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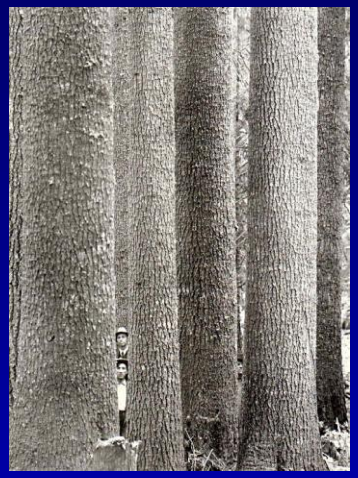
Integrated Forest Restoration



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Terrie Jain, Russ Graham, Ann Abbot (vegetation), Bill Elliot, Randy Foltz, Pete Robichaud (fire/erosion) John Squires, and Rich Reynolds (wildlife)

Collaborators

Han-Sup Han (forest products), Humboldt State University; Chris Keyes (silviculture), University of Montana

National Forests

Black Hills, Idaho Panhandle, Boise, Colville, Kootenai, Dixie

Stakeholders

Colville Coalition, Yaak Valley Council, Kootenai Coalition, Coeur d'Alene Coalition

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Why Restore?
Forest Change

Diseases

Fire

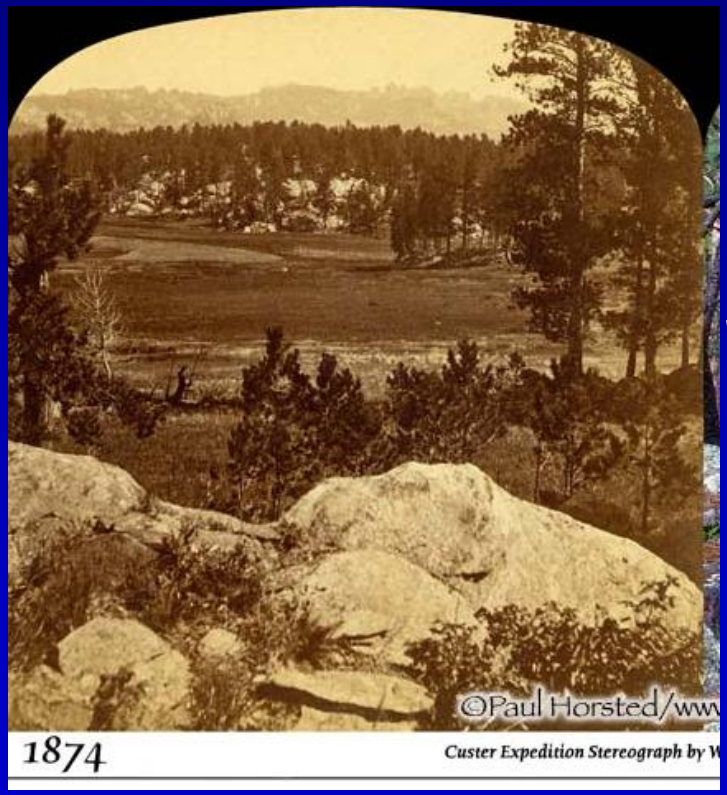
Weather

Insects

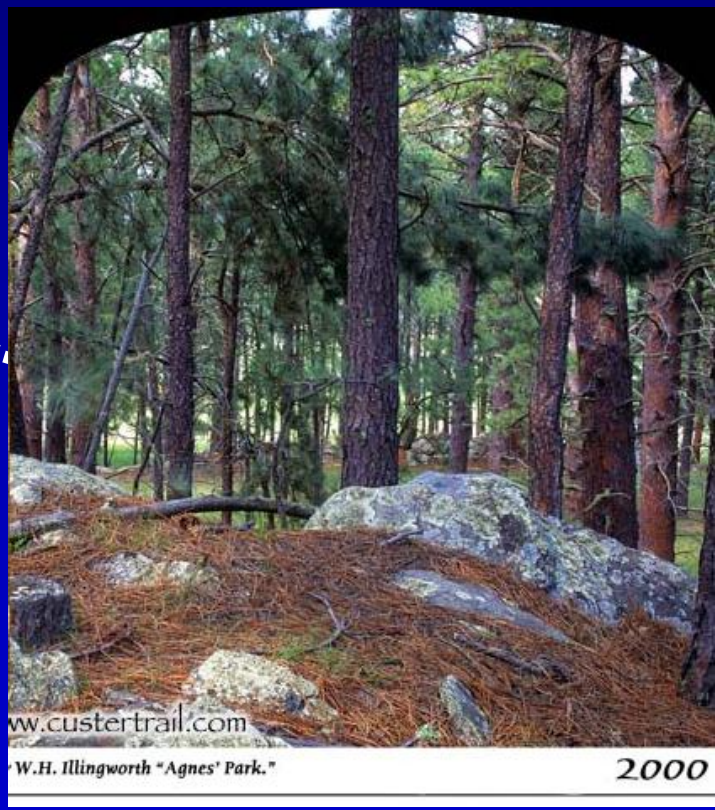
Harvesting

Nutrient/Organic Matter Compression Towards the Soil Surface

Crowns



Soil surface



Roots/myco/
nutrients

Restoration Elements
Short-term (One Day) Benefits
Success of Fuel Treatments

- Fire fighter and citizen safety
- Infrastructure protection
  - Homes, cabins, lodges
  - Power lines
  - Culverts, camp grounds
- Alter fire behavior
  - Contain & suppress a fire
  - Point/area protection

Long-term (Decades) Benefits of Fuel Treatments

- What is left after a wildfire
- Forest values
  - Sense-of-place
  - Wildlife & fish habitat
  - Clean air & water
  - Productive soils
  - Carbon cycling
- Economics
  - Products
  - Tourism

Wildlife Habitat
For example: Goshawk
Forest Conditions

- Interlocking tree crowns – grouped trees
- Small openings between tree groups
- As much old forest as is sustainable
- High interspersion of age classes

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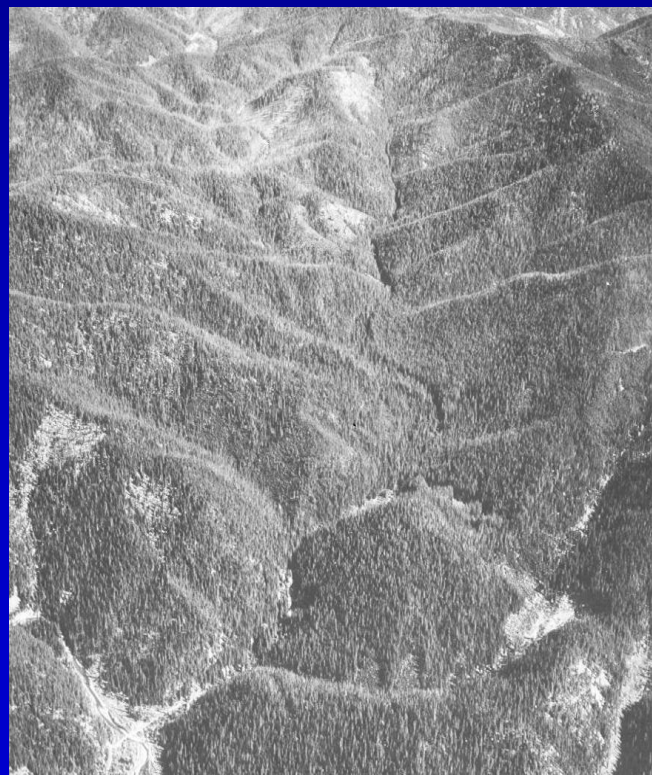
Watershed Health
Roads
Ecosystem services



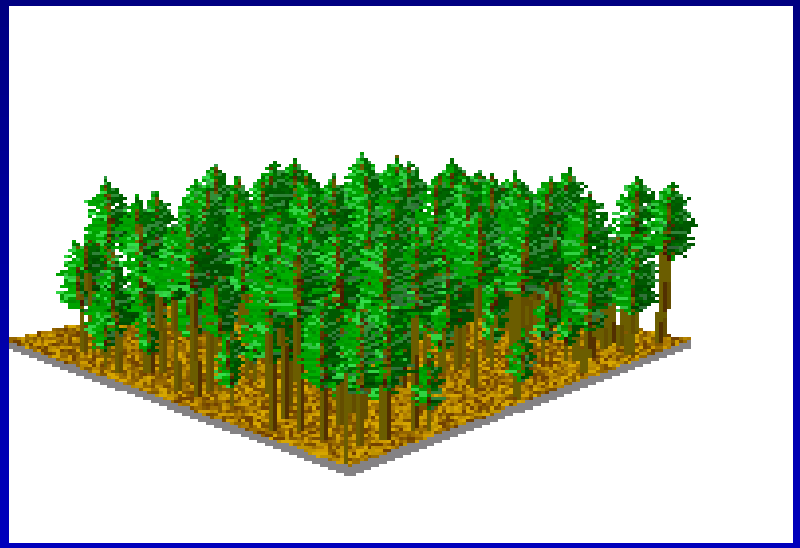
Logic Paths for Approaching Restoration
A Scientist's Perspective.

- Provide ecologically sound information
  - Management issues
  - Social values
- Provide management alternatives
  - Ecologically sound
  - Socially acceptable
  - Economically viable
  - Integrate multiple management objectives
  - Science based
- Provide examples

Relation Between Forest Structure and Burn Severity Wildfires in Moist, Cold, and Dry Forests

Burn Severity

=



As a Function of Pre-Fire Forest Structure

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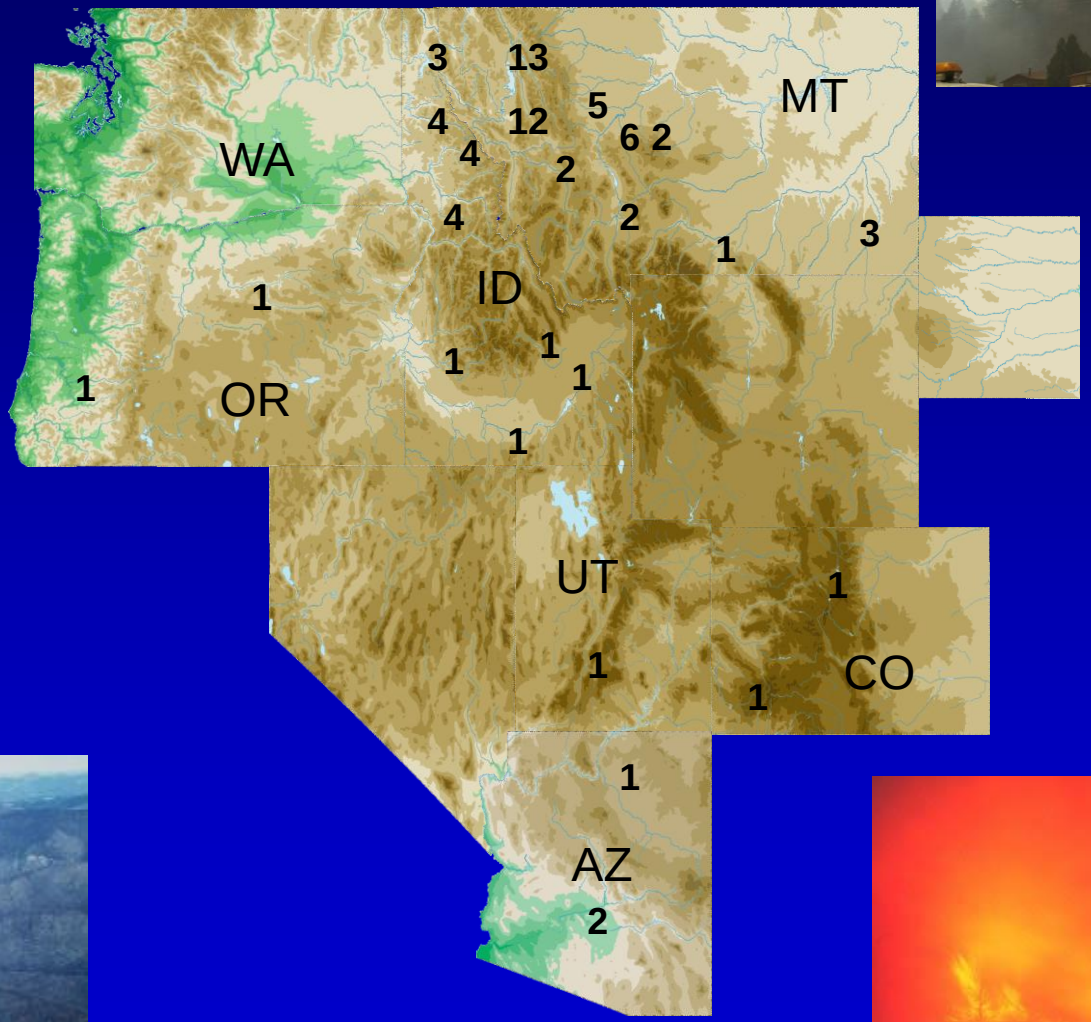
Visited 73
2001-2003 Wildfires



Tree Burn Severity

Vertical

Horizontal

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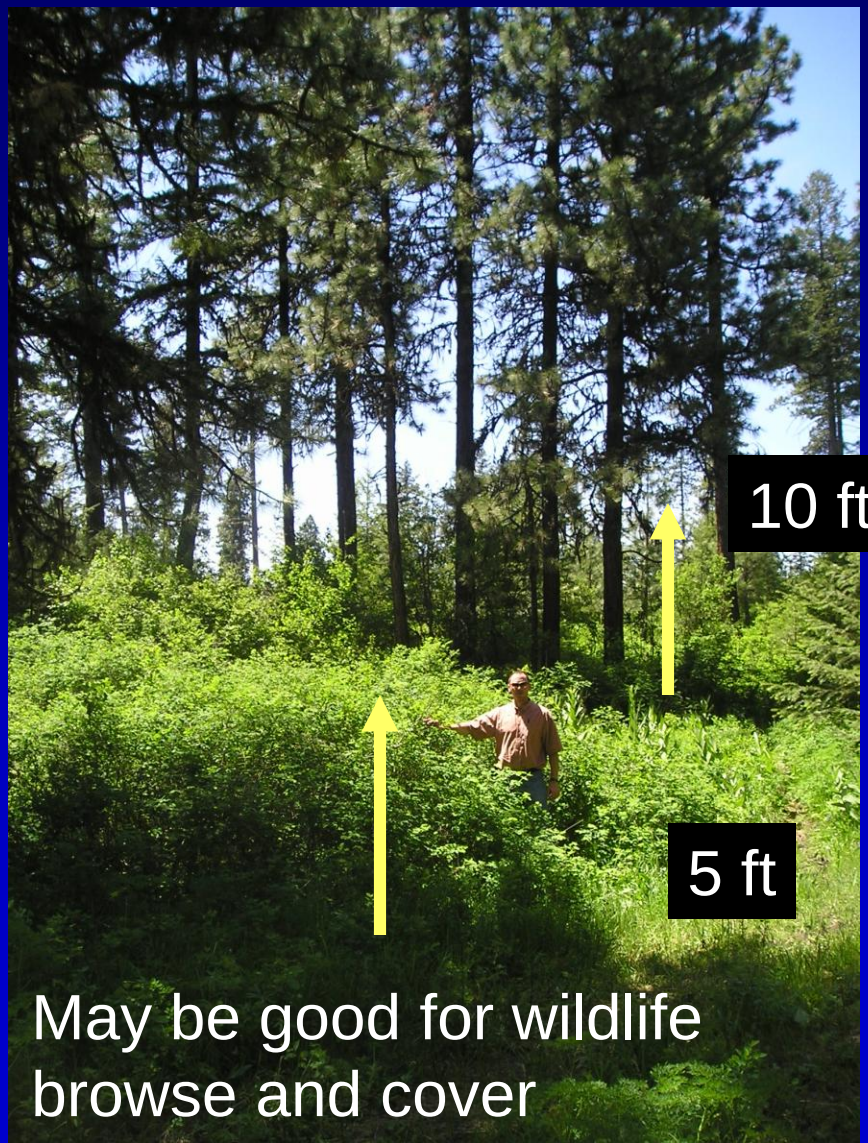
Low Overstory Tree Density

PP/Mixed Conifer Forests
Tree Burn Severity



May be good for wildlife browse and cover

53% probability of brown trees (mixed brown and brown) from heat scorch –
23 obs. – 10 mixed brown, 1 brown, 5 black

Conditions:

1) Dry forest
2) Low canopy base height
3) Low cover (20%)
4) Surface fuels – produce high heat?

PP/Mixed Conifer Forests
Tree Burn Severity

Tree size > 21”
  70% probability of green trees
Surface fuels < 3 t/a
  57% probability of green trees

Conditions:
1) Dry forest
2) Canopy base height (high)
3) Low surface fuels

Take Home Message
Low Overstory Density

- Be aware of habitat type – vegetation type
- A low overstory density does not always result in low soil or tree burn severity
- Be aware how overstory density may influence understory vegetation – surface fuels
- Key component that influenced the outcome – surface fuels

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High Overstory Tree Density

PP/Mixed to Moist Conifer Forests
Tree Burn Severity

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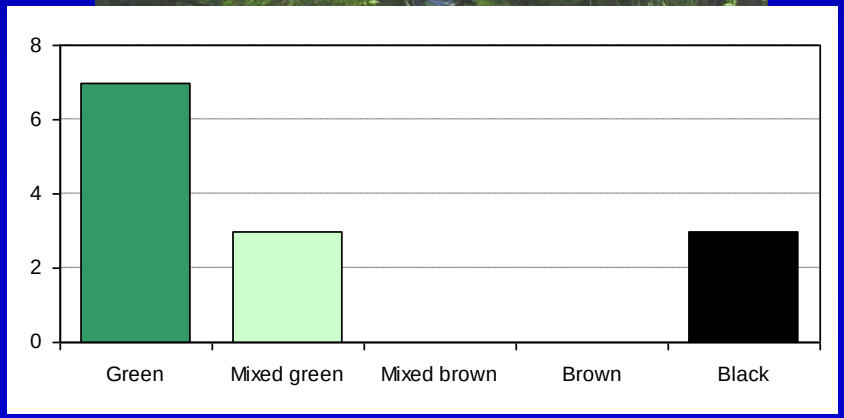
67% probability of green trees

Conditions: 13 observations
Top height: Dry=58; Moist=61
Canopy cover: 60 to 70%
Basal area: Dry=140; Moist=120
High canopy base heights:
Dry = 30; Moist = 12
Crown ratio: Dry=38; Moist=39



75 % cover

45 % cover

All forest types
Tree Burn Severity

Conditions:
High overstory density
Needle understory
Higher canopy base height

52 % probability of mixed green

41 % probability of brown trees

Conditions:
Low overstory density
Grass understory
Low canopy base height

Take Home Message

- High overstory density can be resilient
  - Distance between the surface and canopy base height
  - Type of surface fuel
- When do high densities become a problem?
  - Continuous canopy – fire enters from adjacent stand
  - No distance between surface and canopy
- Can you still kill trees?
  - Yes
  - Depends on species

Moist and Cold Forests
Tree burn severity

Conditions:
Dense stands of trees
Low canopy base heights
Herbaceous understory
Treated site after harvest
Young forests (< 50 years)
52 & 55% probability of green trees

Fuel moisture and live to dead fuel ratio

Fuel Treatment Effectiveness Wildfires

- All treatments burn
- Do not change fire size
- Wildfire behavior changes quickly with changes in forest structure
- Distance matters in changing severity
- Irregular forests tend to burn irregularly

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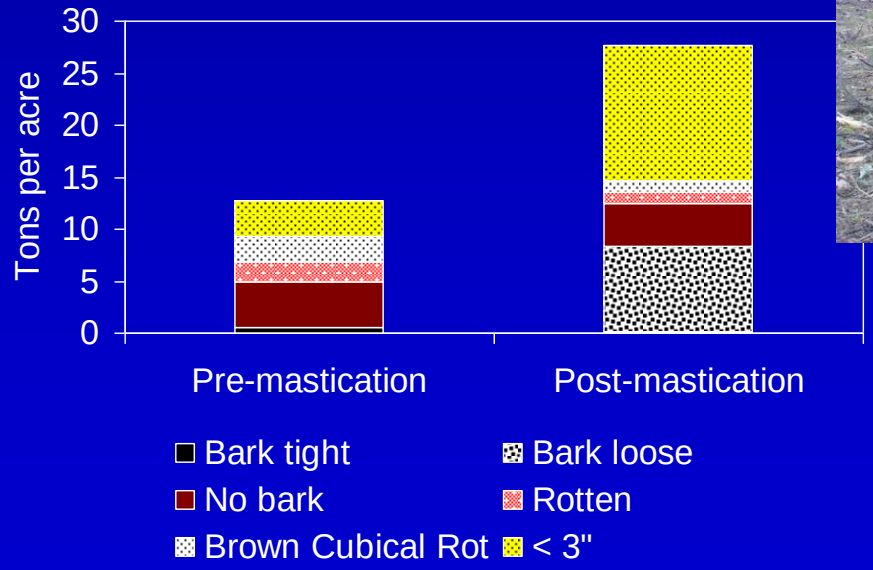
Slash Chunking

Surface Fuel Treatments
Mastication

- Enhance decomposition
- Mastication w/wo burning
- Prescribed fire - lower duff moisture



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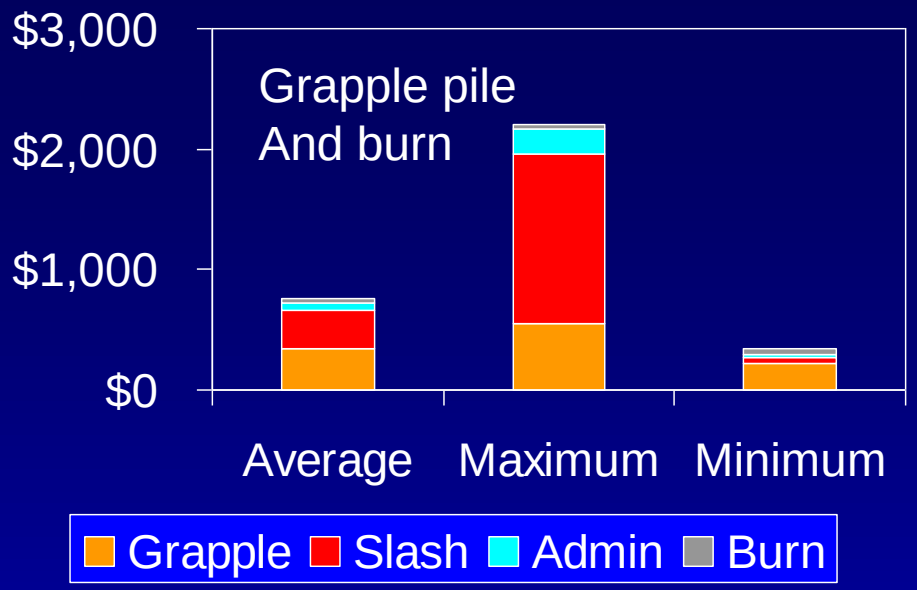
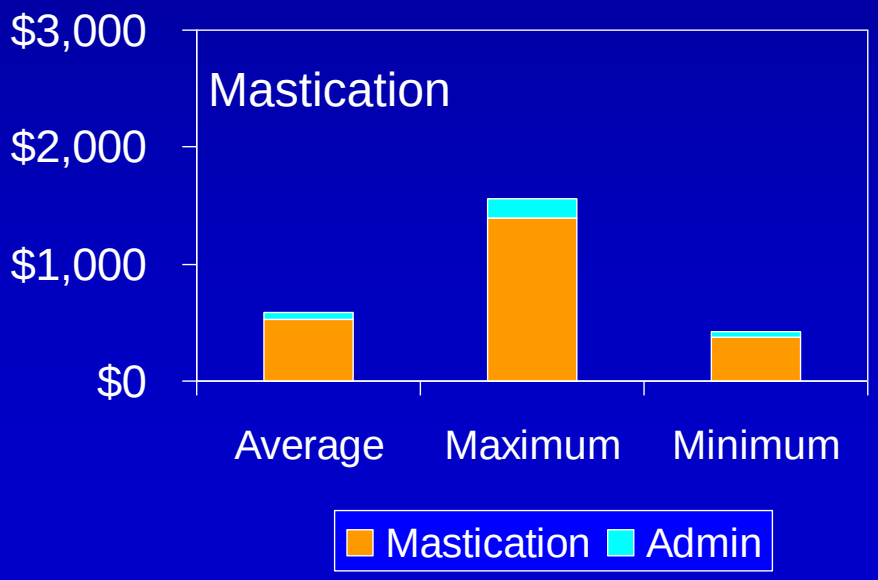
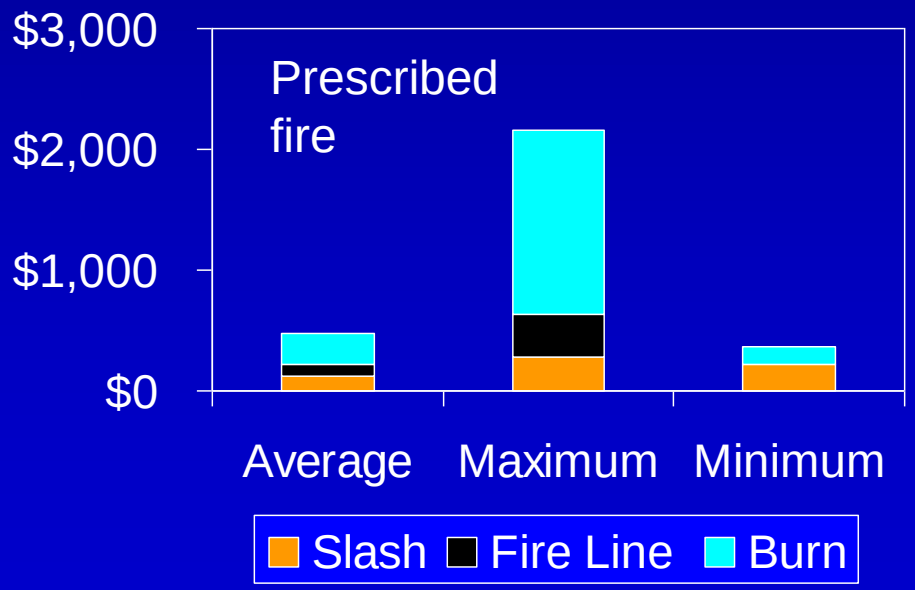
Economic Evaluation







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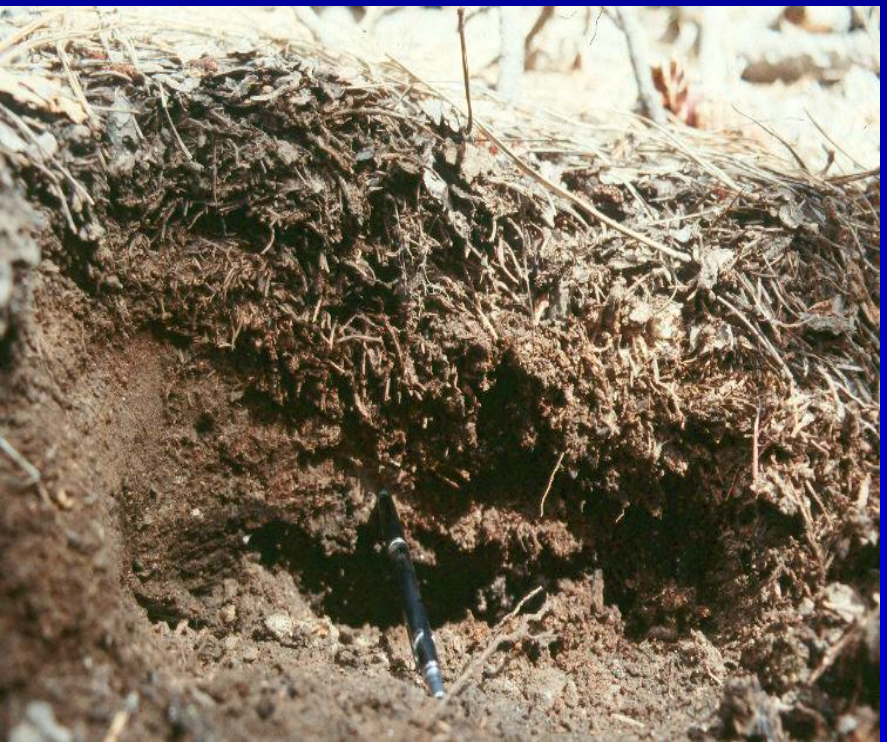
Litter/humus/ fermentation (Duff) build-up



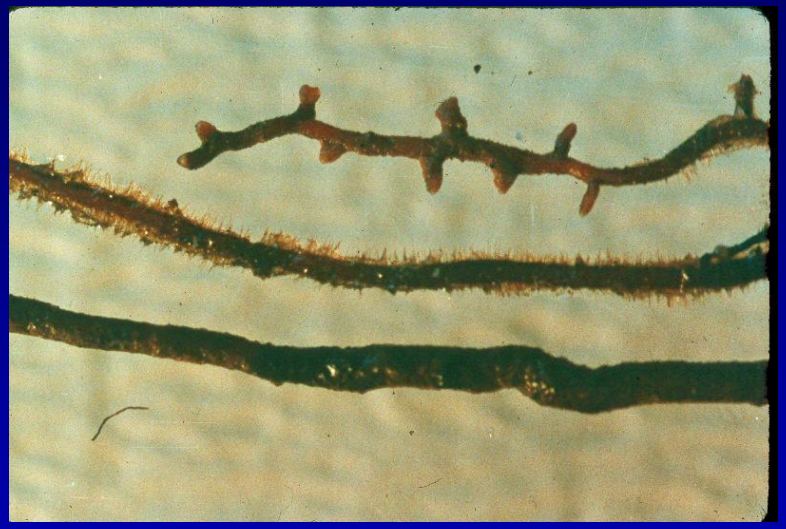
Rationale

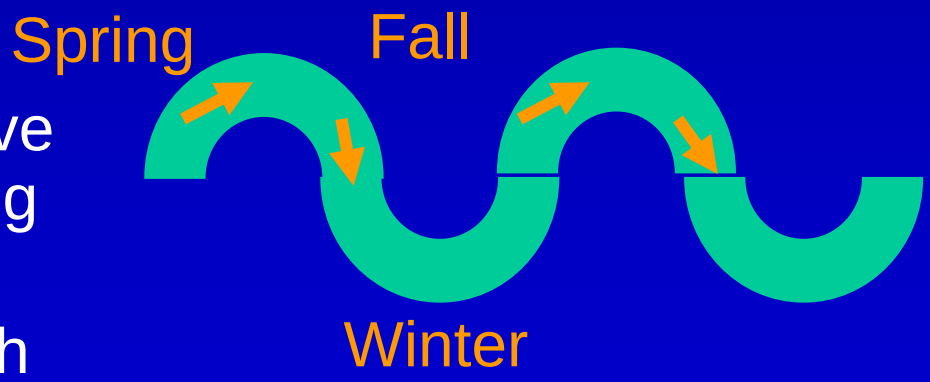
Issues

- Fire not present for over 100 years
- Increase biomass
- Increase stress

Ecology

- Fine roots and ectomycorrhizae in duff (humus)
- Cyclic
- Grow and become active > 40 degrees F in spring
- Decrease temperature pulse into ground – high lower duff moistures





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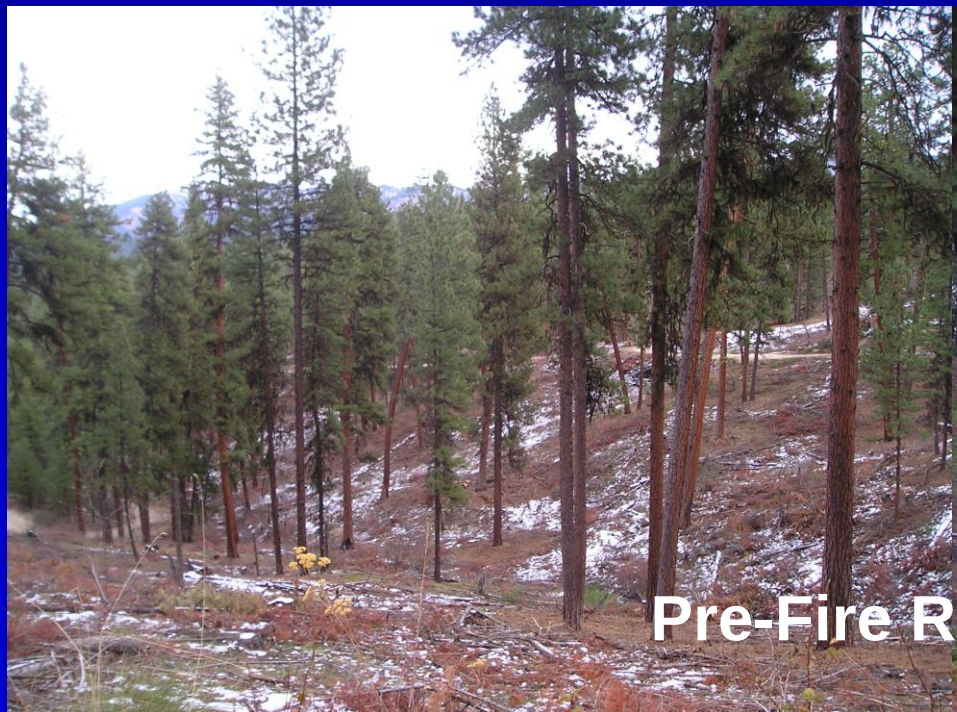
Burning Conditions and Consumption

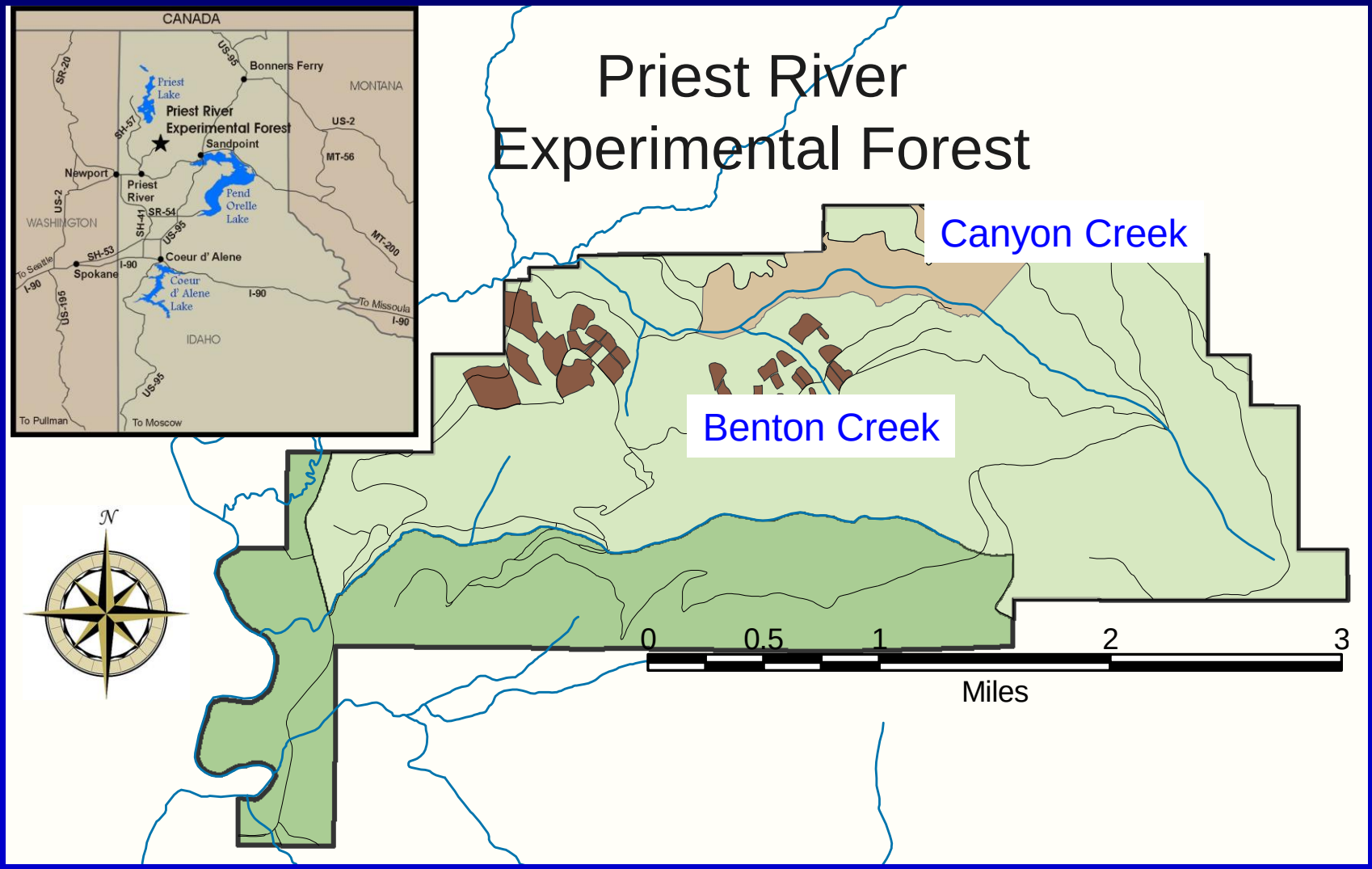
	2002 1st Application	2004 2nd Application	2005 Reintroduction
Lower duff Moisture	138% +/- 10[1]	97% +/- 17	121% +/- 8
Temperature	40 degrees F +/- 0.6	41.5 degrees F +/- 1	37 degrees F +/- 2
Consumption	1.2 cm +/- 0.4	10 cm +/- 3	2 cm +/- 0.4

[1] Standard Errors

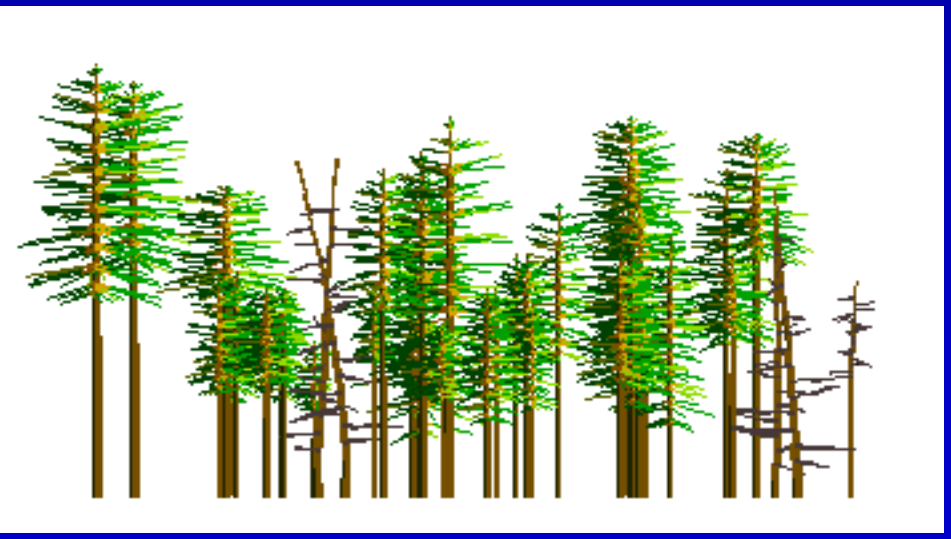


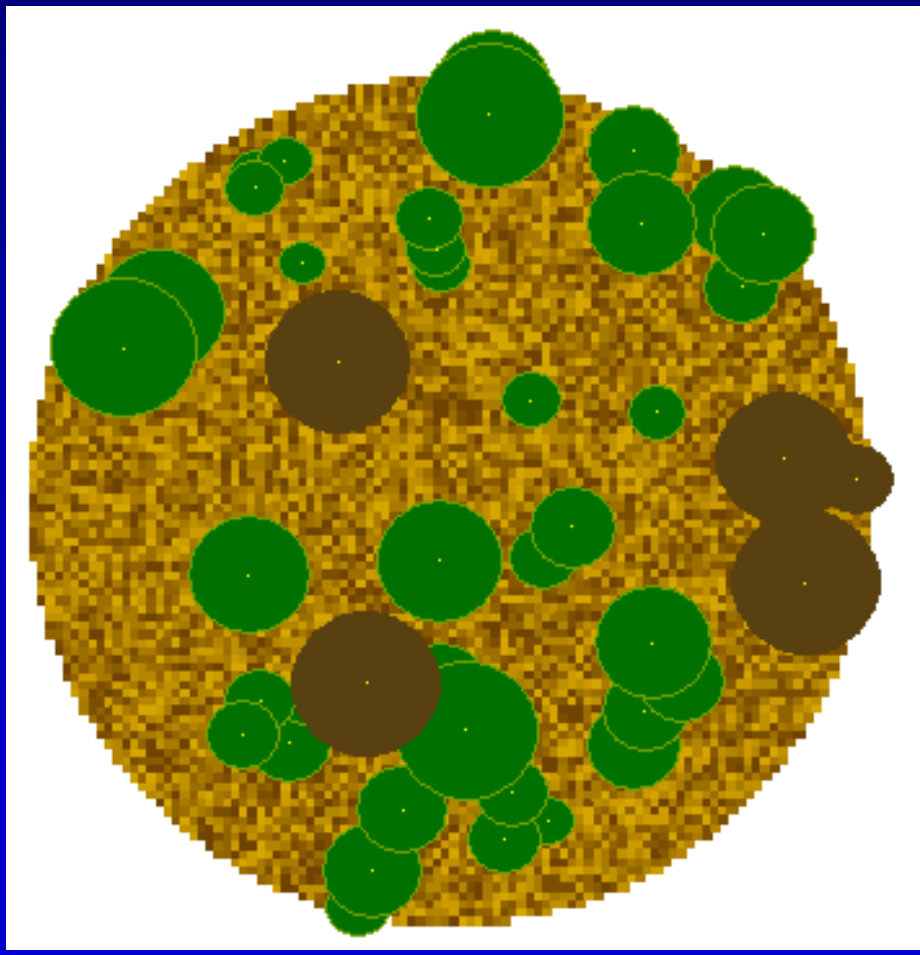
Pre-Fire Reintroduction

Alternative Canopy Fuel Treatments

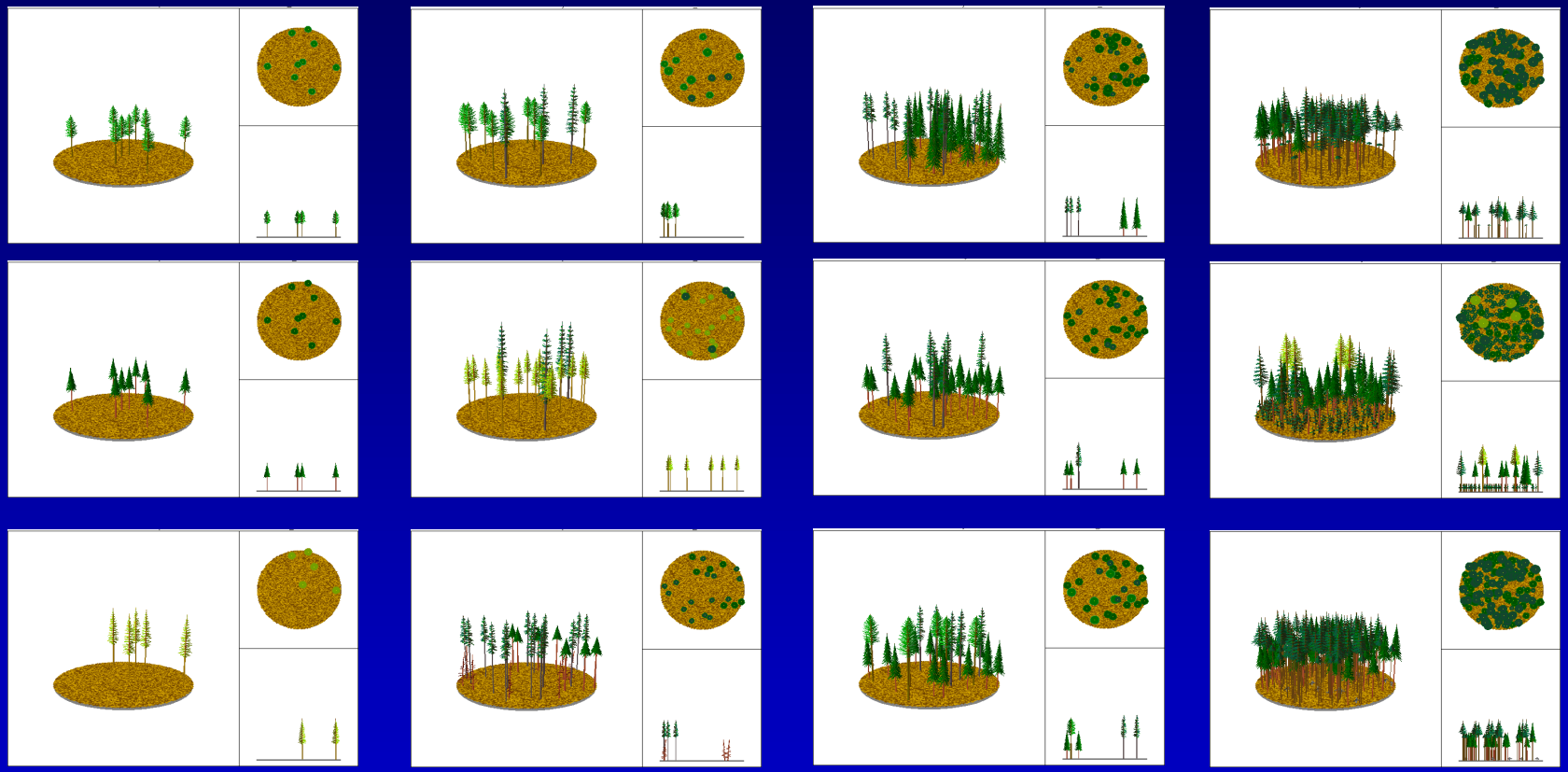


Irregular Selection





Resulting Forest Structure



50% of observations

≤ 10% cover
≤ 40 BA
10-22 TPA
WWP, WL, PP

51 to 100% of observations

11-65% cover
41-160 BA
23-340 TPA
WH, WRC, WWP

Logistics of Implementation

- Slash treatments
  - Photograph guide and discussed our options
  - Not as easy as large units but can be done
  - Needed to dig fire line down middle of some units
  - Incorporate patience

Grapple piling

Mastication

Prescribed fire

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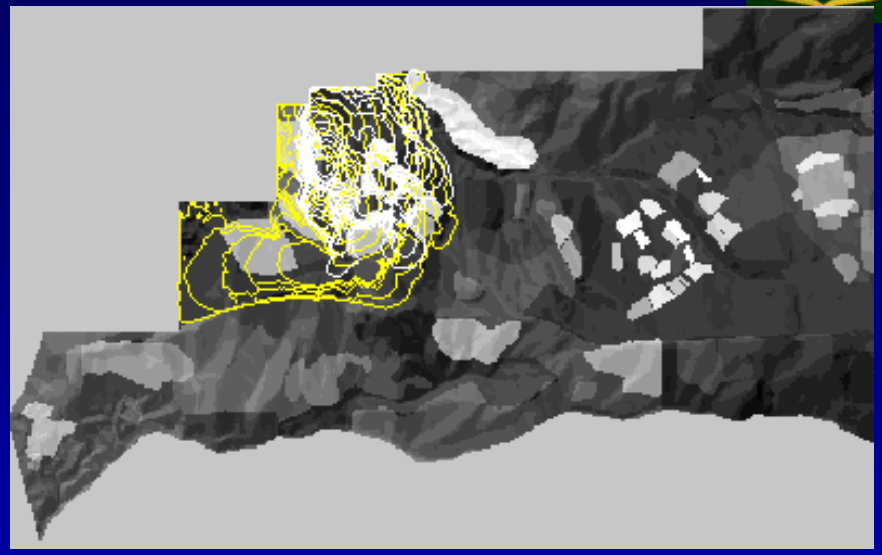
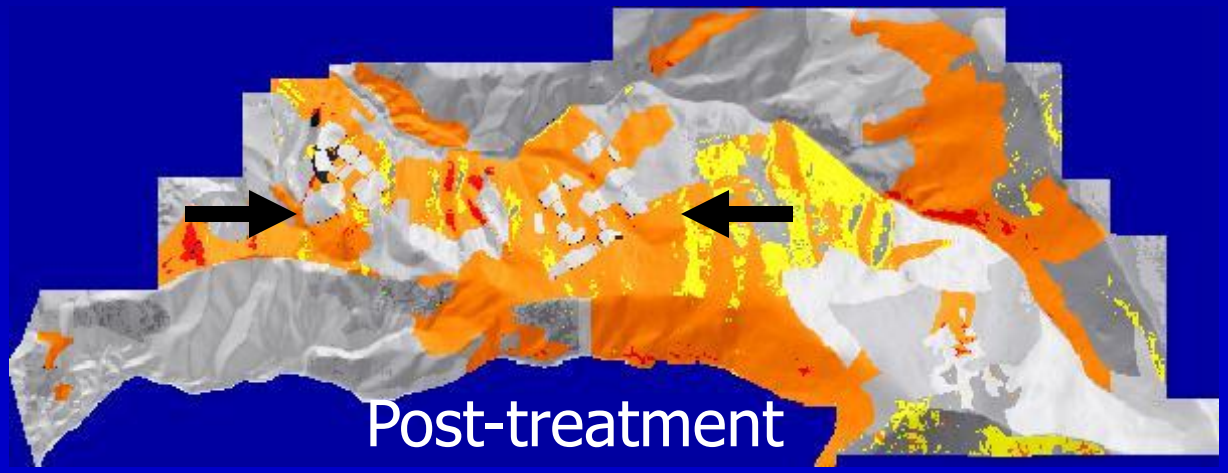
Evaluate fire behavior using FARSITE modeling approach





5 to 10 ft.

11 to 15 ft.

> 15 ft.

Stand location