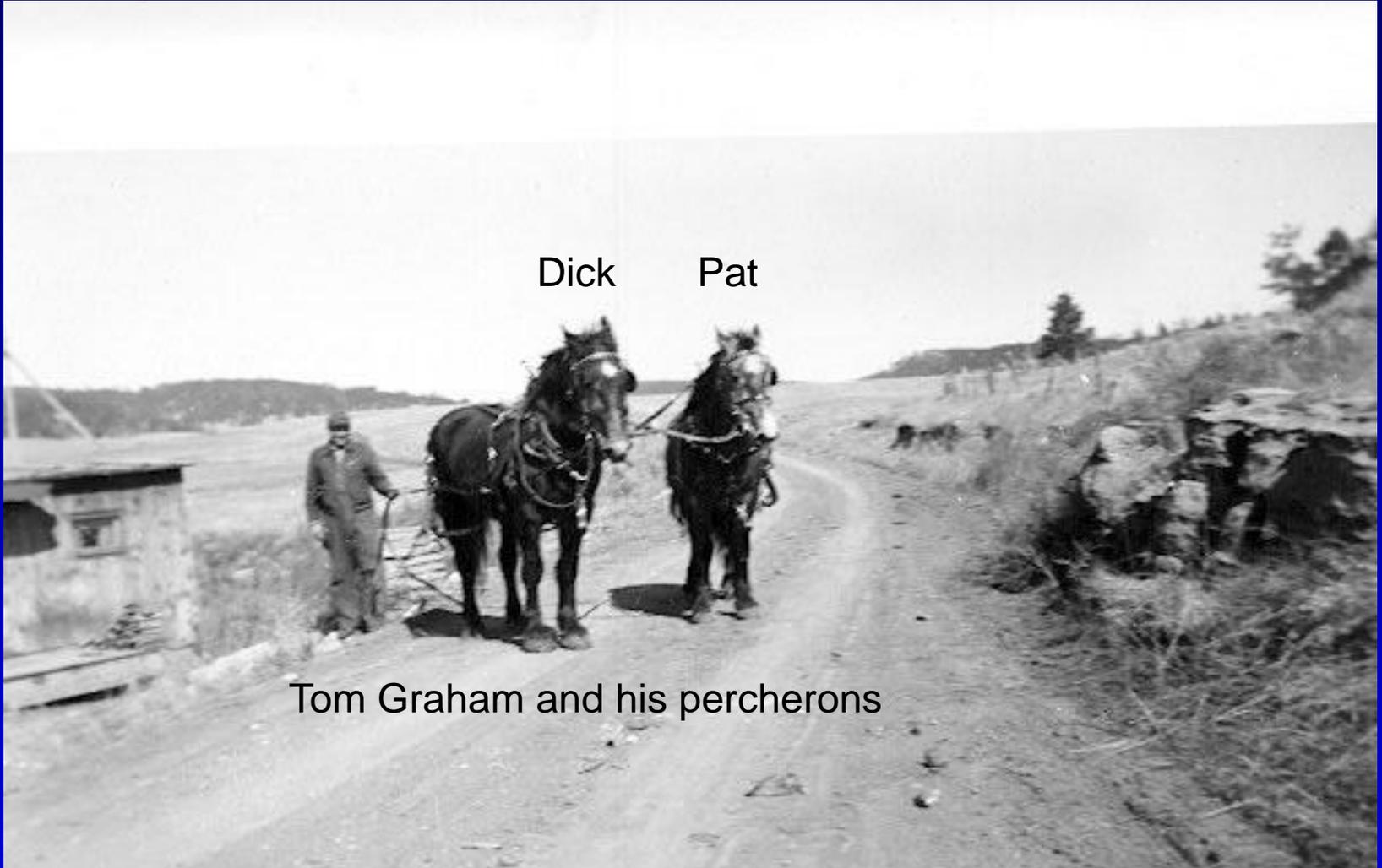




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Dick Pat

Tom Graham and his percherons



Dry and Moist Mixed Conifer Forests of Idaho



Russell T. Graham and Theresa B. Jain
Rocky Mountain Research Station
USDA Forest Service
Moscow, ID 83843
208.883.2325 rtgraham@fs.fed.us



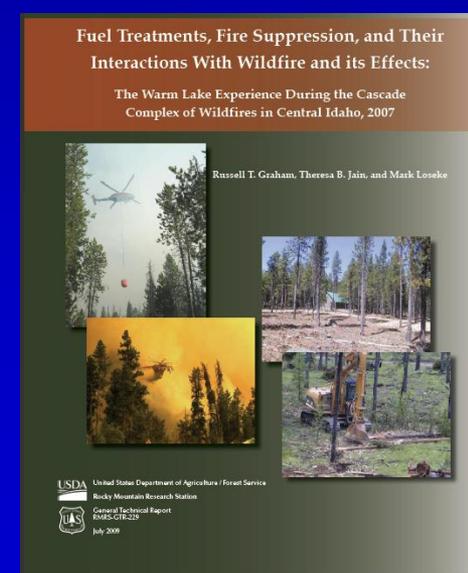
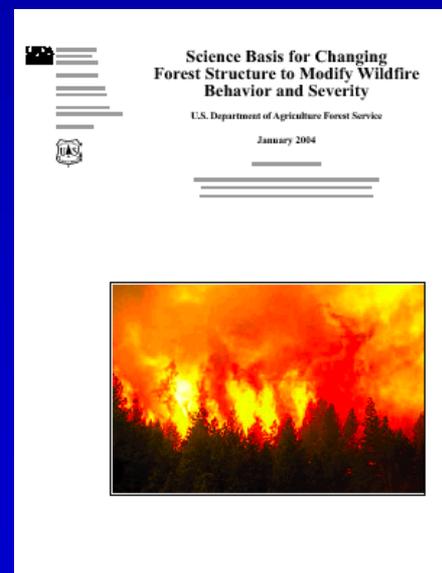
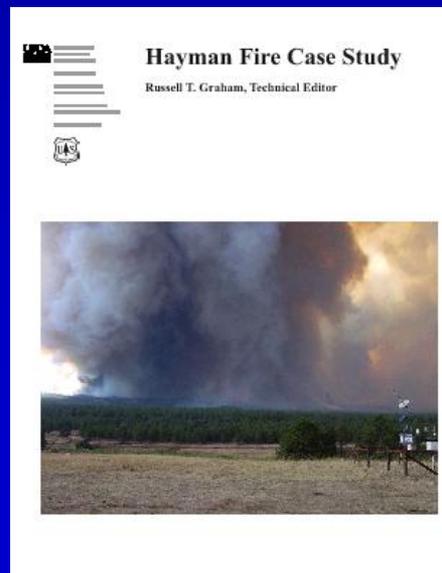
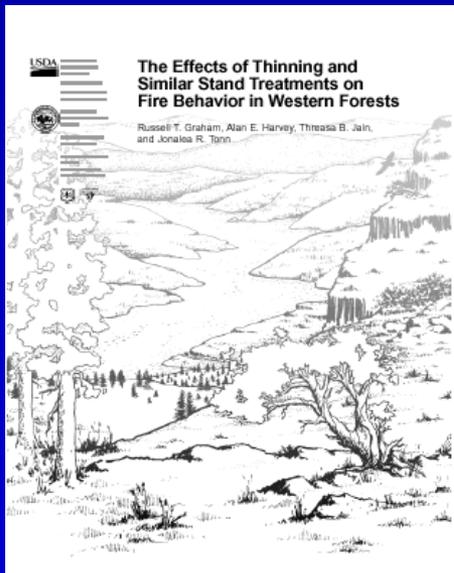


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Information



- The effects of thinning and similar stand treatments on fire behavior in western forests; PNW-GTR-463
- Hayman Fire Case Study; RMRS-GTR -114
- Warm Lake RMRS-GTR - 229
- Science Basis for changing forest structure to modify wildfire behavior and severity; RMRS-GTR-120



Fuel Synthesis

7-GTRs

49 Fact Sheets (Res. Notes)



All Publications

<http://www.fs.fed.us/rm/publications/>

USDA

Fuels Planning: Science Synthesis and Integration

Fact Sheet: The Fuels Synthesis Project Overview

Fuels treatment planners often find the challenge of integrating diverse scientific findings into the design of their projects a barrier to timely decisionmaking. With an increased emphasis on treating fuels to address wildfire impacts in the United States, the need for well-documented, accessible scientific information is becoming ever more critical. In April 2005, the USDA Forest Service initiated a project to coordinate the delivery of research information to fuels specialists and others involved in project planning.

The geographic focus of the "Fuels Planning: Science Synthesis and Integration" project focuses on the Pacific Northwest Project in the dry forests of the Western United States. Project goals include developing accessible analysis protocols, and developing science-based documents that synthesize and integrate the ecological and social science relevant to fuels treatments, and delivering these products to a user-friendly format. Target audiences include fuels management specialists, resource specialists, National Environmental Policy Act (NEPA) planning team leaders, law officers in the USDA Forest Service and the Department of the Interior, community leaders, and educators.

The Fuels Synthesis Project is organized around four key science topics:

- Forest structure and fire hazard
- Environmental consequences of fuels treatments
- Economic uses of material and costs of fuels treatments
- Public understanding of social issues, beliefs, attitudes, and behaviors related to fuels management

Synthesizing Scientific Information for Fire and Fuels Project Managers

David E. Goshan
Kath M. McCaffrey

Fuels planning, science synthesis and integration, an integrative research management paradigm to support the Ten-Year Fire Plan.

USDA

USFS

Root Diseases in Coniferous Forests of the Inland West: Potential Implications of Fuels Treatments

Environmental Consequences

USDA

Forest Structure and Fire Hazard in Dry Forests of the Western United States

David L. Peterson, Martin C. Johnson, James K. Agee, Theresa B. Jain, Donald McKenzie, and Elizabeth O. Westford

Wildland Fire Behavior & Forest Structure
Environmental Consequences
Economics
Social Concerns

United States Department of Agriculture
Forest Service
Pacific Northwest Research Station
General Technical Report
PNW-GTR-428
February 2005

USFS

Social Science to Improve Fuels Management: A Synthesis of Research on Collaboration

Wildland Fire Behavior & Forest Structure
Environmental Consequences
Economics
Social Concerns



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Idaho Landscapes & Climate

↑
479 mi
↓
← 305 mi →



Selkirk
90-100"

Continental
air masses

Coeur d'Alene
30-60"

80 Mountain ranges

Clearwater
60-90"

50 Peaks 10,000' +

710'

118°

Pacific
Air masses

Bitterroot

Seven Devils
7,800' Gorge

Lemhi

Lionhead
-61°

Sawtooth
30-60"

Lost River
12,662'

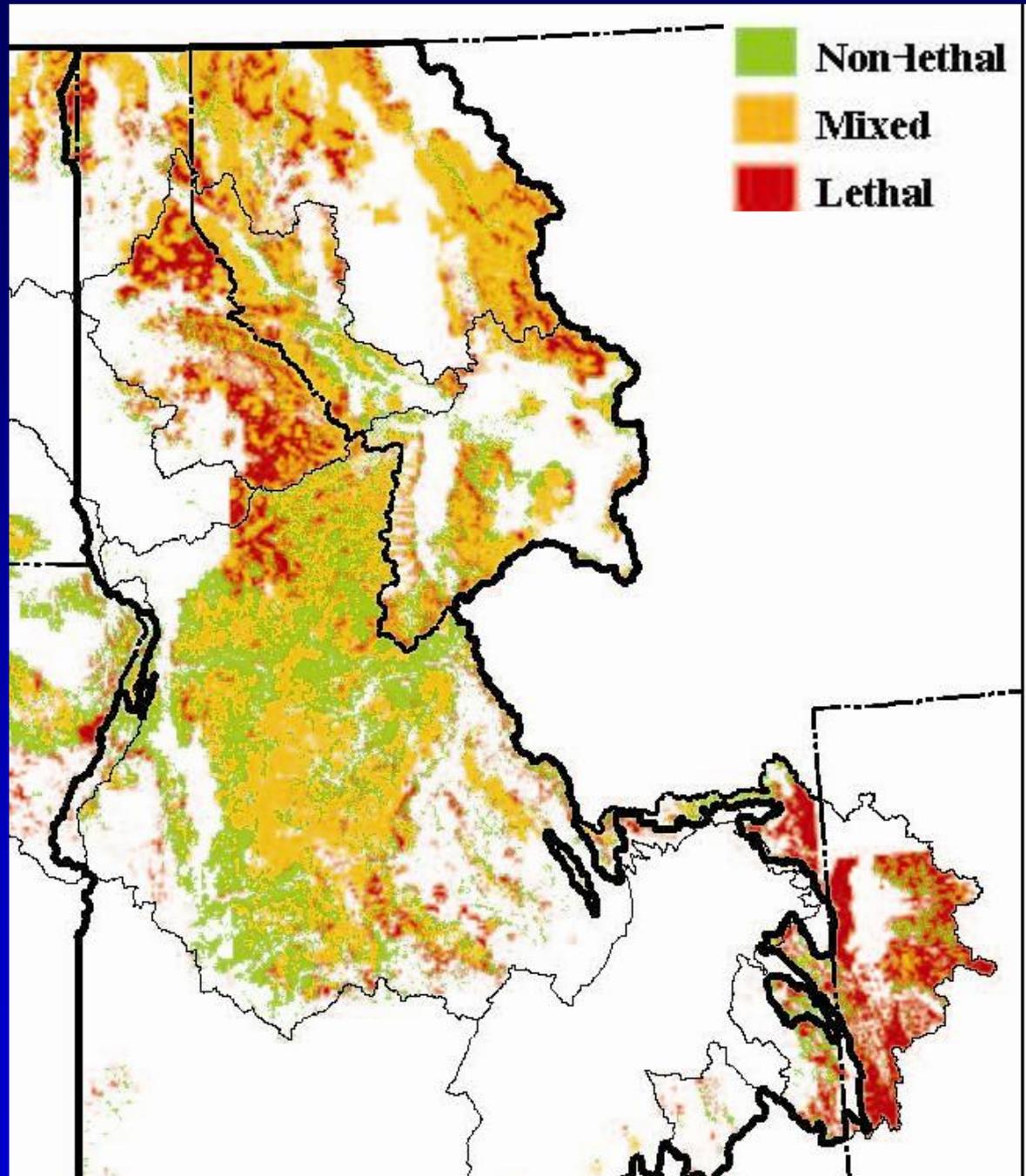
10-20"

Portneuf



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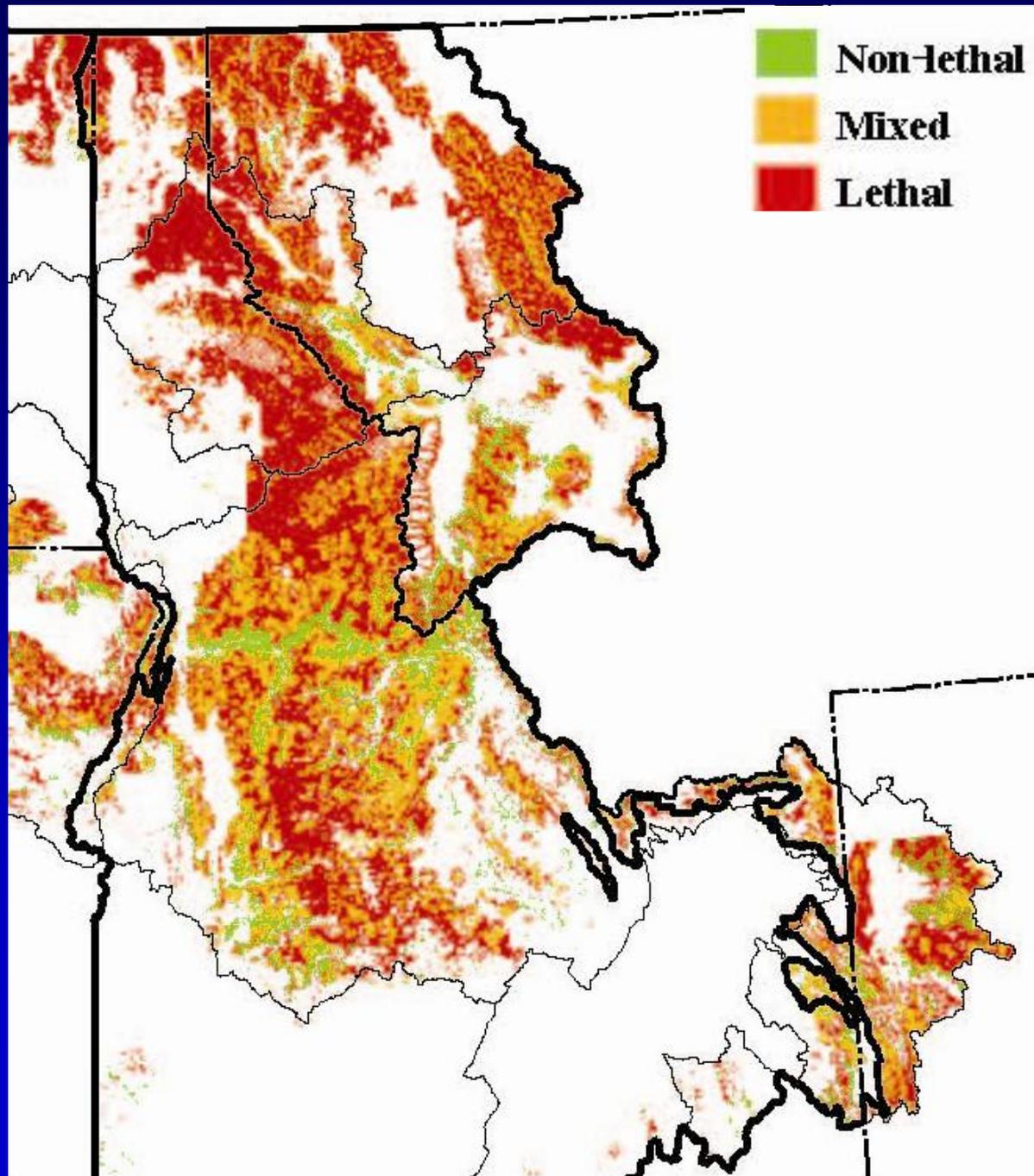
Historical Mixed Fire Regimes ICBEMP





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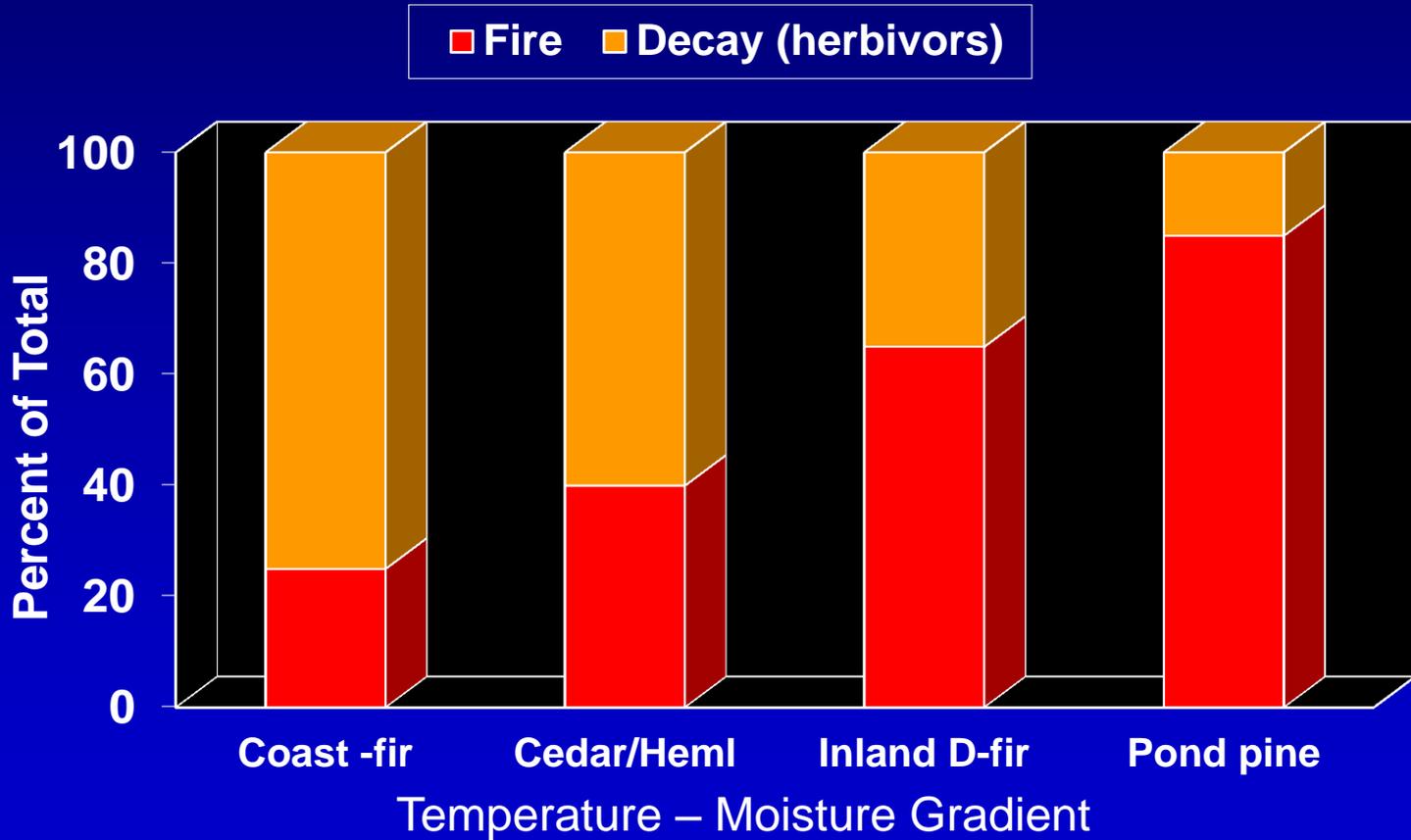
Current Mixed Fire Regimes ICBEMP





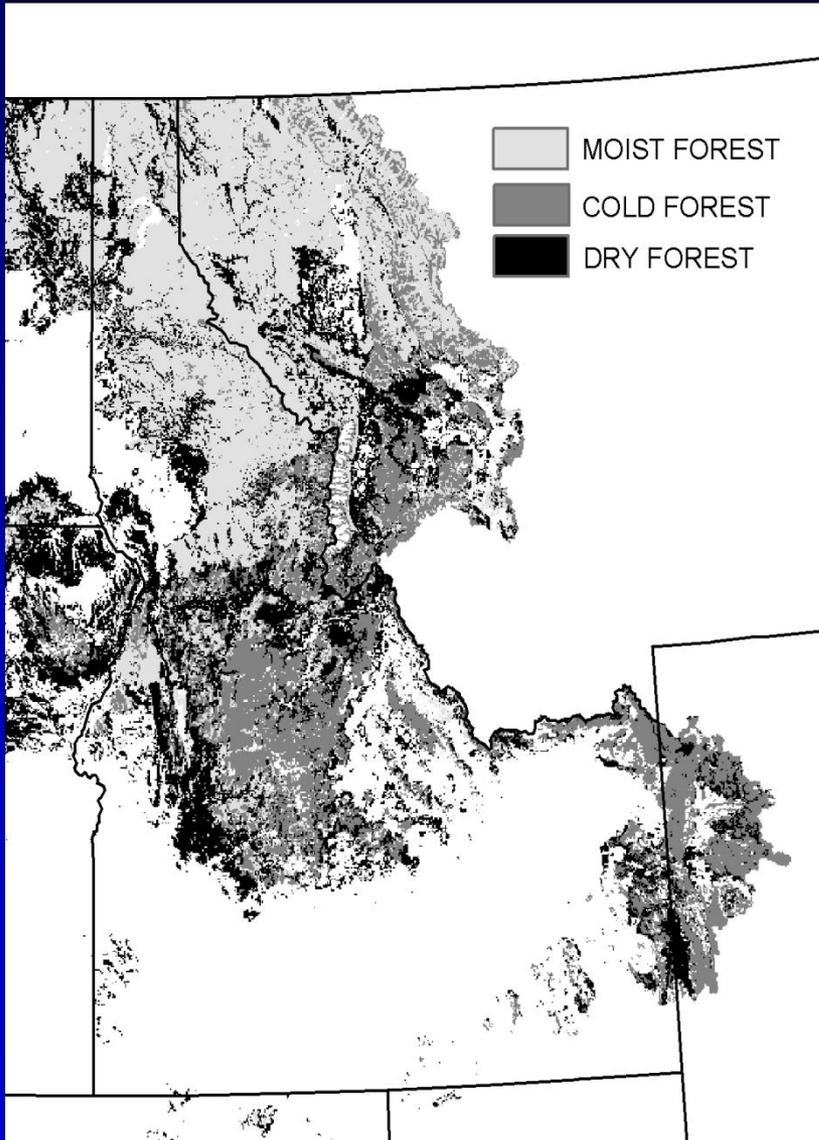
Combustion-Decomposition

Recycling of Carbon and Other Nutrients





Forests of Idaho



Moist

Dry



Cold



Forests are Inherently Unique

- Fire regimes
- Other disturbances
 - Insects
 - Disease
 - Weather
- Succession
- Species

Dry



Cold

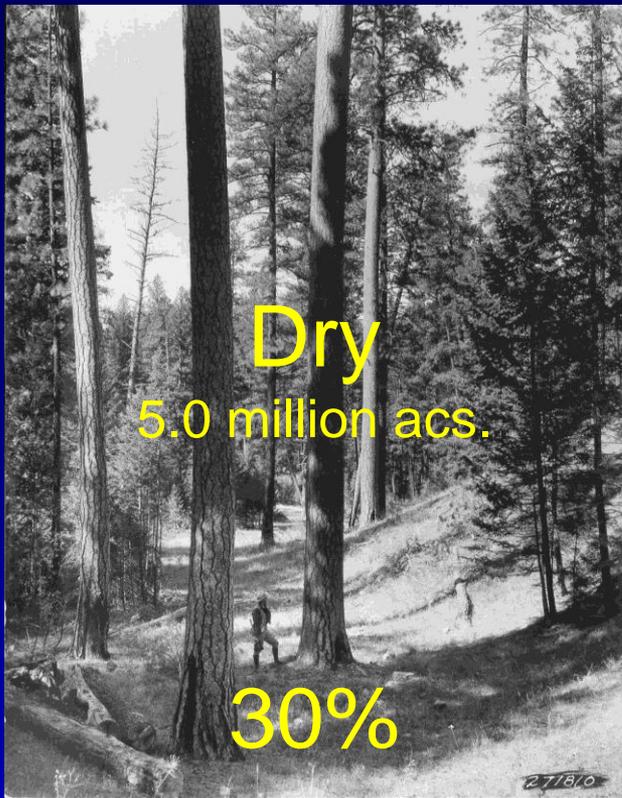


Moist



- Ground, surface, crown
- Intensity – rate at which fuel is consumed and heat generated
- Burn severity – damage to both abiotic and biotic forest components

No two fires are the same

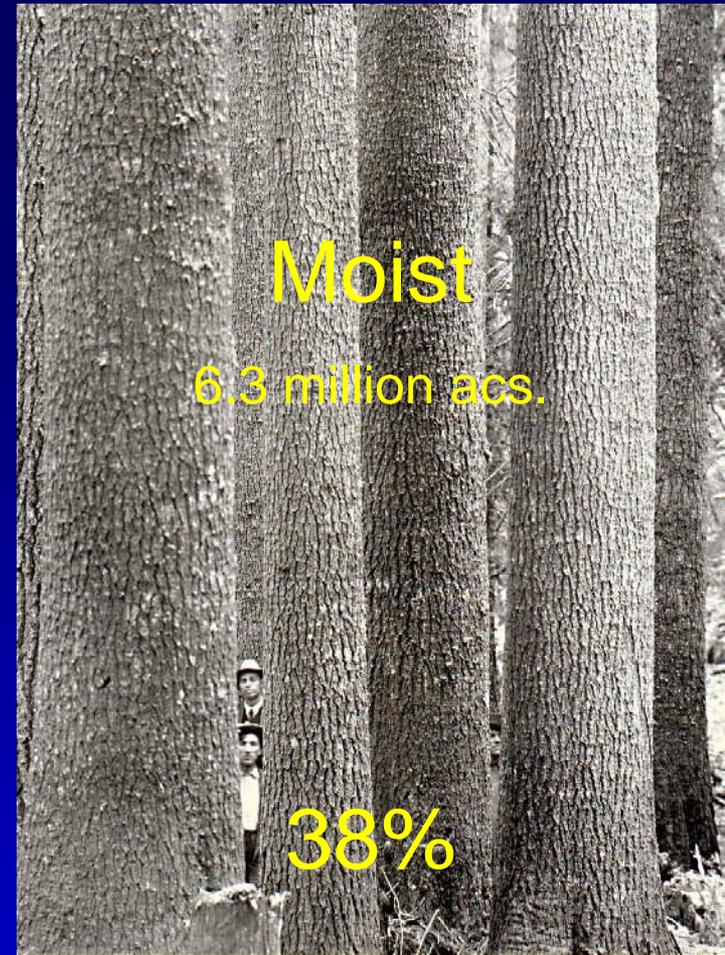


Dry

5.0 million acs.

30%

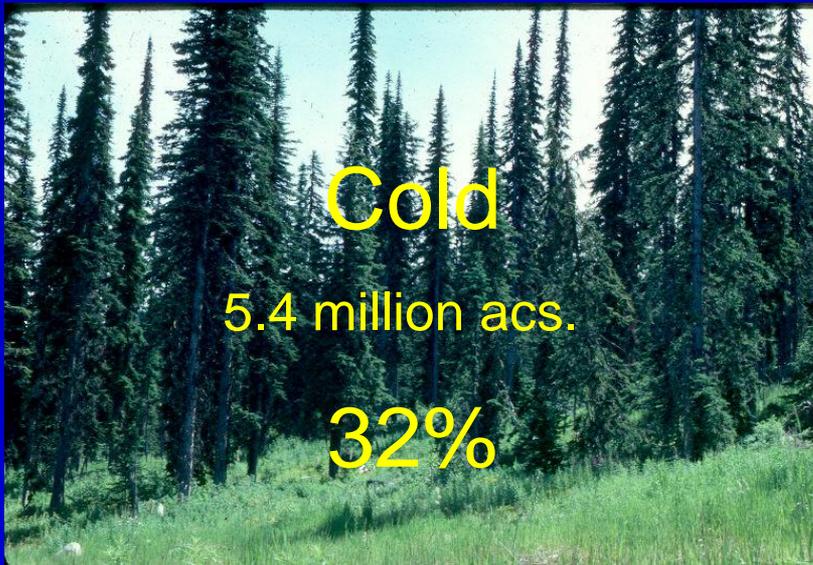
16.7 million acres
of forests in
Idaho (31%)



Moist

6.3 million acs.

38%



Cold

5.4 million acs.

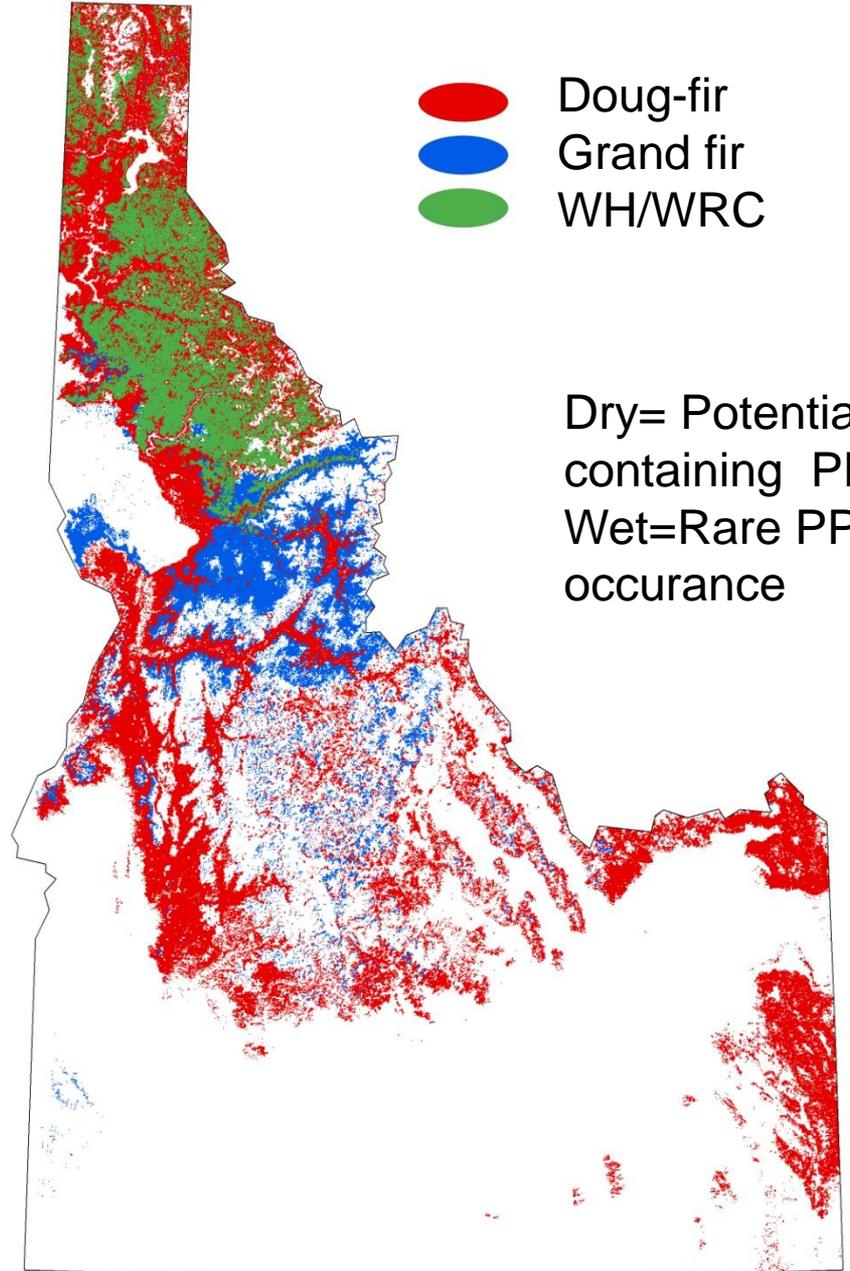
32%

Historical Forests



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Dry and Moist
Mixed
Conifers
Potential
Vegetation Groups
PVG





Succession

Successional stage

≠

Structural stage



Early seral Ponderosa pine

- The gradual supplanting of one community of plants by another
- The sequence of communities is called a sere or seral stage

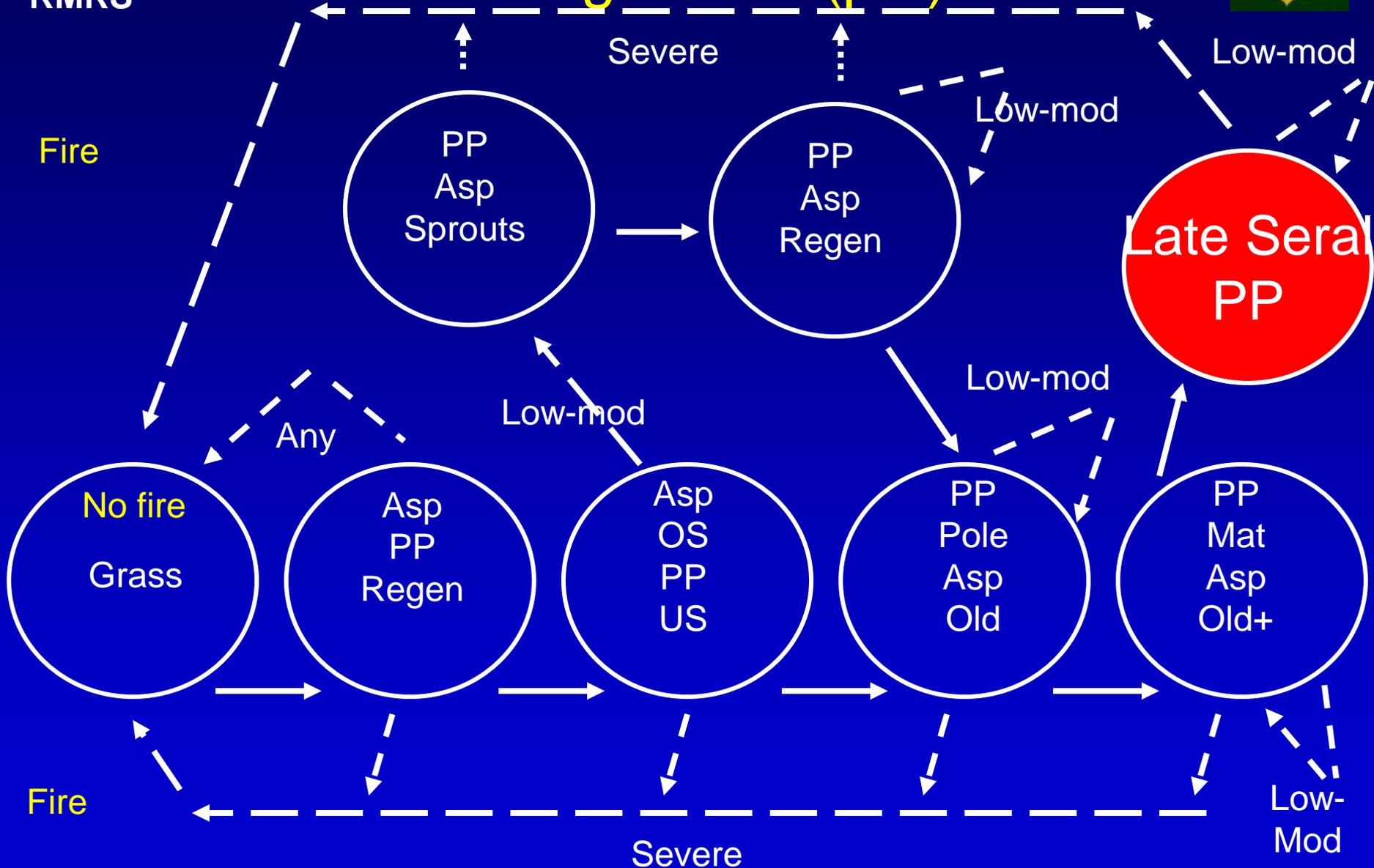


Late seral western hemlock



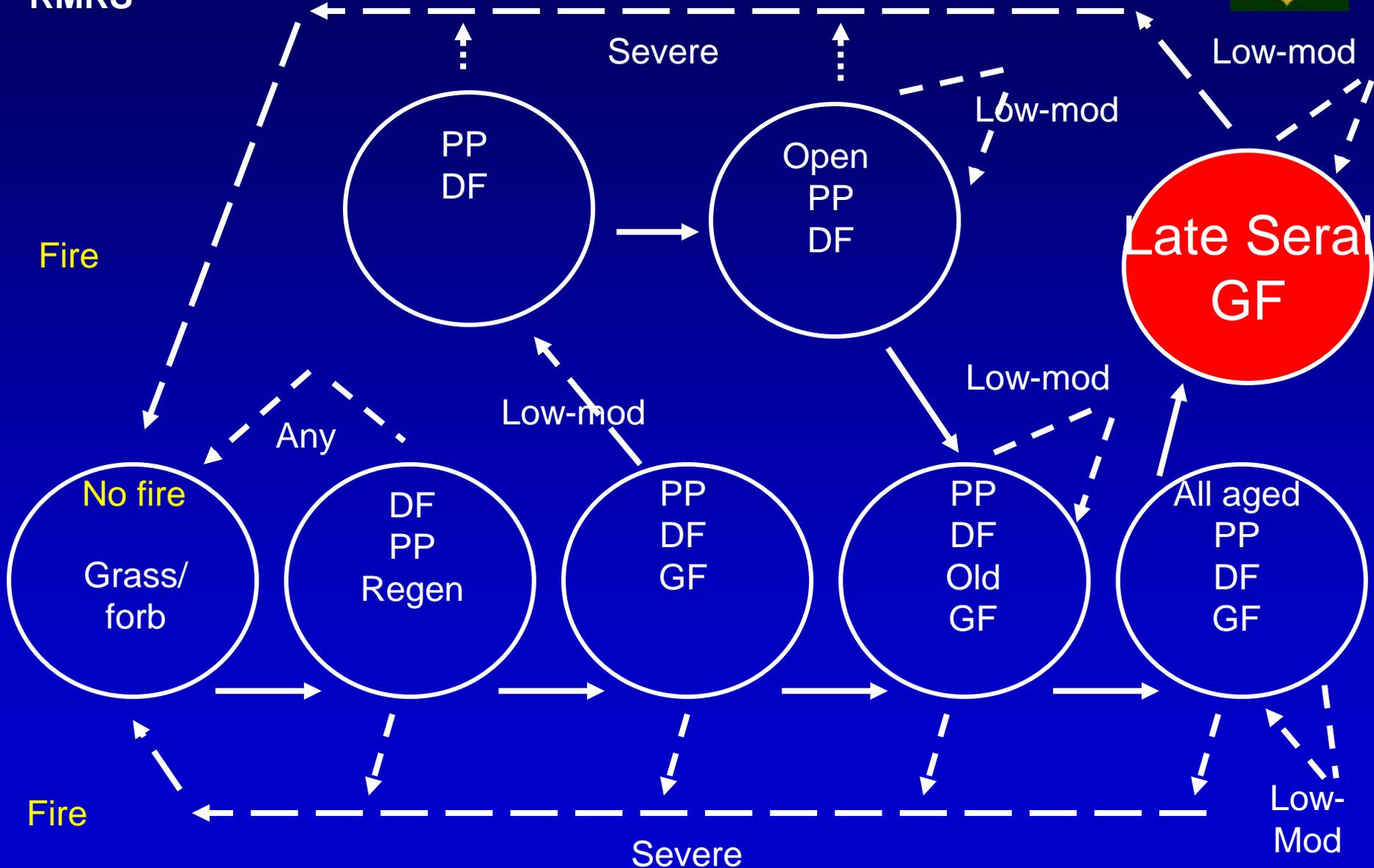
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Ponderosa Potential Vegetation (pvt)





Grand Fir Potential Vegetation (pvt)



Potential Vegetation

- A physical and biological environment, that produces a kind of vegetation. Potential vegetation (climax) types are identified by indicator species of similar conditions

Late seral grand fir





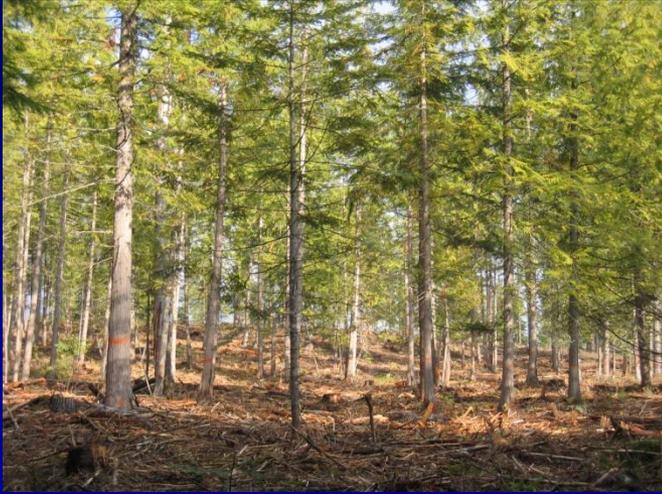
Potential Vegetation Types with Moist Mixed Conifer

- Western redcedar
 - Devils club
- Western hemlock
 - Clintonia
 - Lady fern





Moist Forests





Moist Forests



Late-seral

Trees

Lower Veg.

- W. hemlock
 - W. redcedar
 - Grand fir
 - W. white pine
 - Douglas-fir
 - Lodgepole pine
 - Western larch
- Bear grass-S*
 - Menziesia-S,C
 - Ninebark-S
 - Alder-S, N-fix
 - Maple-S
 - Shiny leaf-C, N-fix
 - Red stem-C, N-fix

Tolerance



Early-seral

*S=Survivor, C=Colonizer



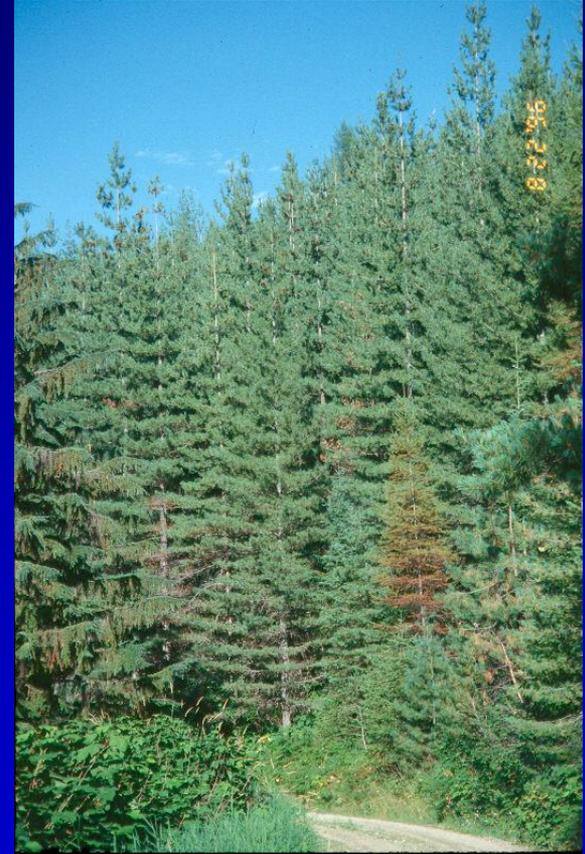
Moist Forest

- Soil wood BCC 25-30%
- Organic matter rich soil
- Adequate organic reserves
- Microbiological activity
 - Ectomycorrhizae
 - Nitrogen fixation
 - Carbon cycles





Current Moist Forests





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Dry Forests





Potential Vegetation Types with Dry Mixed Conifer



- Douglas-fir
 - Ninebark-pine grass
- Grand fir
 - Maple-pine grass
- Western redcedar
 - Clintonia





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Late-seral

Dry Forests

Trees

Tolerance ↑

- Western redcedar
- Grand fir
- Douglas-fir
- Ponderosa pine
- Lodgepole pine
- Western larch

Early-seral



Lower Veg.

Tolerance ↑

- Pine grass-S
- Elk sedge-S, C
- Ninebark-S
- Bitter brush-N-fix

*S=Survivor, C=Colonizer



Northern Idaho

P. Pine

Cedar/Wet Grand fir PVTs





Dry Forests



Forest Change



Diseases

Fire

Mixed →



Crown



Weather



Insects



Surface



Changing From An Early Seral to Late Seral Forest



Early Seral

- Fire tolerant
- Low nutrient demand
- Tolerant of low supply
- High canopy
- Low N content
- Deep roots
- Mixed soils
- Tolerant of native “pests”
- Tolerant of site/soil var.
- Tolerant of climate var.

Late Seral

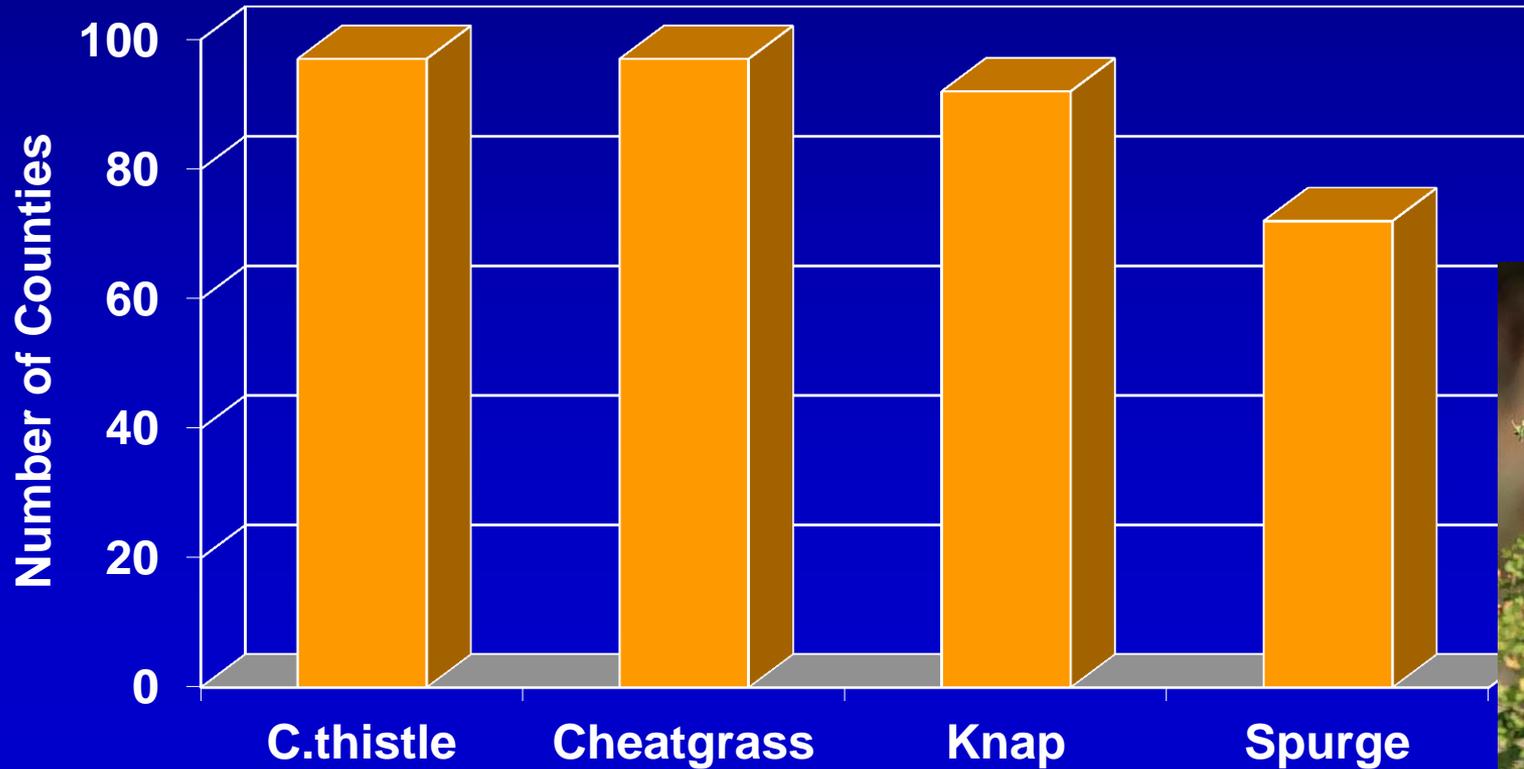
- Fire intolerant
- High nutrient demand
- Intolerant of low supply
- Low canopy
- High N content
- Shallow roots
- Strongly layered soils
- Susceptible to native “pests”
- Intolerant of site/soil var.
- Intolerant of climate change

Shifting from adaptable, long-lived, disturbance tolerant forest to “specialized,” short-lived, change intolerant forests is a very risky during times of change



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Exotic Plants ICRB



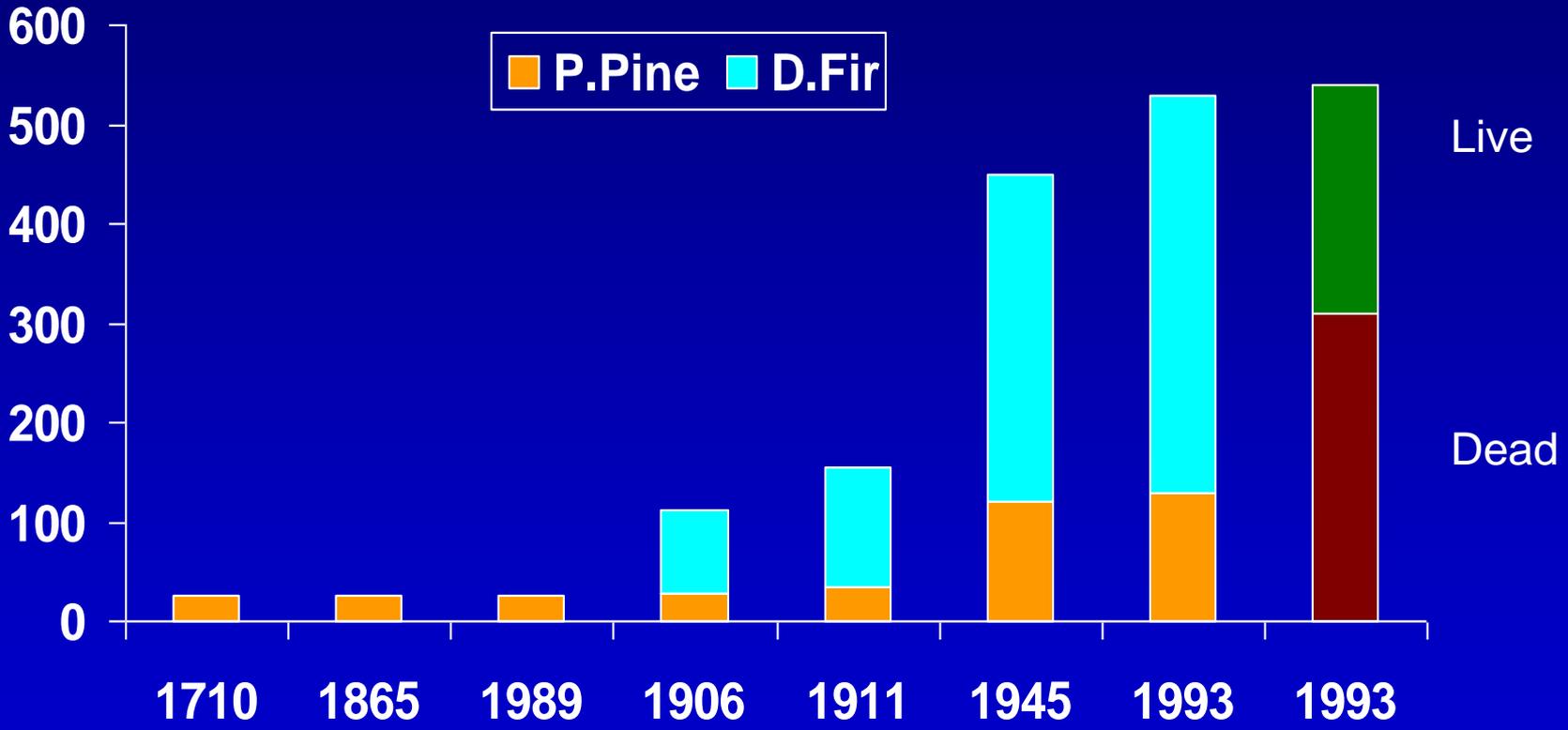


Composition Change In Idaho Undisturbed, Dry Forest



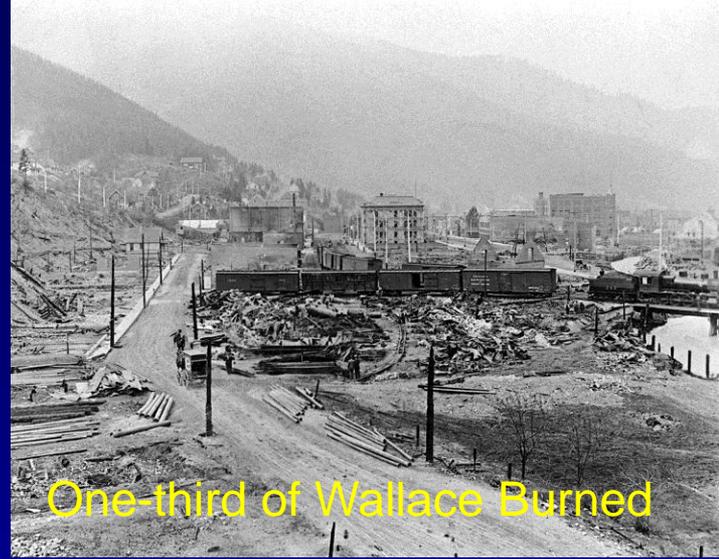
Trees/acre

Condition

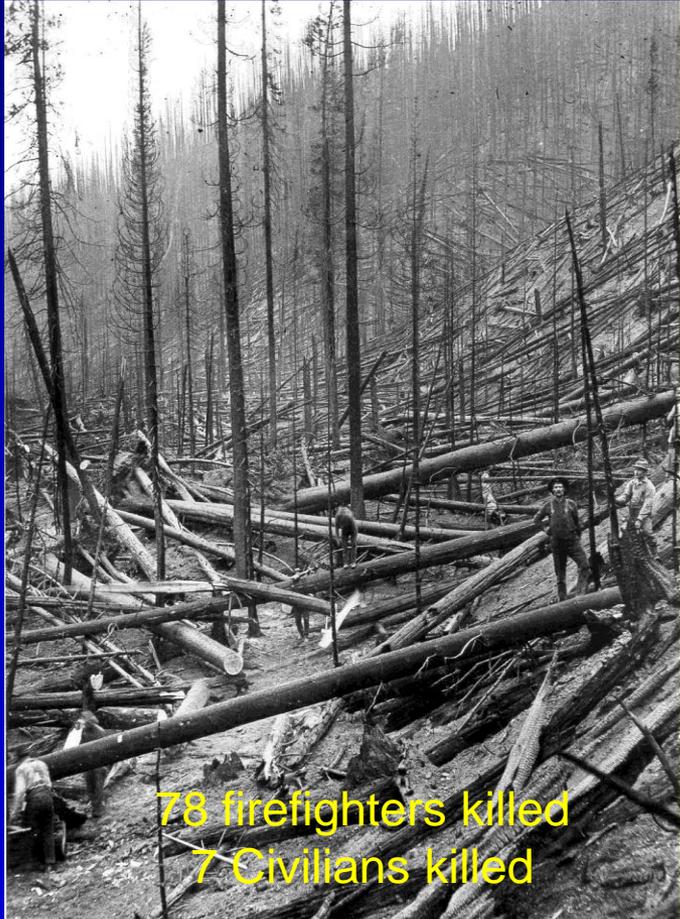




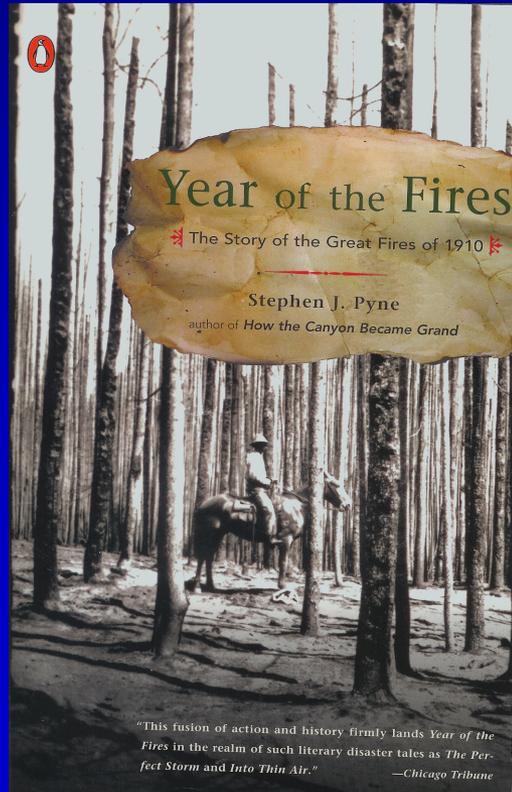
Northern Rockies August 20-21, 1910



One-third of Wallace Burned



78 firefighters killed
7 Civilians killed



Year of the Fires

The Story of the Great Fires of 1910

Stephen J. Pyne

author of *How the Canyon Became Grand*

"This fusion of action and history firmly lands *Year of the Fires* in the realm of such literary disaster tales as *The Perfect Storm* and *Into Thin Air*."
—Chicago Tribune



1,736 fires
3.1 million ac.

Moist Forest Change Decline of White Pine



Blister rust



European disease
introduced beginning
of century



Civilian
Conservation Corp

Pulling Ribes
“Like bailing
the ocean with
a tea cup”



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Dry Forest Change

- Climate change (cycles)
- Grazing
- Fire Exclusion
- Timber harvesting
- Urbanization
- Land-use changes
- Insects
- Disease
- Reproduction

1909



1948



1989



Bitterroot - Montana



Fire

Exclusion/Succession





Dry Forest Change Idaho 2007

- 1.9 million acres
- 1454 fires
- Cascade complex
300,000 + acres





Historical Forest Floor



Nutrients and microbial activities deep in mineral soil





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Nutrient/organic matter compression towards the soil surface



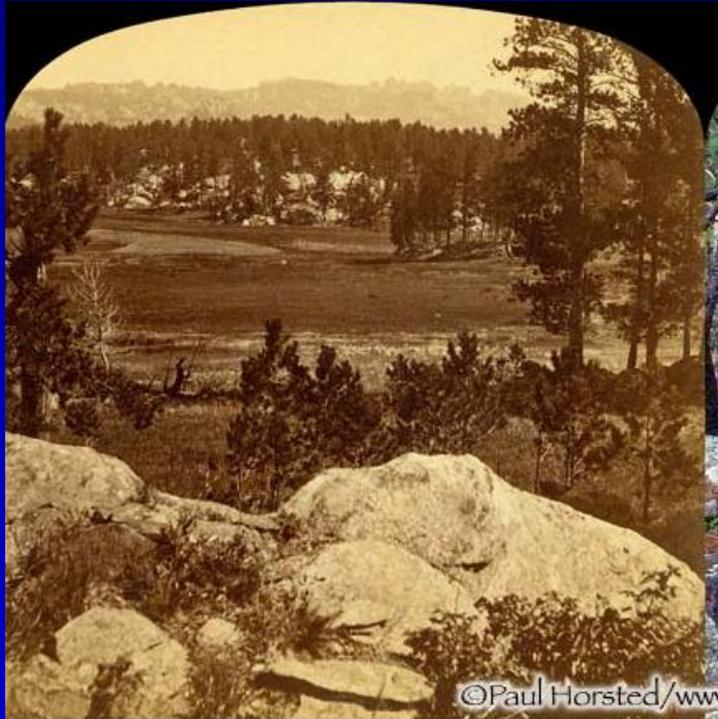
Crowns



Soil surface



Roots/myco/
nutrients



©Paul Horsted/www

Custer Expedition Stereograph by W

1874



www.custertrail.com

W.H. Illingworth "Agnes' Park."

2000



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Forests as Fuel

Crown

A Canopy

B Ladder

C Shrub

Surface

D Low veg

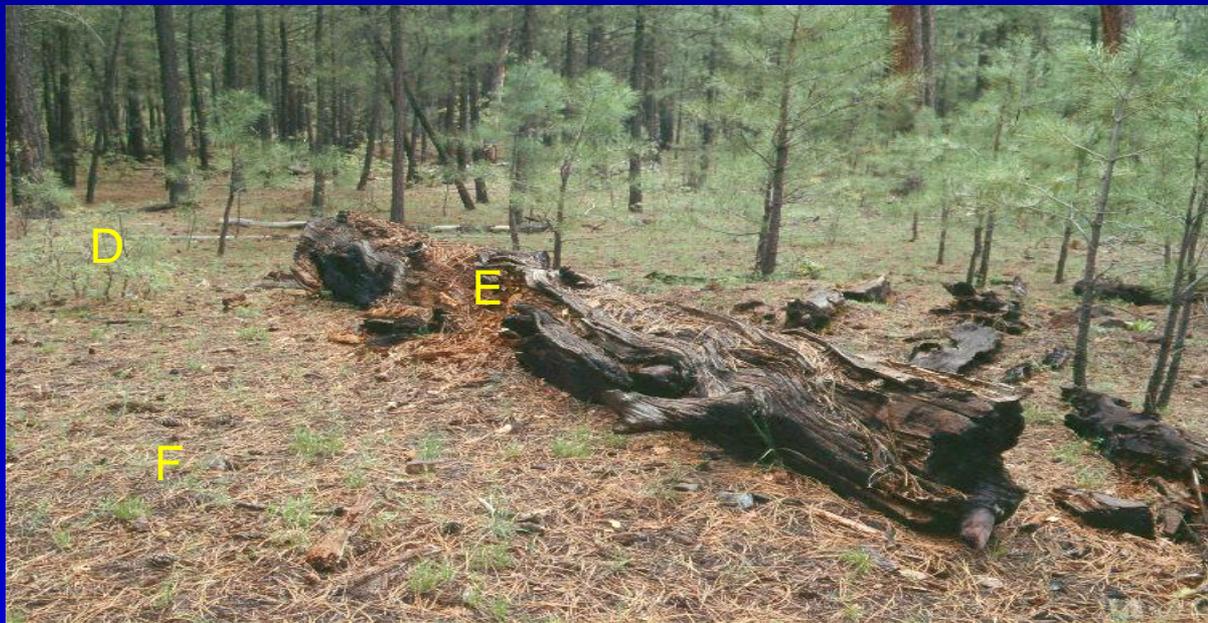
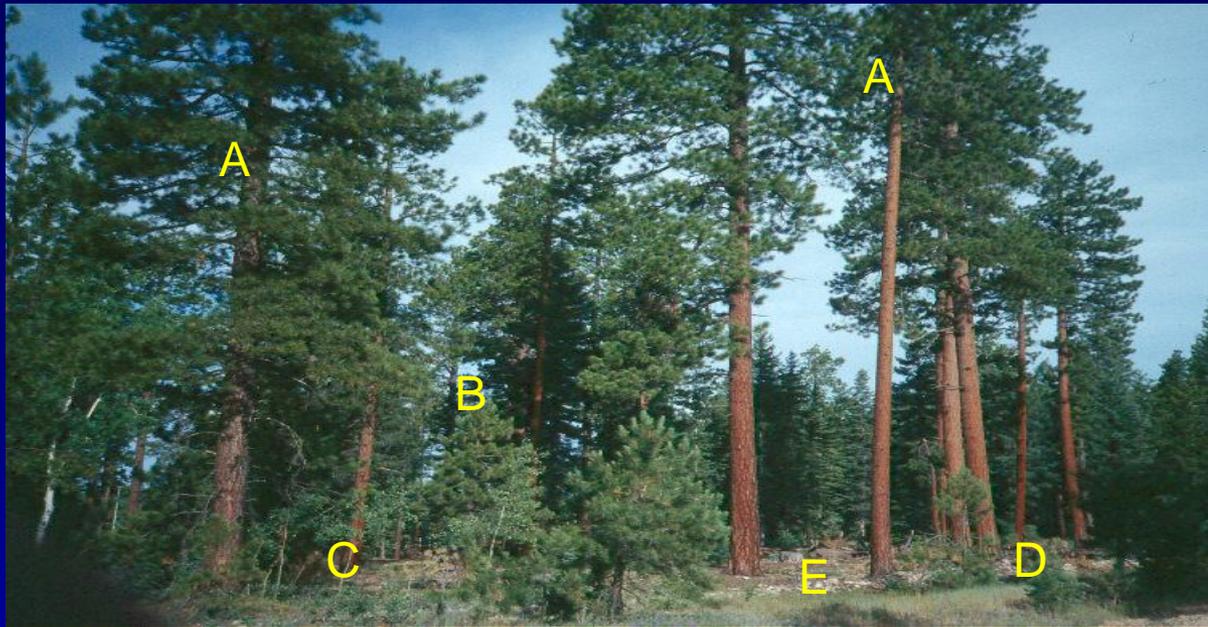
E Woody fuel

F Ground fuels

Smoldering

E Woody

F Ground





Ponderosa Pine Fire Resistance

- Seedlings can maintain themselves with fire intervals as short as 6-years
- Self pruning
- Open loose foliage (Low bulk density)
- Unburnable bark



Decomposers

- Top rotters
- Bottom rotters
- Live rotters
- Dead rotters
- White rotters
- Brown rotters
- Black rotters





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Roller Chopping and Chipping

- Create deep compacted layers
- Insulating soil surface
- Slowing decomposition
- Especially on cool sites
- Destroys
 - Nitrogen fixation
 - Animal habitat
 - Site protection

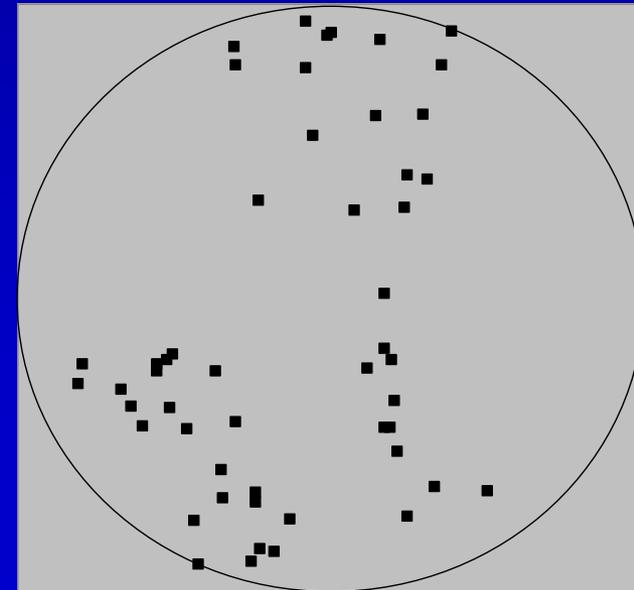




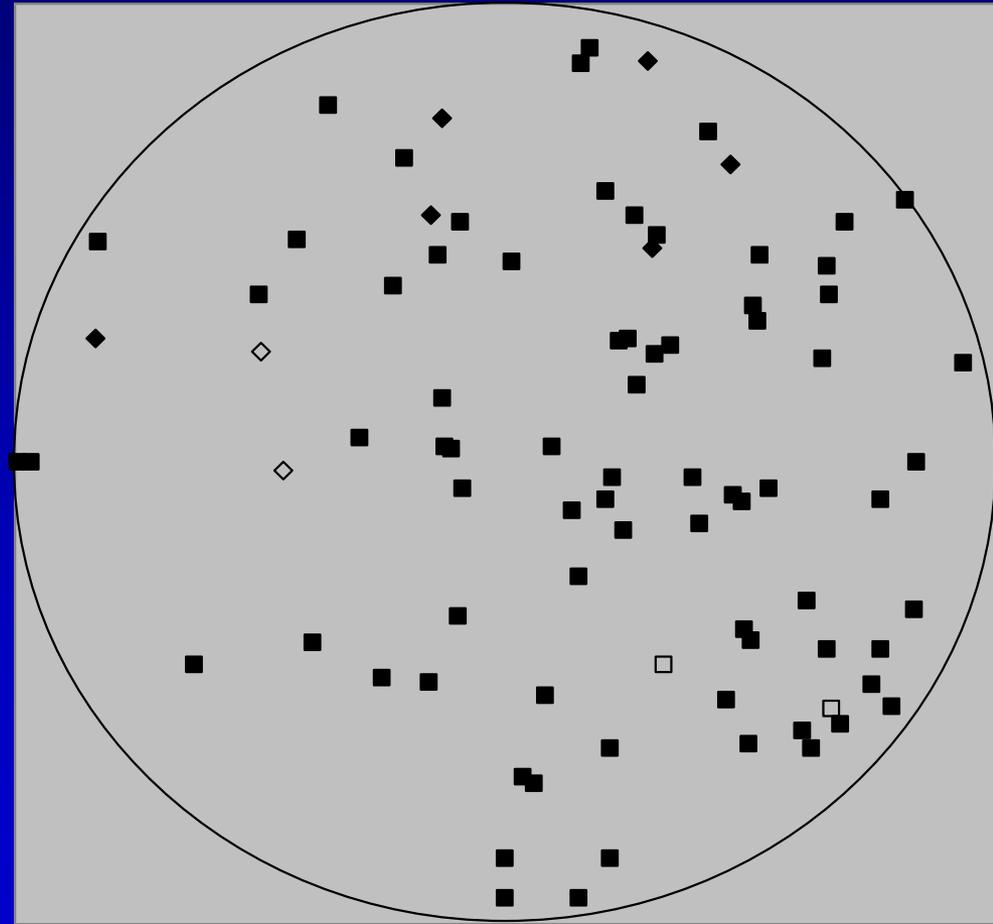
RMRS

Vertical and Spatial Arrangement

- Spatial
 - Group
 - Line
 - Regular
- Vertical
 - Single story
 - Multi-story



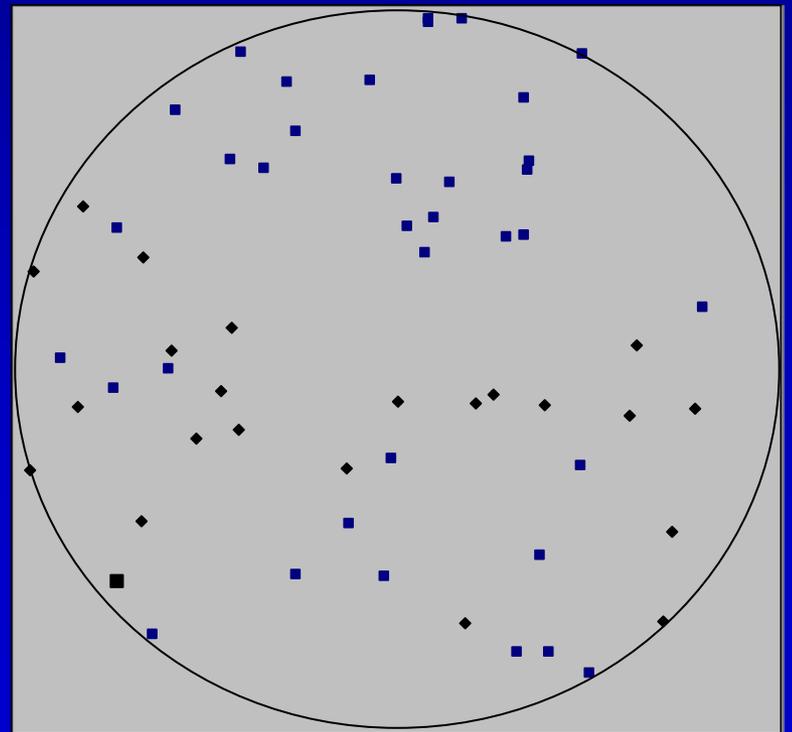
Dry Forest Treatments





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Dry Forest Ladder Fuel Treatments



118 5"+ Trees/Ac

575 Total Trees/Ac

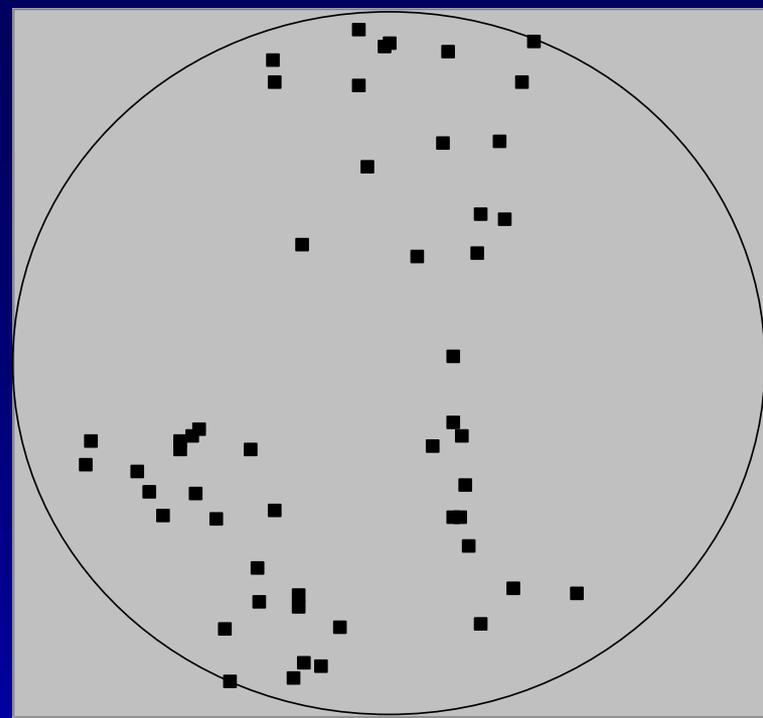
112 Ft² BA/Ac



Dry Forest Treatments



56 Trees/Ac
70 Ft² BA/Ac





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Chunking





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9-months Later

Chunk



Chunk and Burn



Cleaning/thinning Ladder Fuels





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Snow Well Burning

- Lower layers
 - >100% moisture
 - < 40° F
- Fine root activity minimal





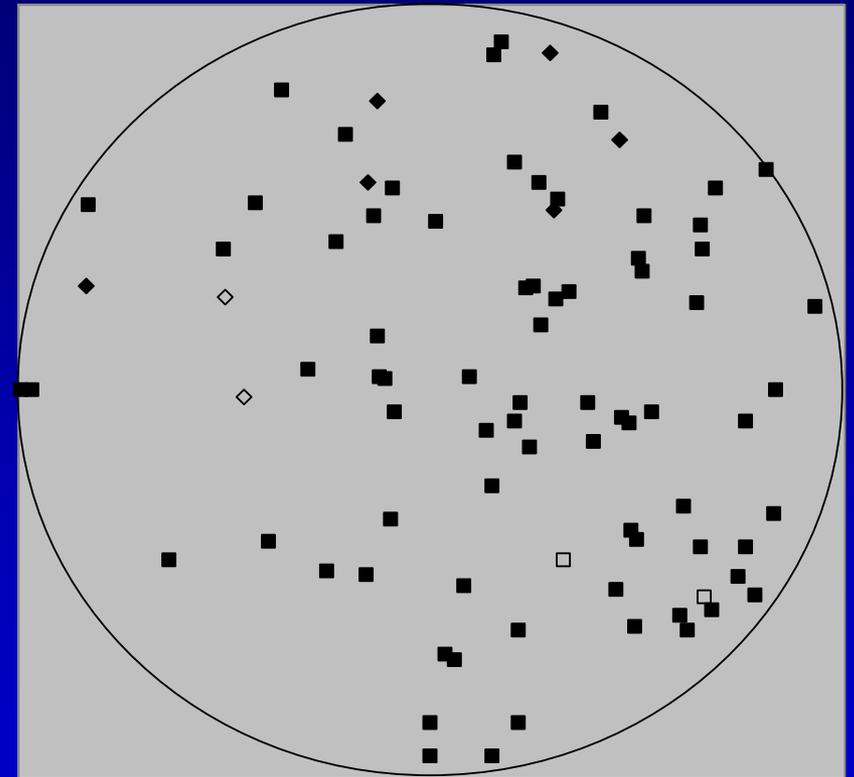
Moist Forest Treatments Urban Interface



Moist Forest WUI Treatments



CWD 33.8 Tons/Ac



179 Trees/Ac

121 Ft² BA/Ac



Moist Forest Treatments

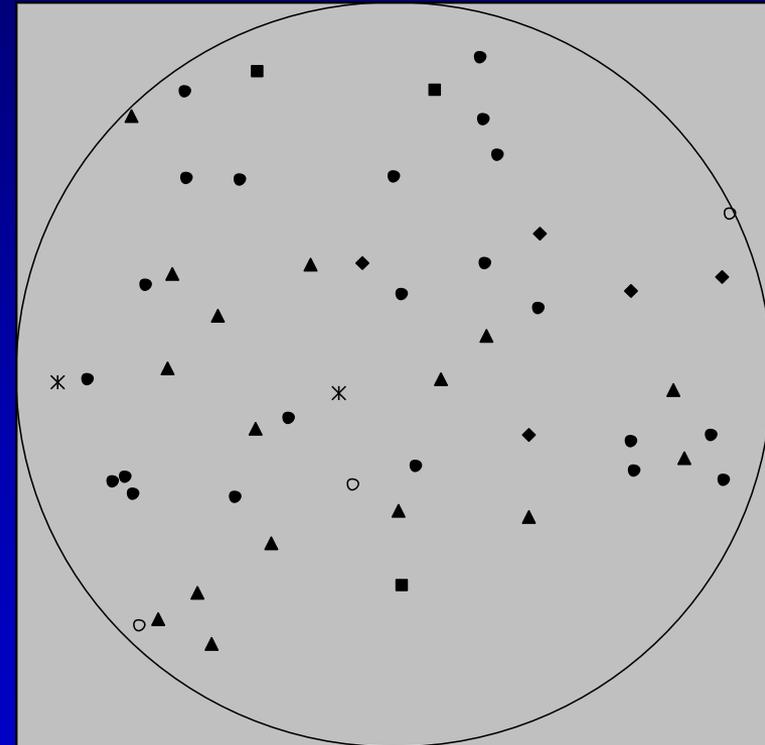
- Yr 0---Standing dead removal
- Yr 4 --- Hazard tree removal
- Yr 8 --- selection cutting
- Yr 10 --- Surface fuel reduction
 - Chunking & piling and burning
- Yr 18 Selection cutting



Moist Forest Treatments



CWD 13.4 tons/Ac



117 Trees/Ac
118 Ft² BA/Ac



Moist Forest Restoration



Harvesting-Ladder Fuels, Surface Fuels

- Restore western white pine
- Reduce stand and landscape fire risk
- Irregular selection
- Shelterwoods





Post Harvesting Pre-mastication



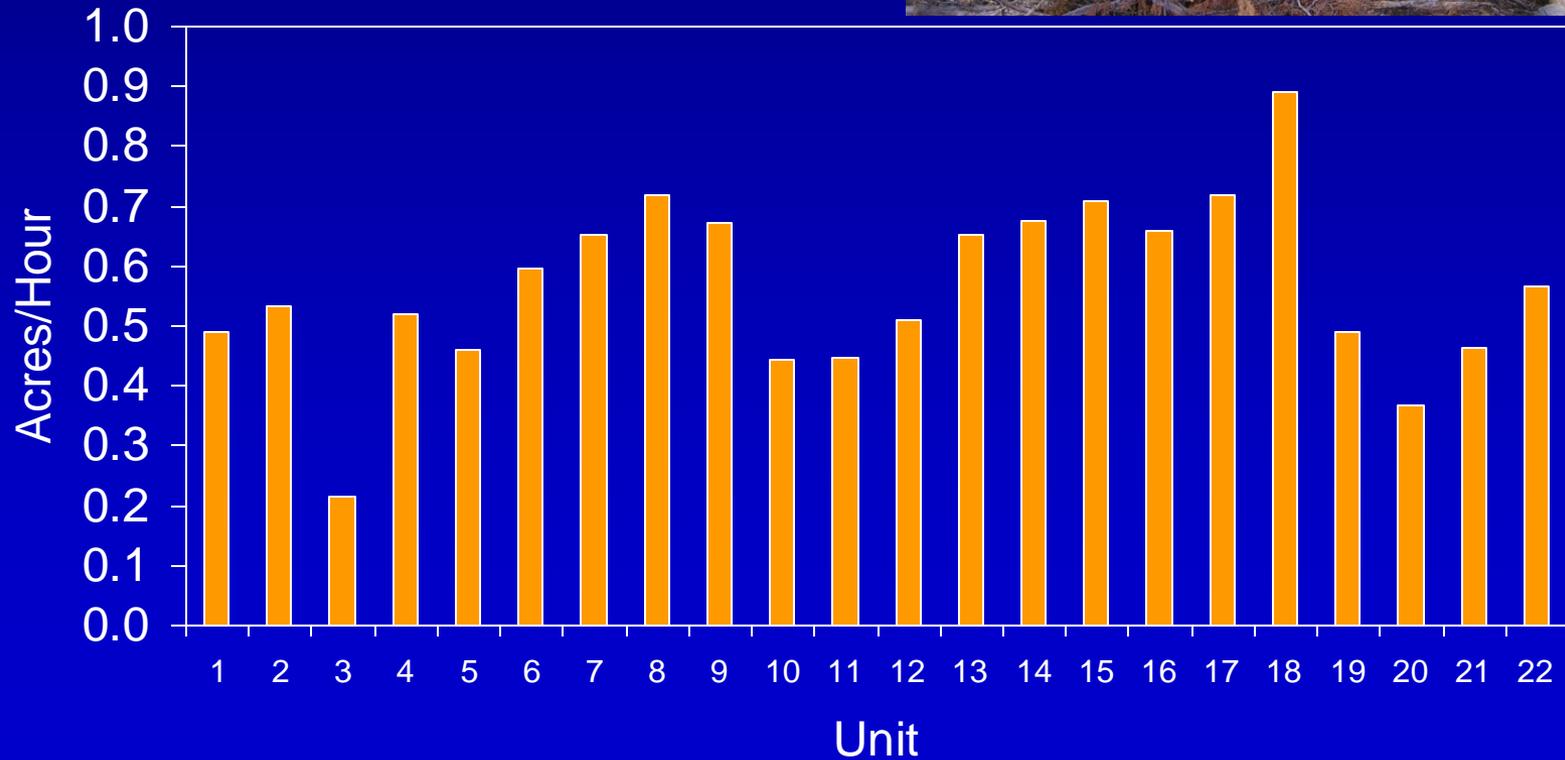
137 Trees/Ac
118 Ft² BA/Ac



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Production

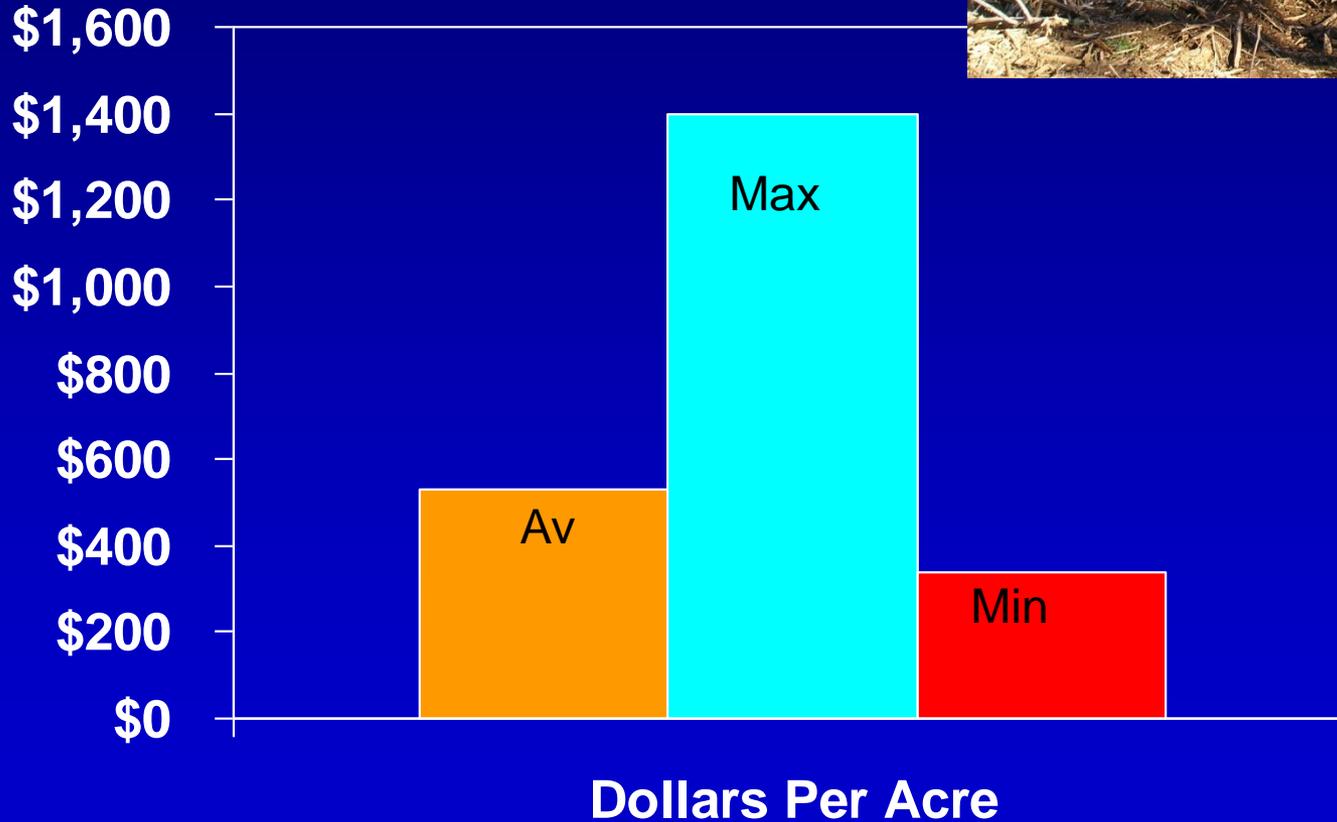
Mean 0.57 acres/hour





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Cost Per Acre 37.5 Acs.



Post Mastication



88 Trees/Ac
116 Ft² BA/Ac



Mastication

Moist Forest Ladder Fuels



1286 Trees/Ac

57 Ft² BA/Ac

CWD 17.3 Tons/Ac



Post Mastication



268 Trees/Ac

41 Ft² BA/Ac



Post Mastication





Forest Treatments in Idaho Forests

- Diverse forest settings
- Diverse moist and dry forests
- One-size treatment does not fit all forests
- Variety of wildfire intensities and burn severities
- Integrated silvicultural prescriptions tailored to the forest and management objectives





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