Fire and Oregon's Dry Forest Landscapes

What Should We Do?

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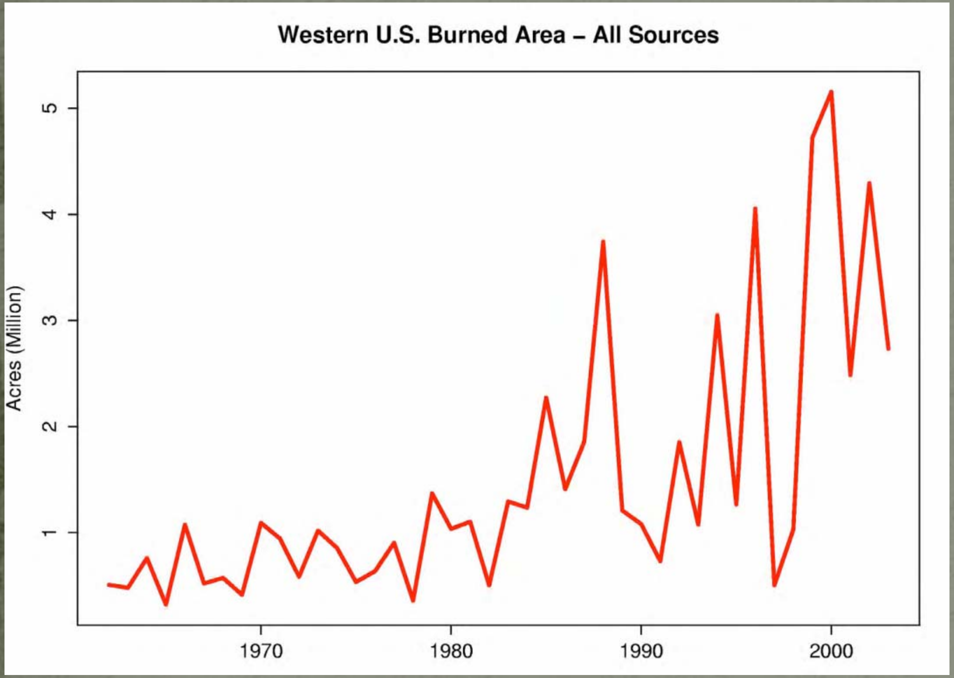
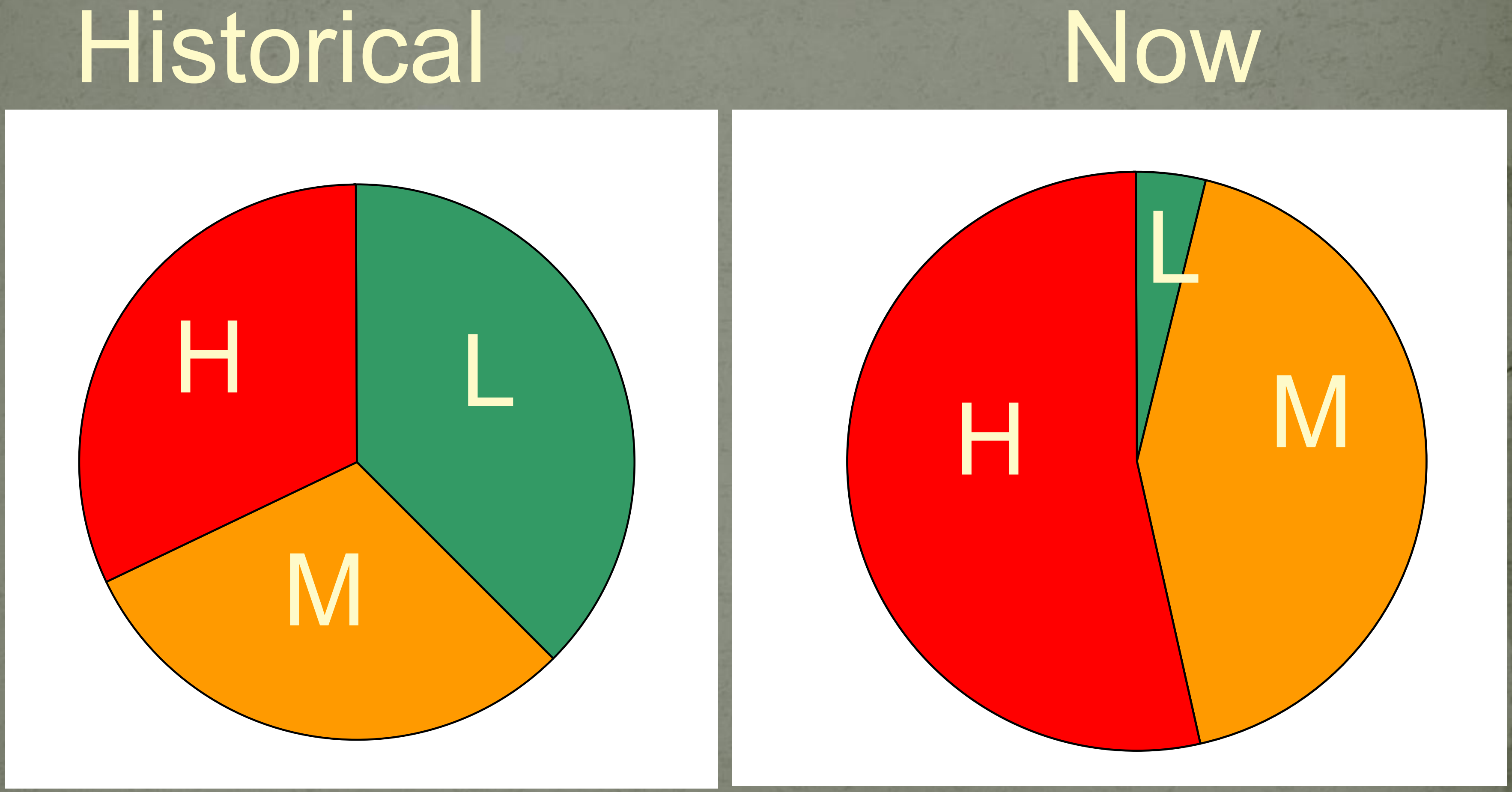
Fire: The West's Big Problem



- Strong link between fire size and climate
- None of the climate studies have looked at fire severity
- Fuels are a major contributor here

Changes in Fire Regimes



Forest Service Regions 1-6 – FRCC 2000 – All Cover Types

Historical

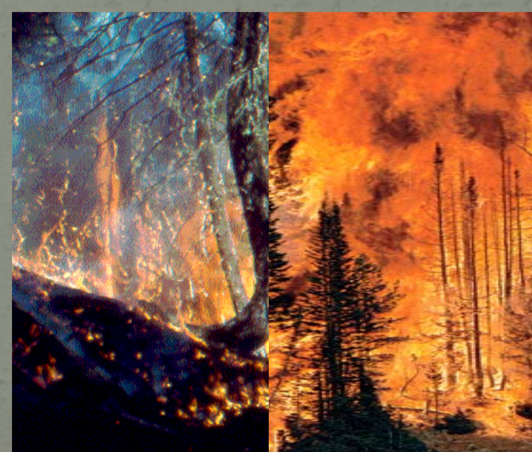
Low

Mixed

High

Today

Mixed



Mixed/High

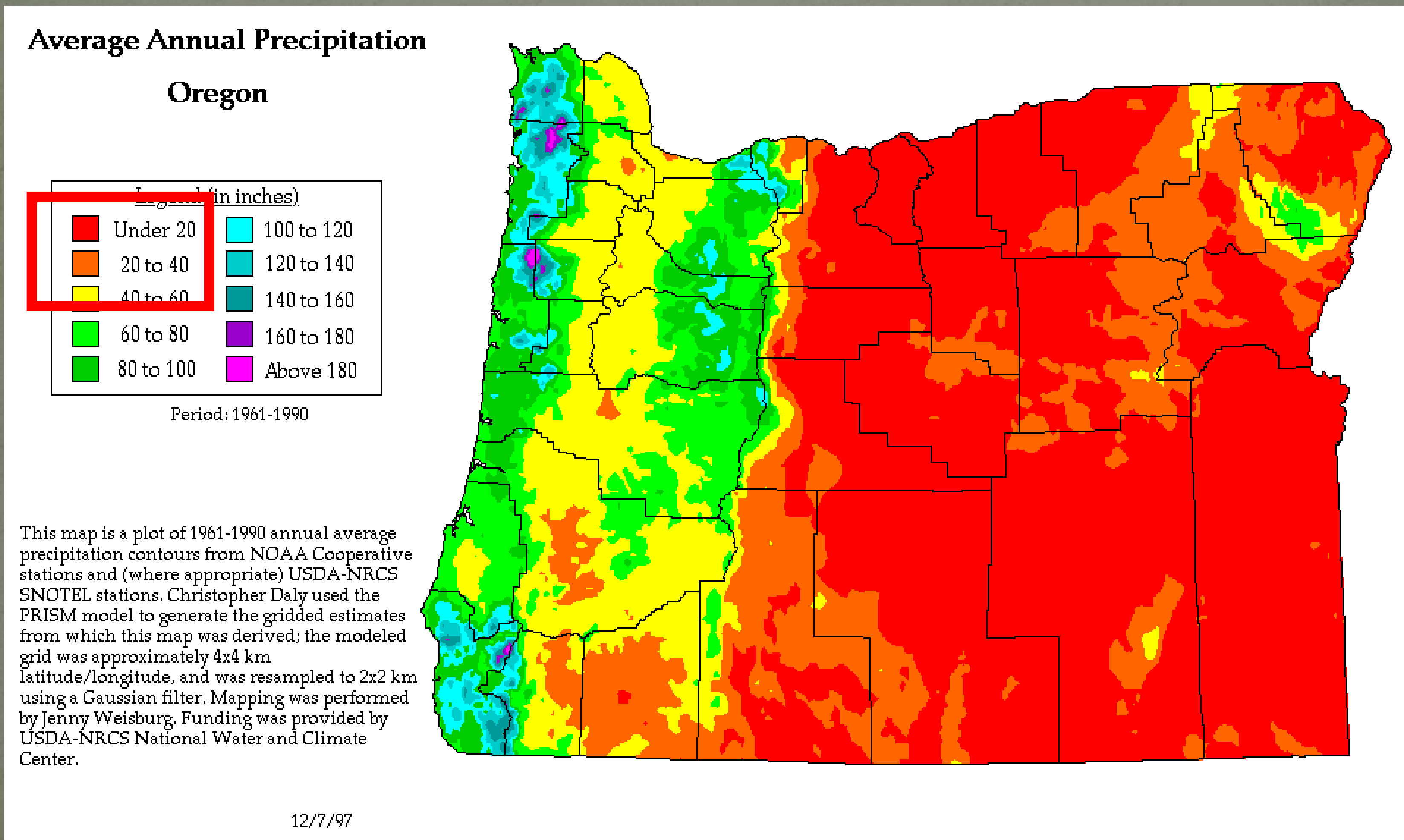
High

Historical Fire Effects

Low Severity Regimes Mixed Severity Regimes High Severity Regimes

Current Fire Effects

Where Should We Treat in Oregon?



What Do We Need to Do?

Simple:

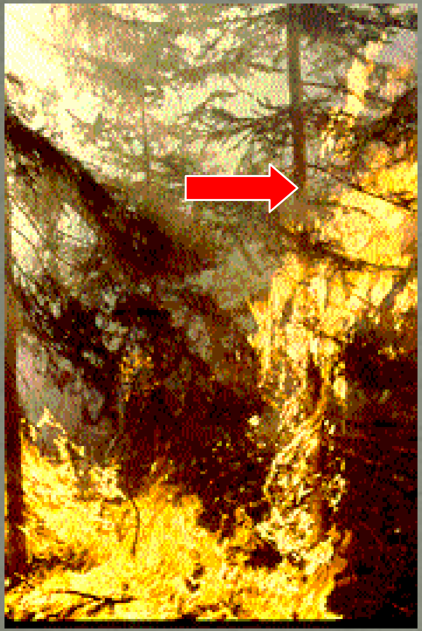
- Reduce Wildfire size
- Reduce Wildfire Severity
- But How?

Firesafe Principles at the Stand Level

- Reduce surface fuels
- Reduce ladder fuels
- Keep the large trees
- Reduce crown density

Agee and Skinner 2005. For. Ecol. Manage.

Prescribed Fire Reduces Surface and Ladder Fuels by Killing Small Trees



Mastication, pile burns, other ways to reduce or rearrange surface fuels

Pile Burning Effective, too

Torching – A Stand Scale Process

Torching or Passive

- Two concepts:
  - Passive crown fire
  - Active crown fire
- Passive crown fire – "torching" – fire transitions from surface fire up into the crowns

Reduce Torching Potential

Keep critical fireline intensity (I_o) high compared to potential I

It's a function of foliar moisture and canopy base height

We can manipulate canopy base height!
(Thinning, Prescribed fire)

Prescribed Fire and Ladder Fuels

- Surface Fuels are Reduced
- Height to Live Crown Increased
- Green surface fuels not flammable

Active Crown Fire

- Active Crown Fire
  - Running crown fire
  - Continuous crown fire

Reduce Active Crown Fire Potential

- Active crown fire a function of rate of spread and canopy bulk density [CBD] (volume of fine crown mass per unit volume)

- Thinning reduces crown mass and therefore CBD and mass flow rate, usually below critical level so that active crown fire cannot be supported

- But it is not always needed!

The Models Seem to Work

- In reality, based on empirical evidence from boreal forests of typically simpler structure than our western dry forests
- Empirical evidence from real fires can be used to validate the models in a general way.
- Examples here:
  - Onion/Megram Fire, N. California
  - Tyee fire, Washington
  - Cone Fire, N. California

Surface and Ladder Fuels Treated Before Wildfire

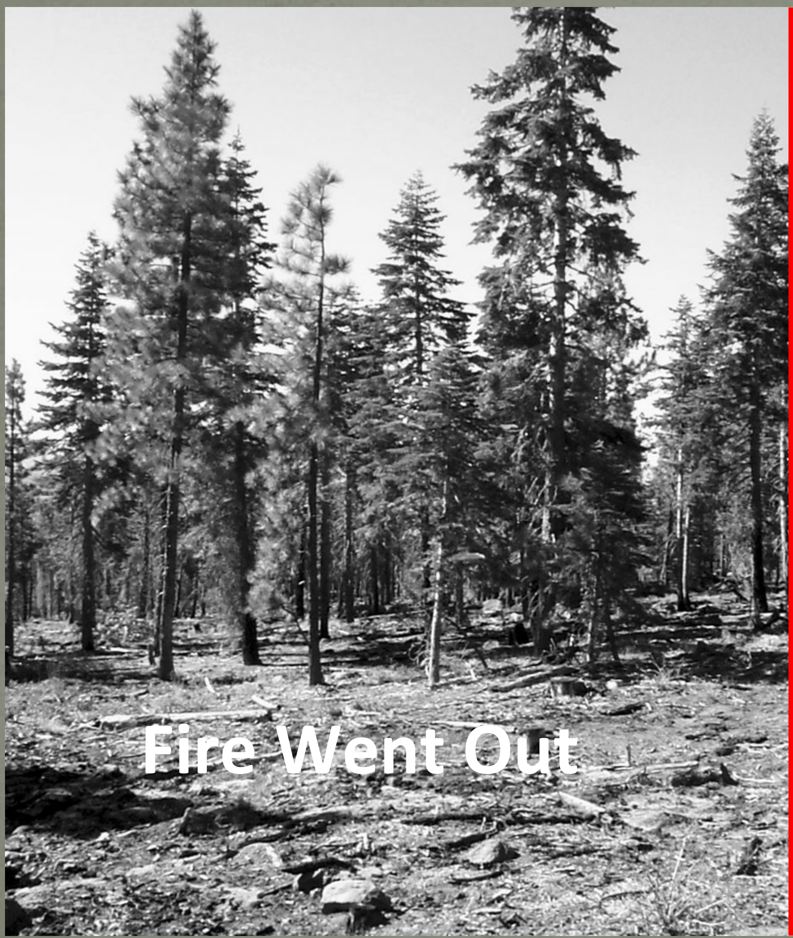
Onion/
Megram
Fire,
CA
1999

Surface and Ladder Fuels Treated

This stand had only ladder fuels removed and surface fuels reduced

- 1994 - 80,000 ha Tyee fire - Washington State
- Stands Where Prescribed fire and thinning occur survive
- Crown fires become surface fires

Cone Fire, CA – Surface, Ladder, and Crown Fuels Removed

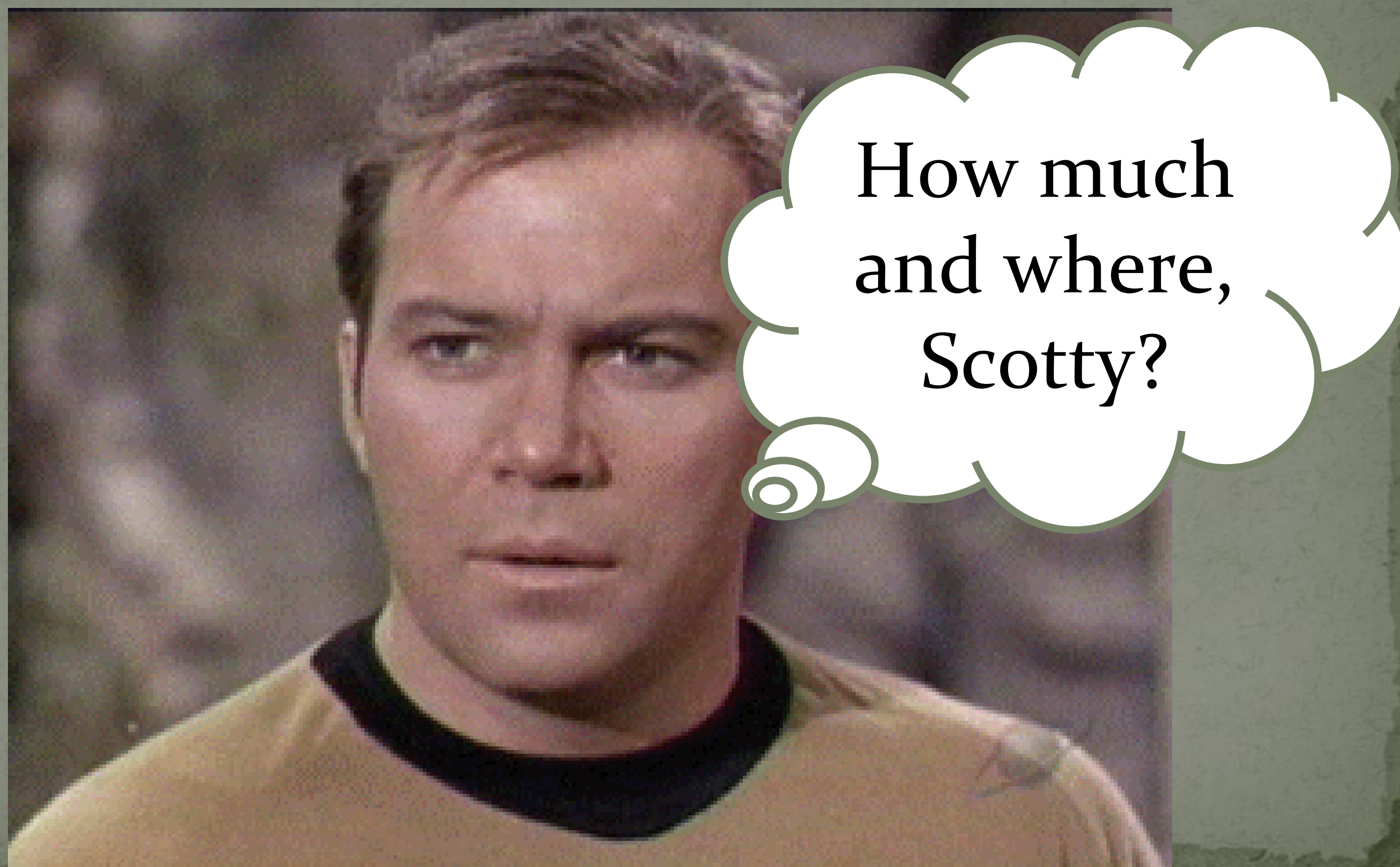


Thin and Burn – 2 yr Old

Untreated

Scaling up to Landscape Levels

"Where no man has gone before…."



Landscape Fuel Treatment and Fire Behavior

- Largely possible through tools such as FARSITE and FLAMMAP
- FARSITE: "Realtime" fire spread
- FLAMMAP: Instantaneous map of landscape fire potential given pixel fuel model, CBH, CBD, topography and selected weather.

  - Mark Finney, Forest Service, Missoula Fire Lab

Theory: Fragmented Fuels Slow Fire Spread

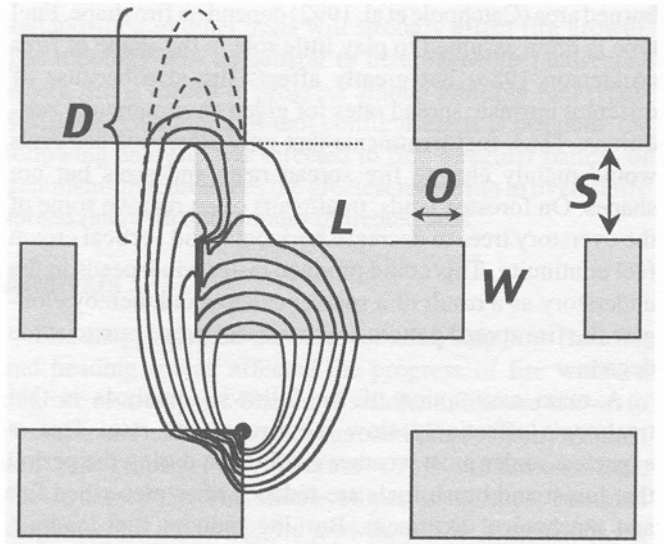
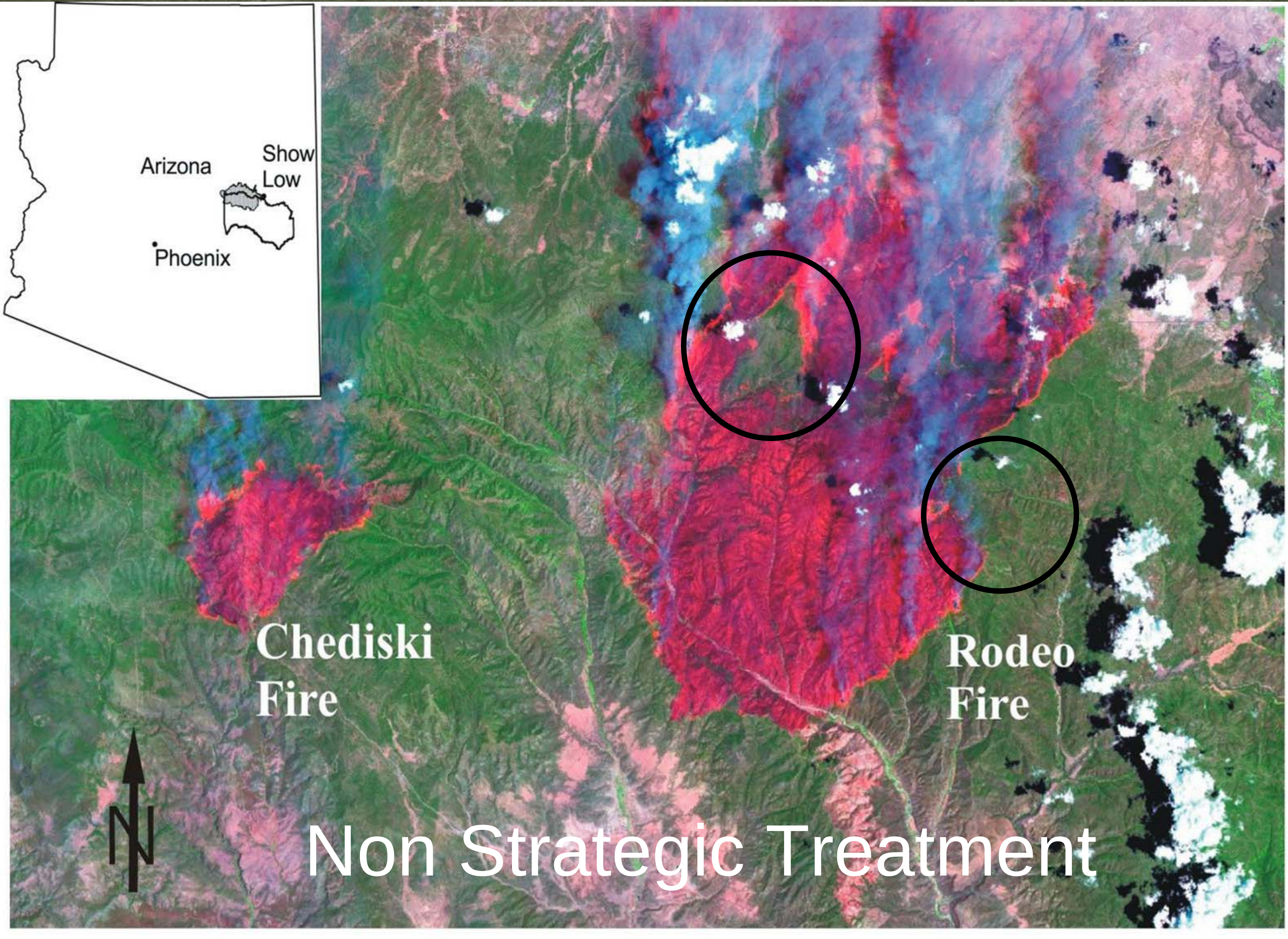


Figure 5. By embedding a single treatment unit in a regular pattern of identical units, *W* delays fire growth during flanking around two sides of the unit. The spread rate of the fire moving around the units is, therefore, equivalent to the spread rate through the units only if the effect of *W* on *O* is reduced by one-half [Equation (10)]. Dashed lines indicate the hypothetical forward spread distance *D* with no treatment.

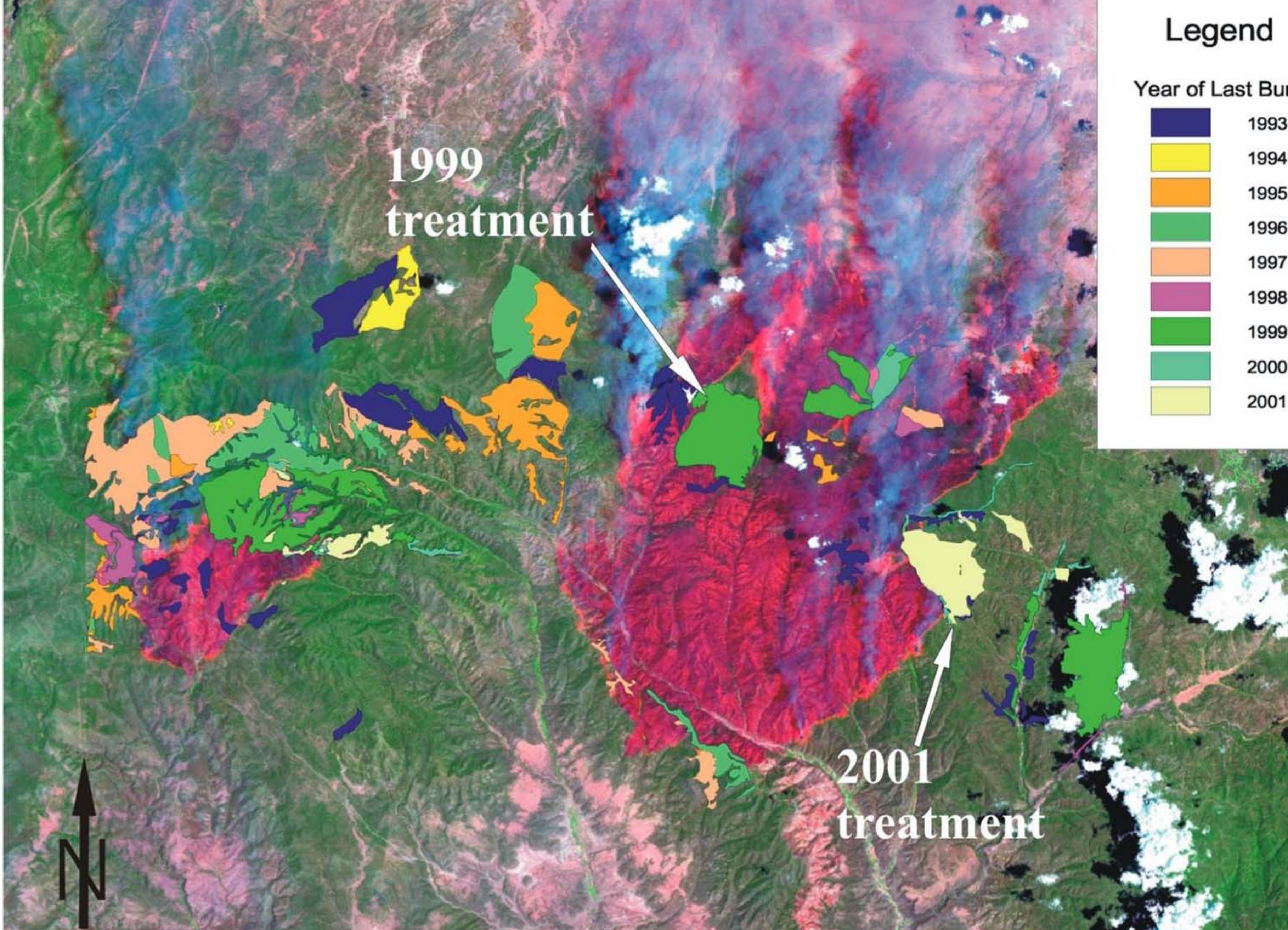
- Fires slow within treated areas
- Move faster between treated areas

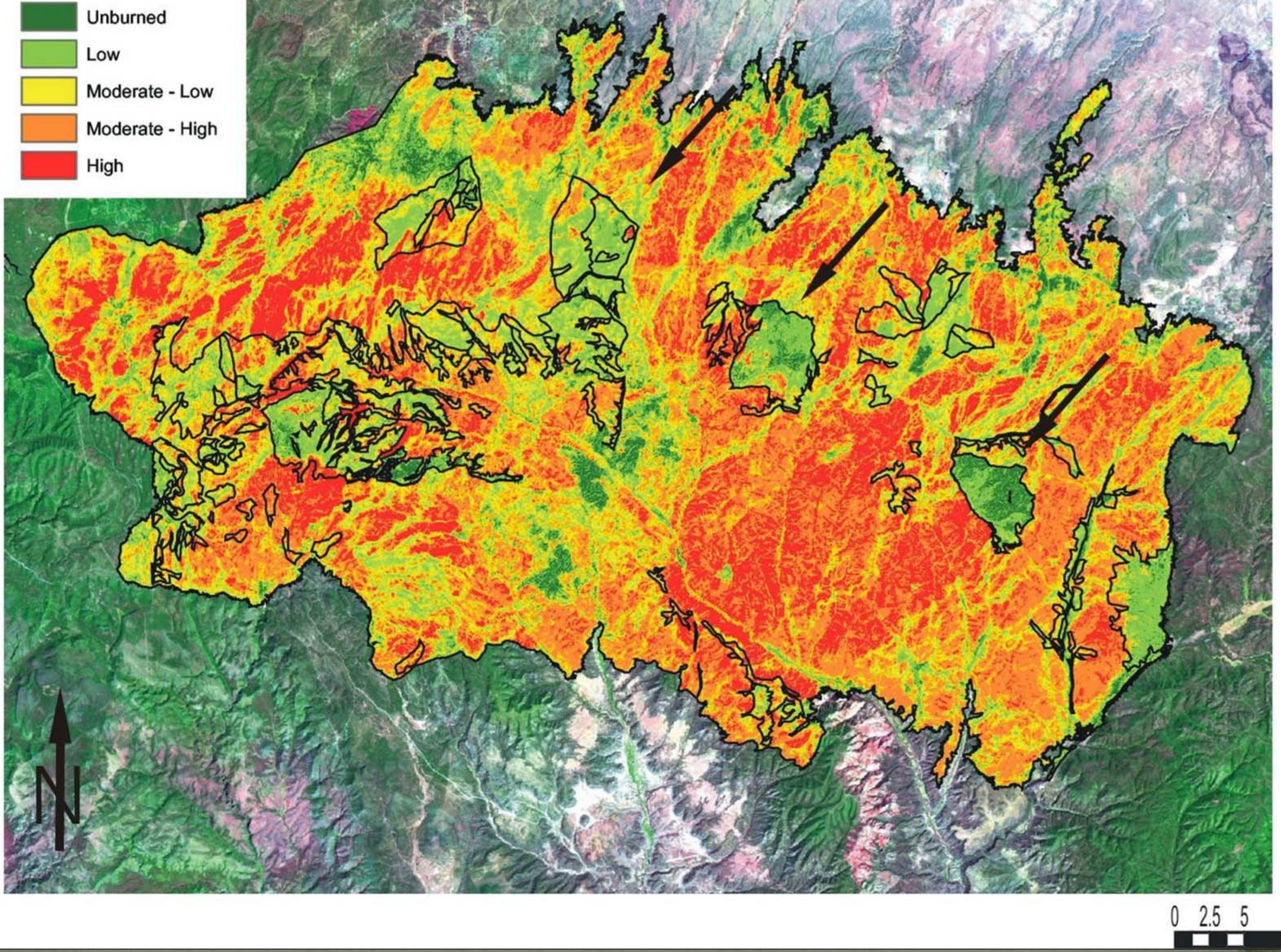
- What configuration is best?



Non Strategic Treatment

(b)


Legend
Year of Last Bur
1993
1994
1995
1996
1997
1998
1999
2000
2001
1999 treatment
2001 treatment
N


Unburned
Low
Moderate - Low
Moderate - High
High
N
0 2.5 5

Finney Landscape Study

- Three study areas
- Sanders Co, MT
- Blue Mtns, OR
- Sierra NF, CA
- How much of a landscape needs to be treated, and where?

Finney et al. 2006 USDA FS RMRS-P-41: 125-148

Model Logic

- Start with stand polygons, FARSITE layers and Treelists for each
- Grow stand with FVS, create custom fuel models
- Apply TOM (and treatment)
  - Prescribed fire
  - Thin if BA >130 ft^2/ac
- Run worst case wildfire through landscape, measure potential size
- Grow stands through next time increment, repeat process

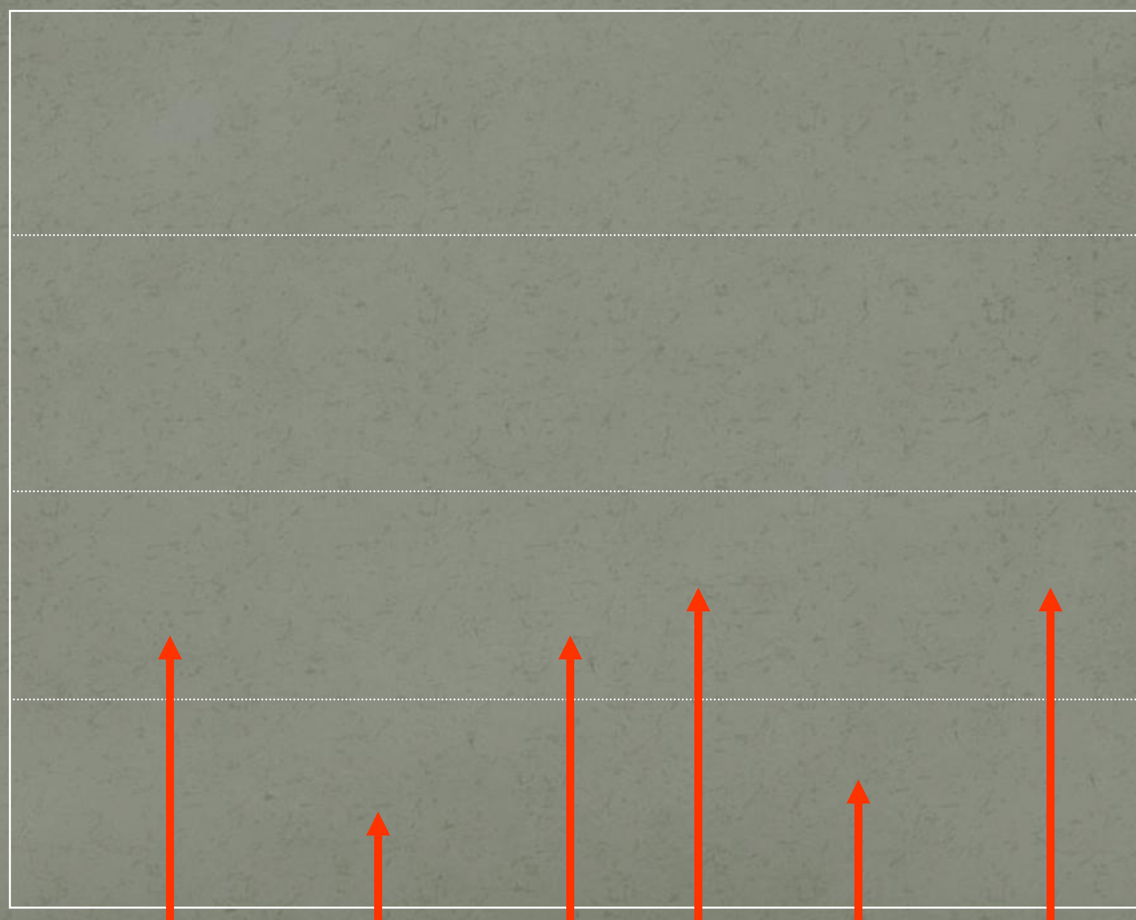
Use of Tom

"TOM" is short for "Treatment Optimization Model"

It takes a slice of landscape in the first downwind direction and treats the areas of highest rate of spread, fragmenting the movement of fire.

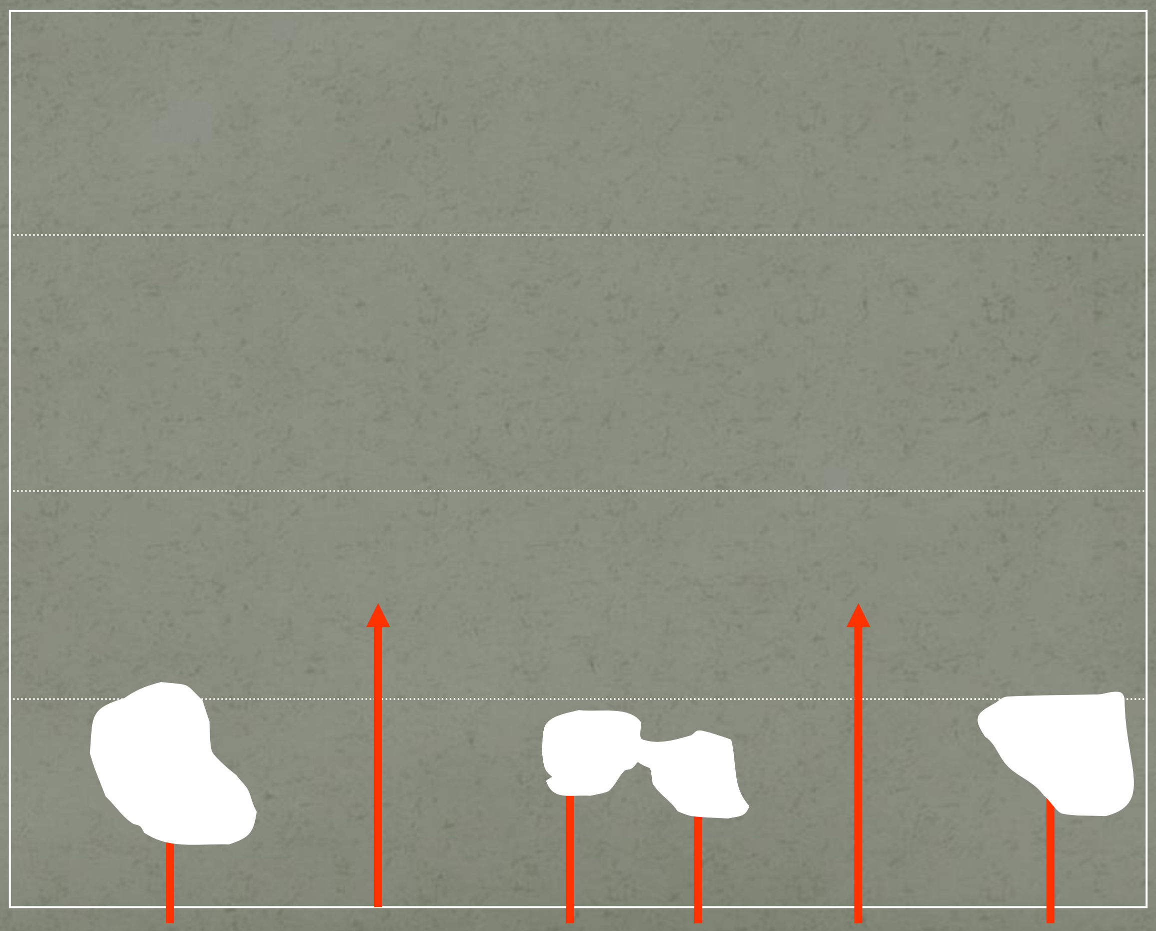
It then takes the second slice, given the treatment in the first slice, and treats around the revised vectors of fastest rate of spread.

Splits landscape up into segments – treats them in order of wind direction

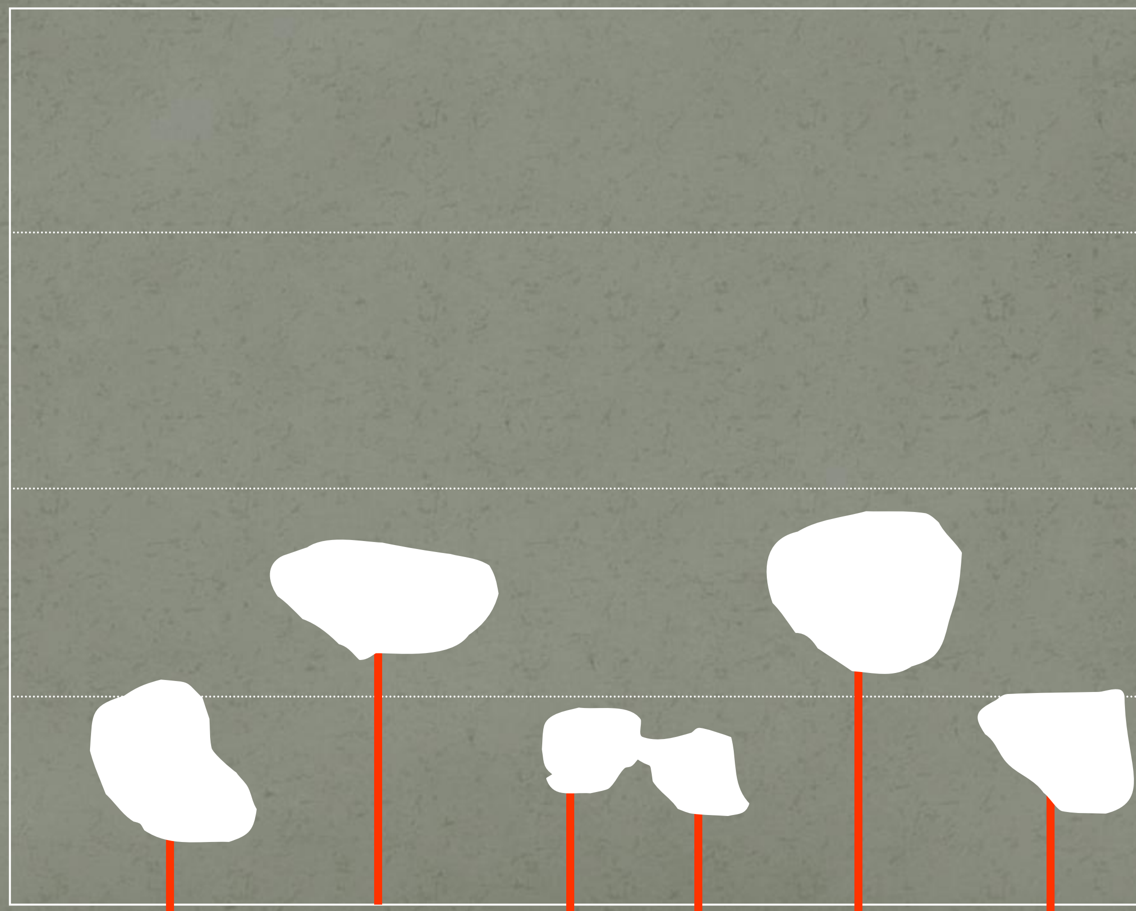


Fire spread rate without treatment

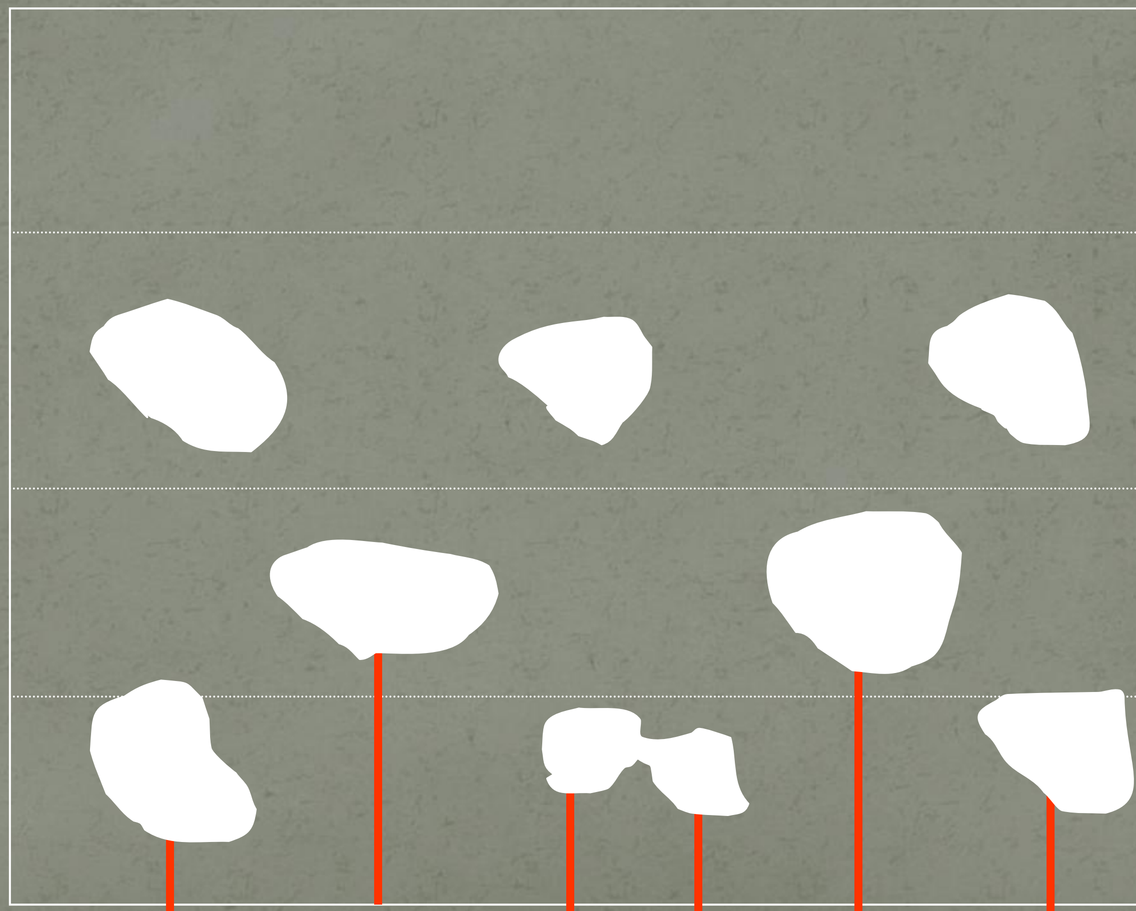
In Next Slice of Landscape, New "Fastest Spread" Vectors are Identified



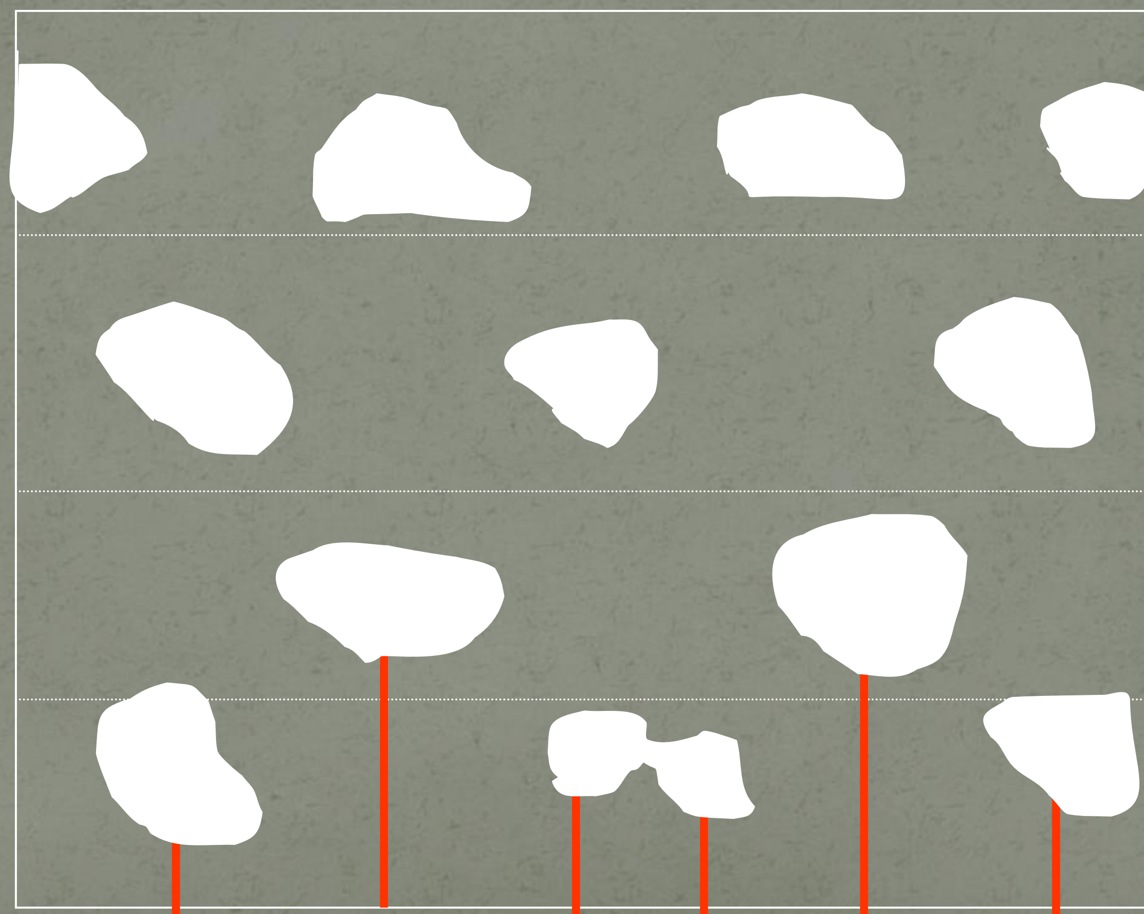
Next Set of "Splats" is Placed to Block Those Vectors



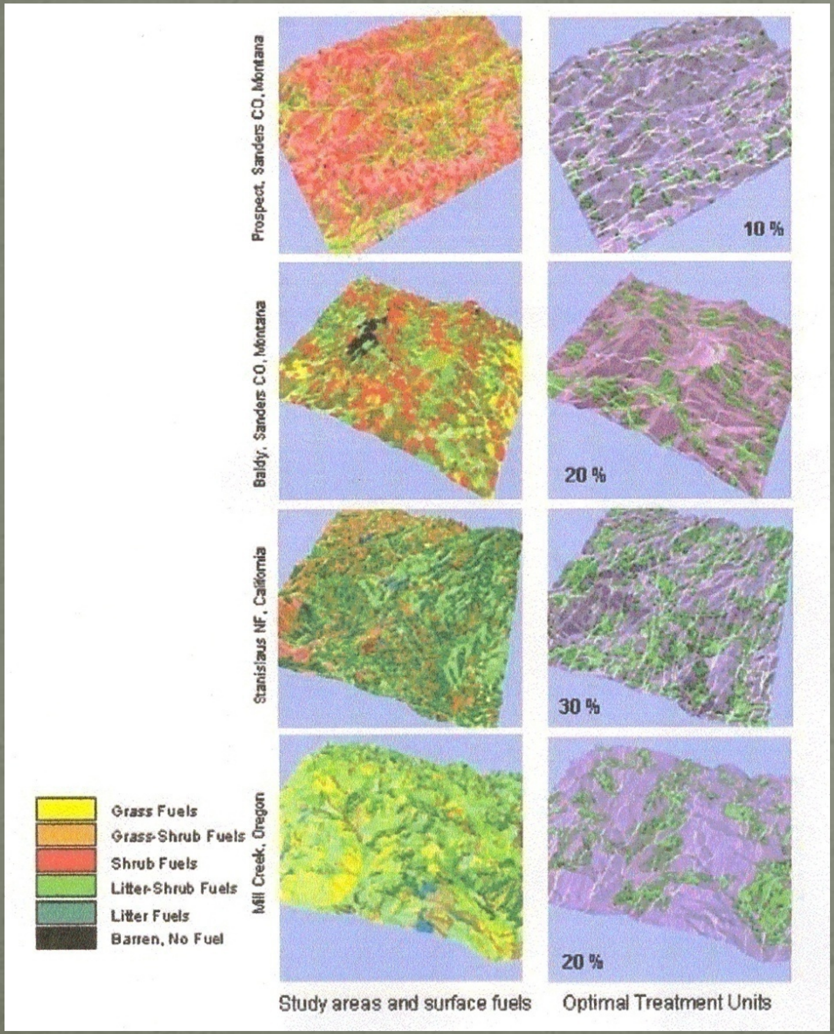
And So On…



Until the Landscape is Splatted – User Controls Percent of Landscape that can be Treated



Finney Landscape Study

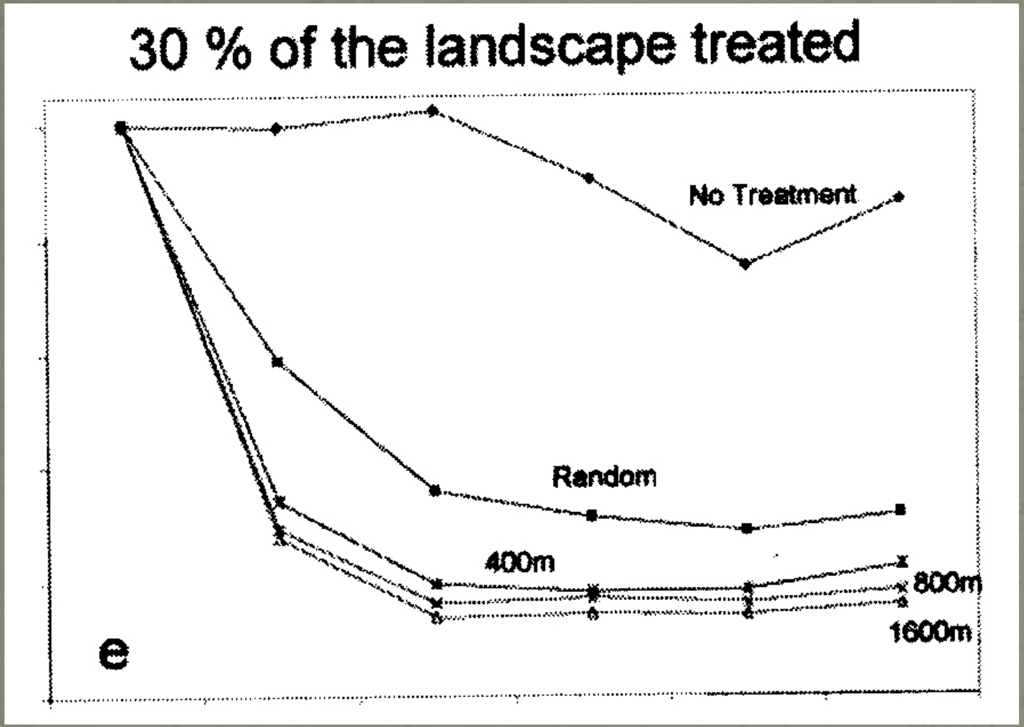


(Green)

- Sites in Montana, Oregon, and California
- How much to treat?
- Where to treat?
- How long will it last?

Treatment Unit Area Flexible

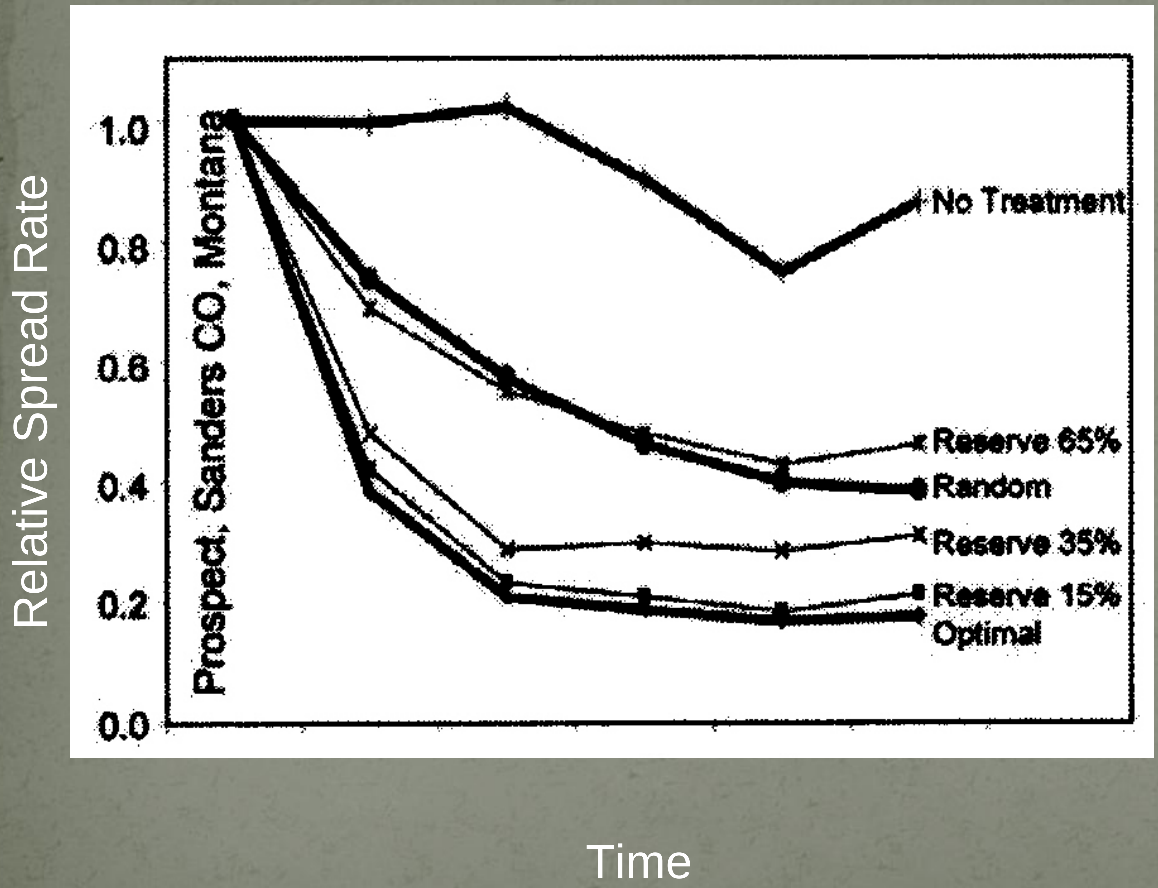
Relative Spread Rate



Time (50 Yr Horizon)

- All treatments reduced fire area burned compared to either:
  - No treatment
  - Random treatment
- Unit size had little effect on treatment

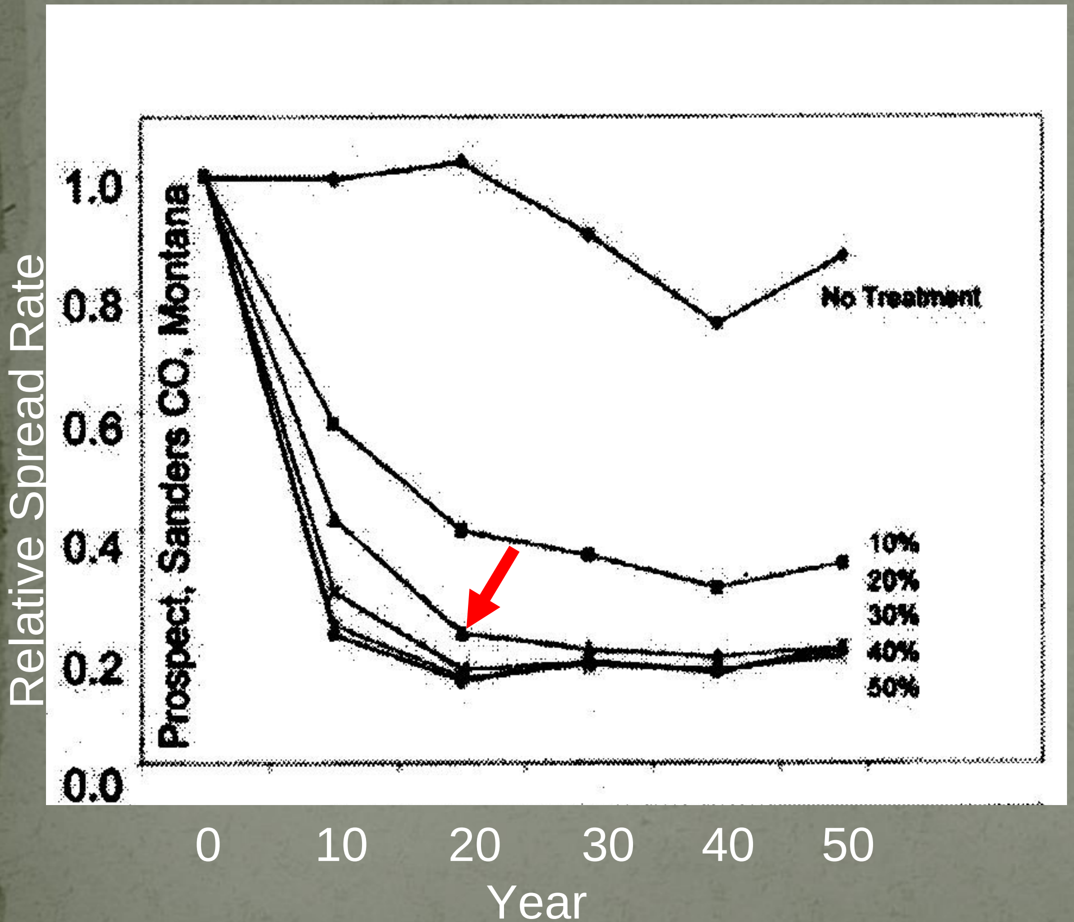
Effect of Reserves (20% per decade treated)



Where areas of the landscape are designated as "no treatment" regardless of their strategic location, treatment effectiveness declines

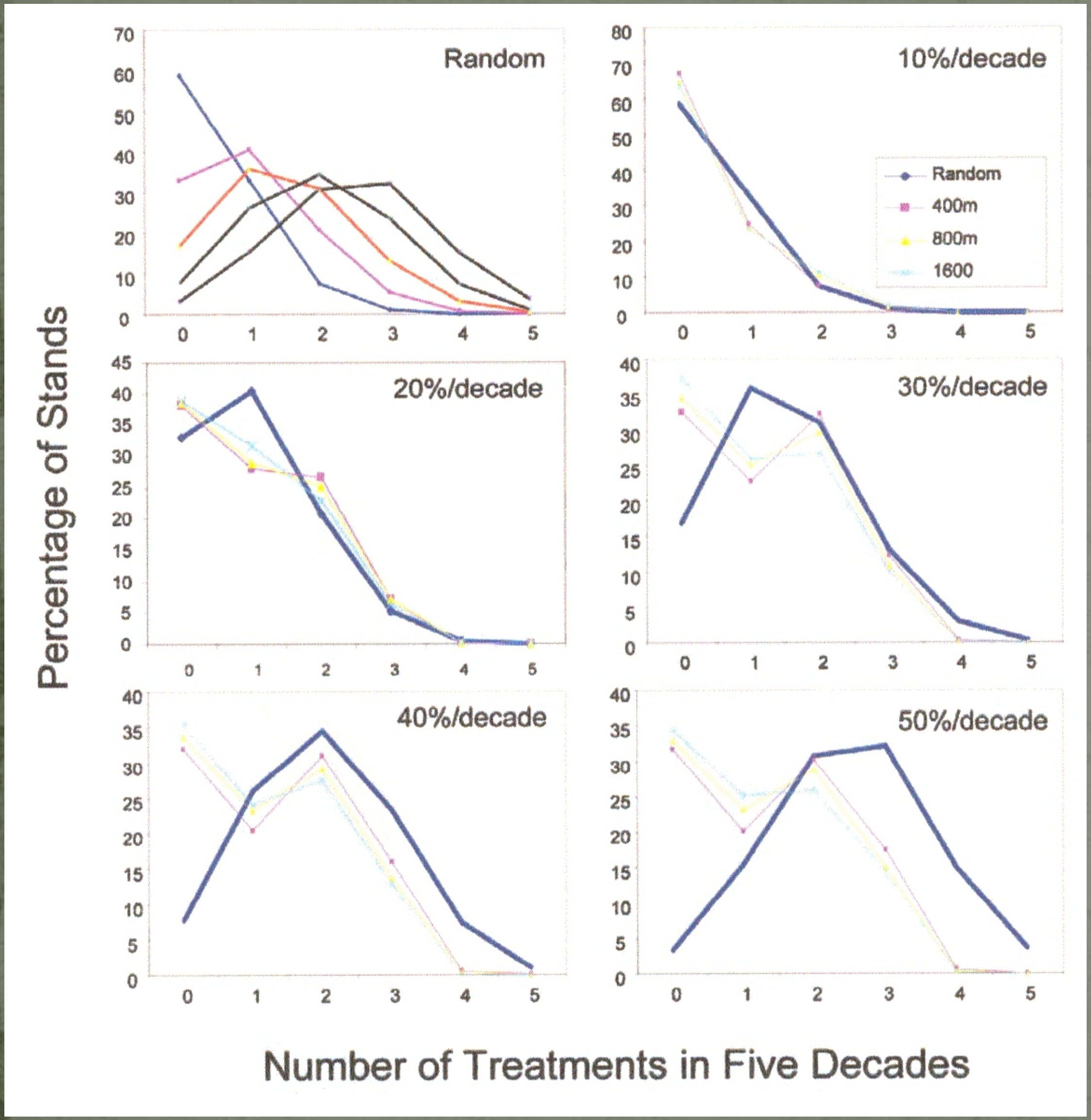
45-65% reserve about the same as random

20% per decade about right



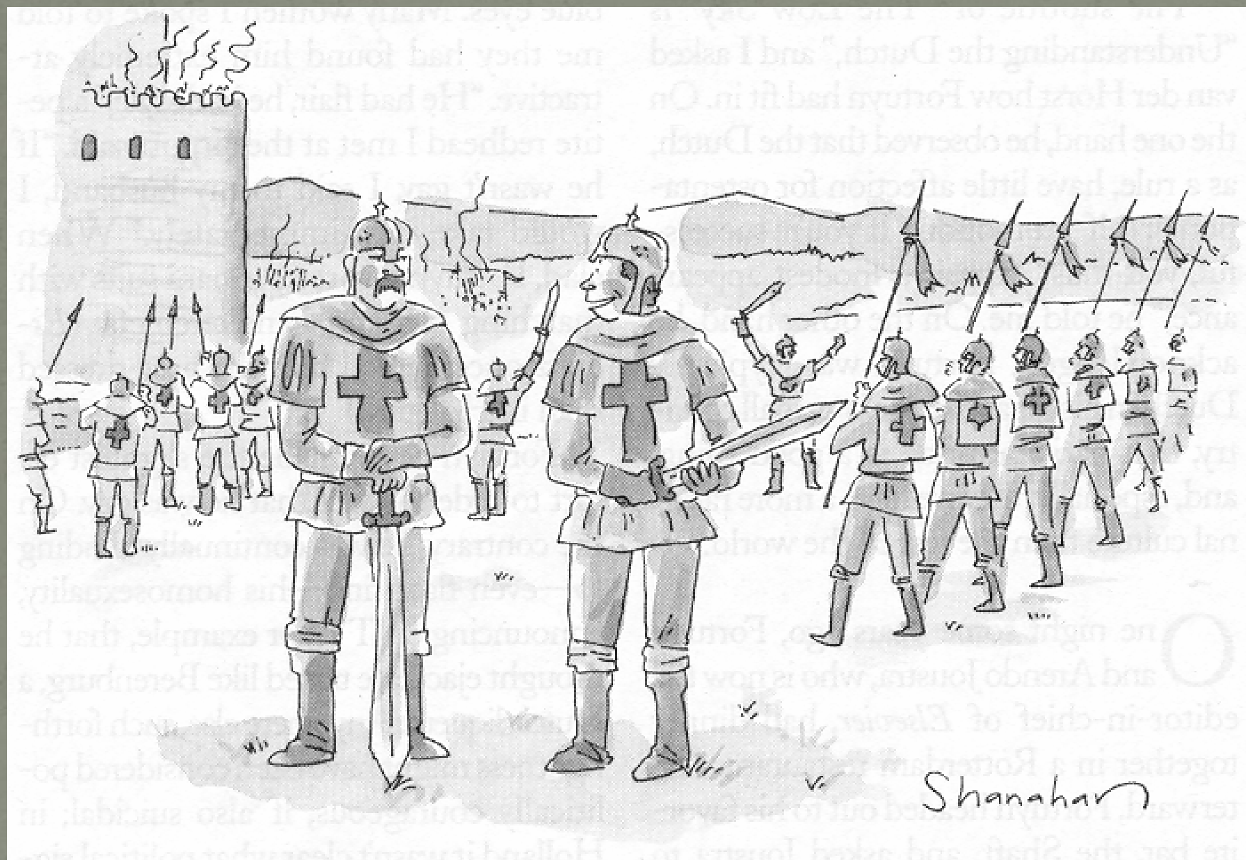
- There was not much difference between spread rates after 2 decades at 20% of the landscape strategically treated per decade
- Total >20%

Re-Treatment?



At treatment levels of 20% and greater per decade, optimal treatment strategies consistently excluded some areas from treatment more often than random selection and refused frequent treatment for other areas.

We Need Real Applications



"I've never actually stormed a castle, but I've taken a bunch of siege-management courses."

Barriers To Implementation

- Large scale: cost, planning difficulties
- Fine filter trumping coarse filter (Air, S&M)
- Smoke/Carbon sequestration issues with fire
- Lack of trained personnel to conduct prescribed fires
- Overemphasis on Federal role in WUI
- Insufficient collaborative support
- The Shotgun Approach
  - NSO Recovery plan
  - Shoot Barred Owls
  - Ignore habitat loss due to fire