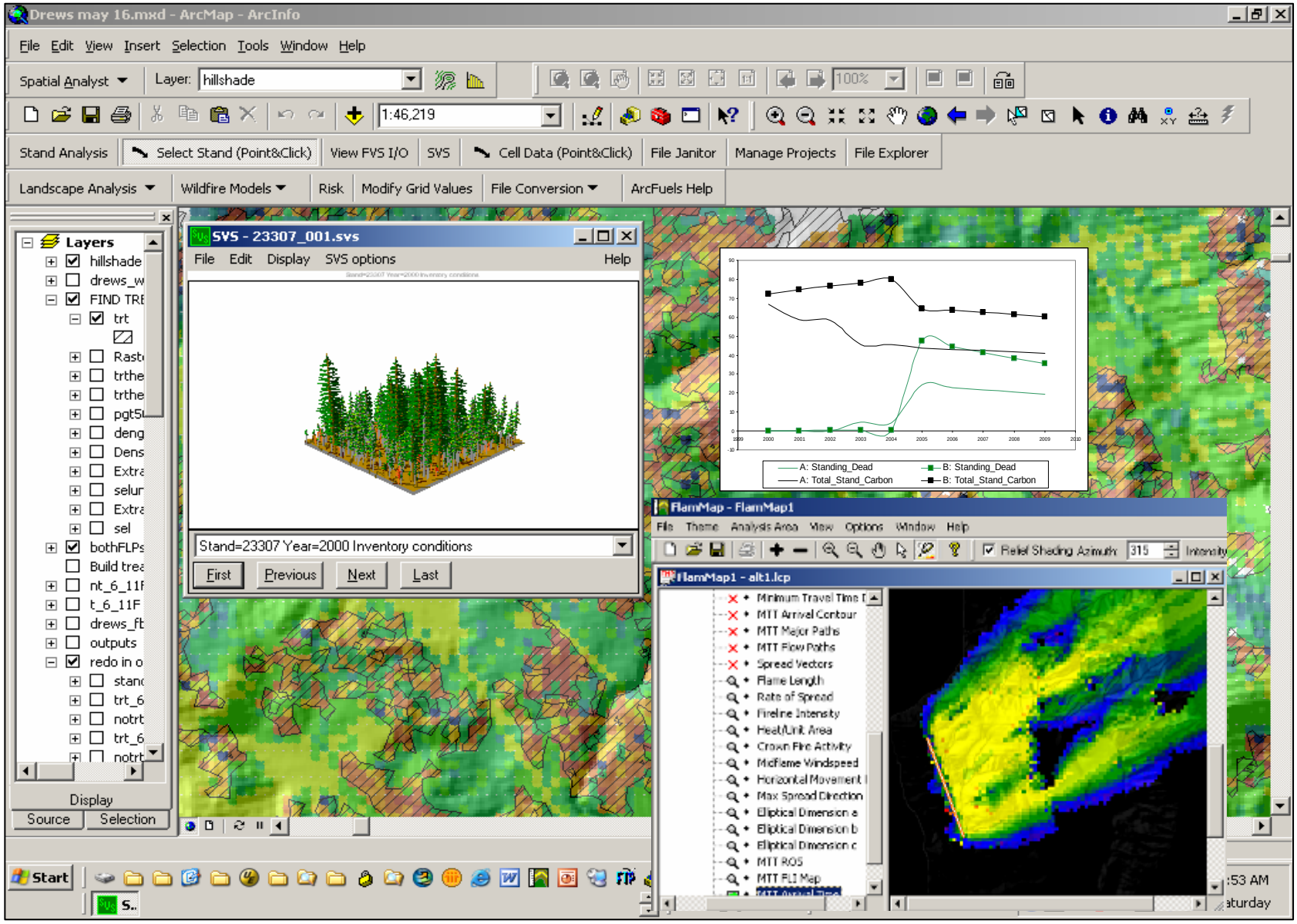

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Thanks…….

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Helen Maffei
Amy Walz
Chris Zanger