



Forest Organic Materials Their Nutrition and Management



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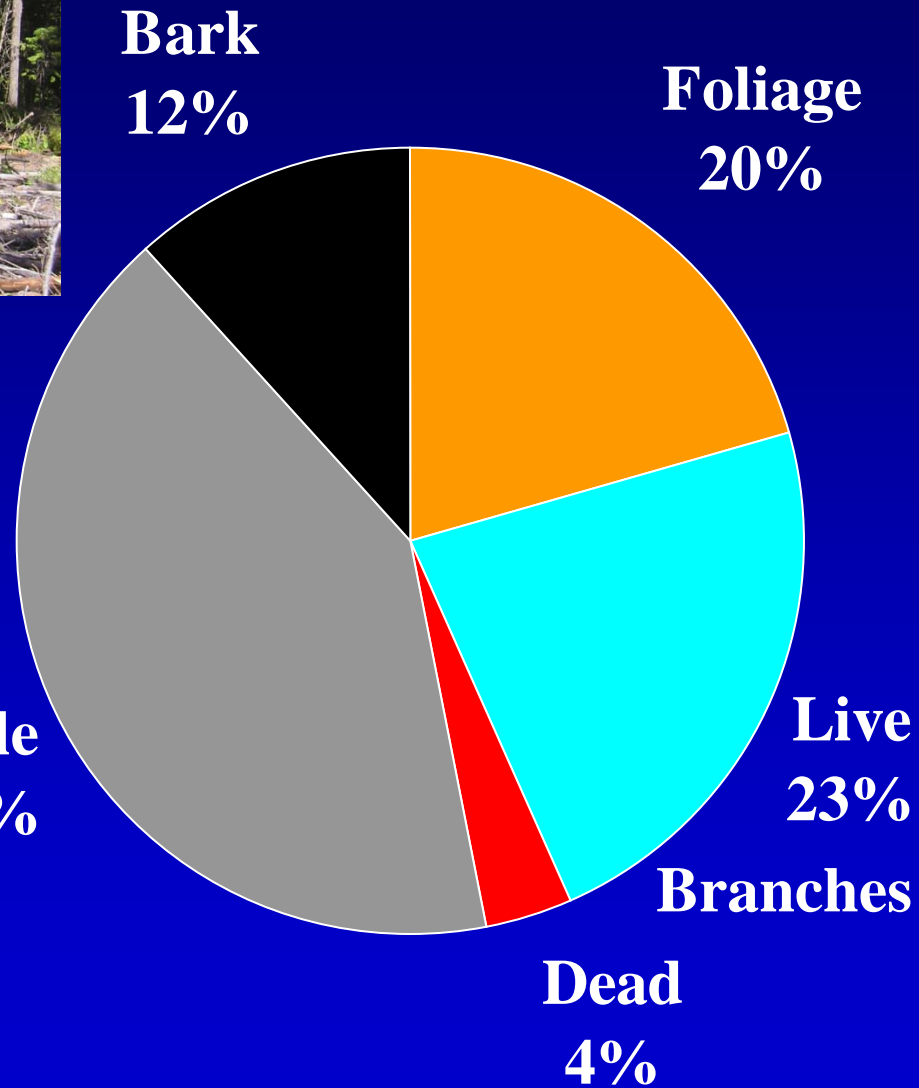
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Rocky Mountain Research Station



Potassium In Douglas-fir



Bole
41%

Bark
12%

Foliage
20%

Live
23%

Branches

Dead
4%

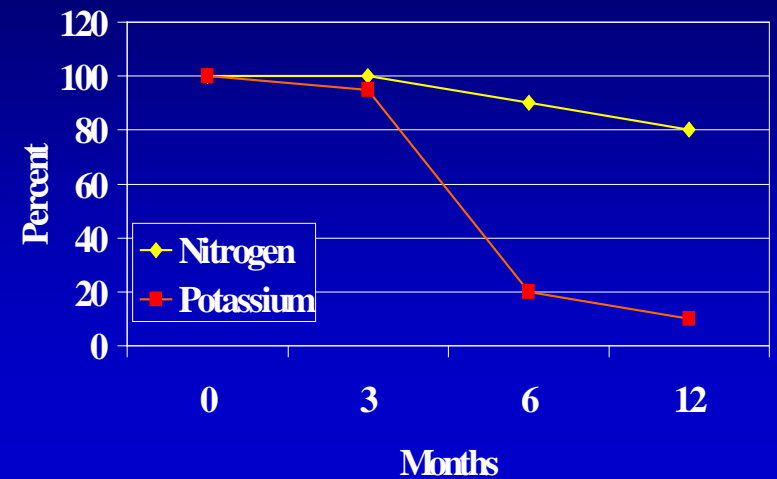


RMRS

Nutrient Leaching

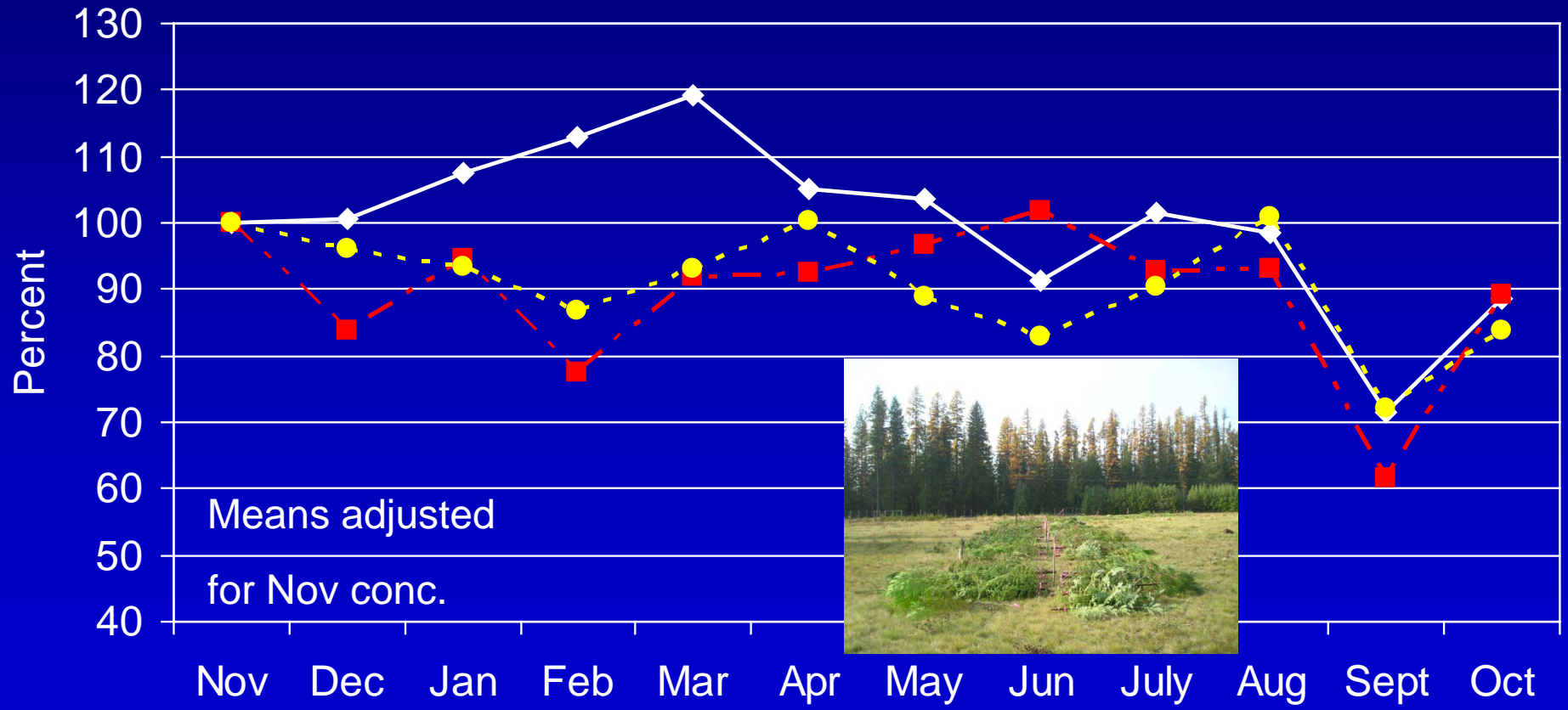


Nitrogen and Potassium Loss Slash



Potassium Nutrient Concentrations

—◆— W Pine -■- D Fir -●- P Pine

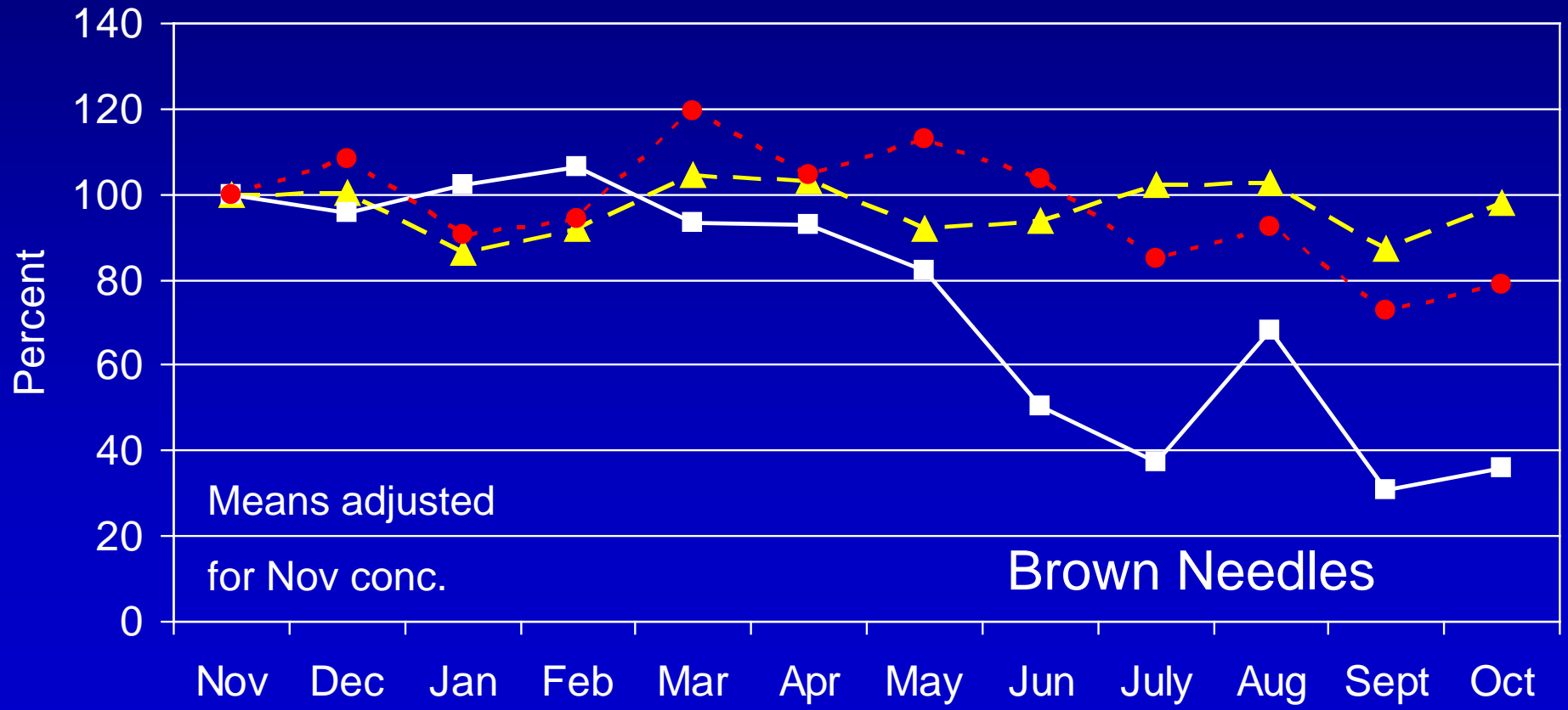




Potassium Nutrient Concentrations



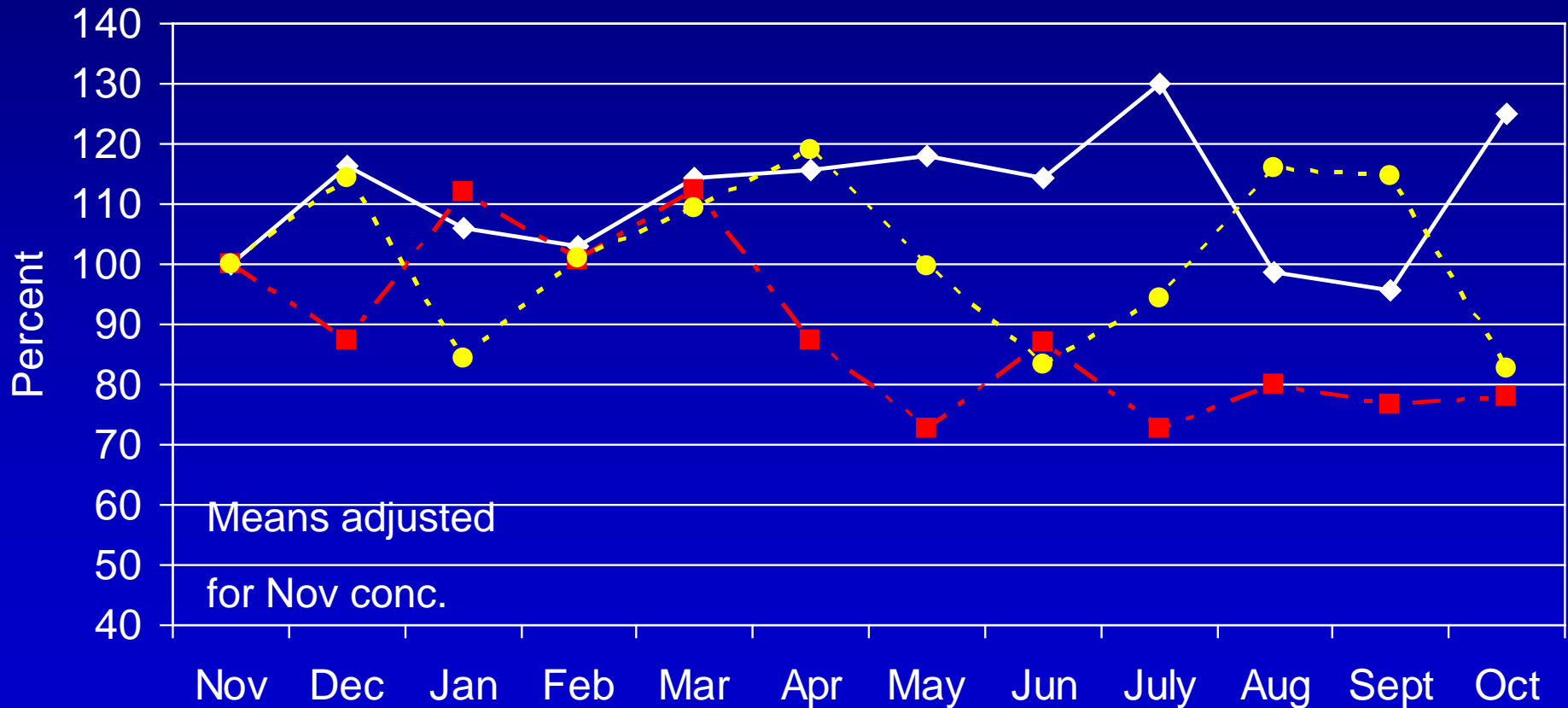
—▲— G Fir —■— Hemlock -●- Cedar





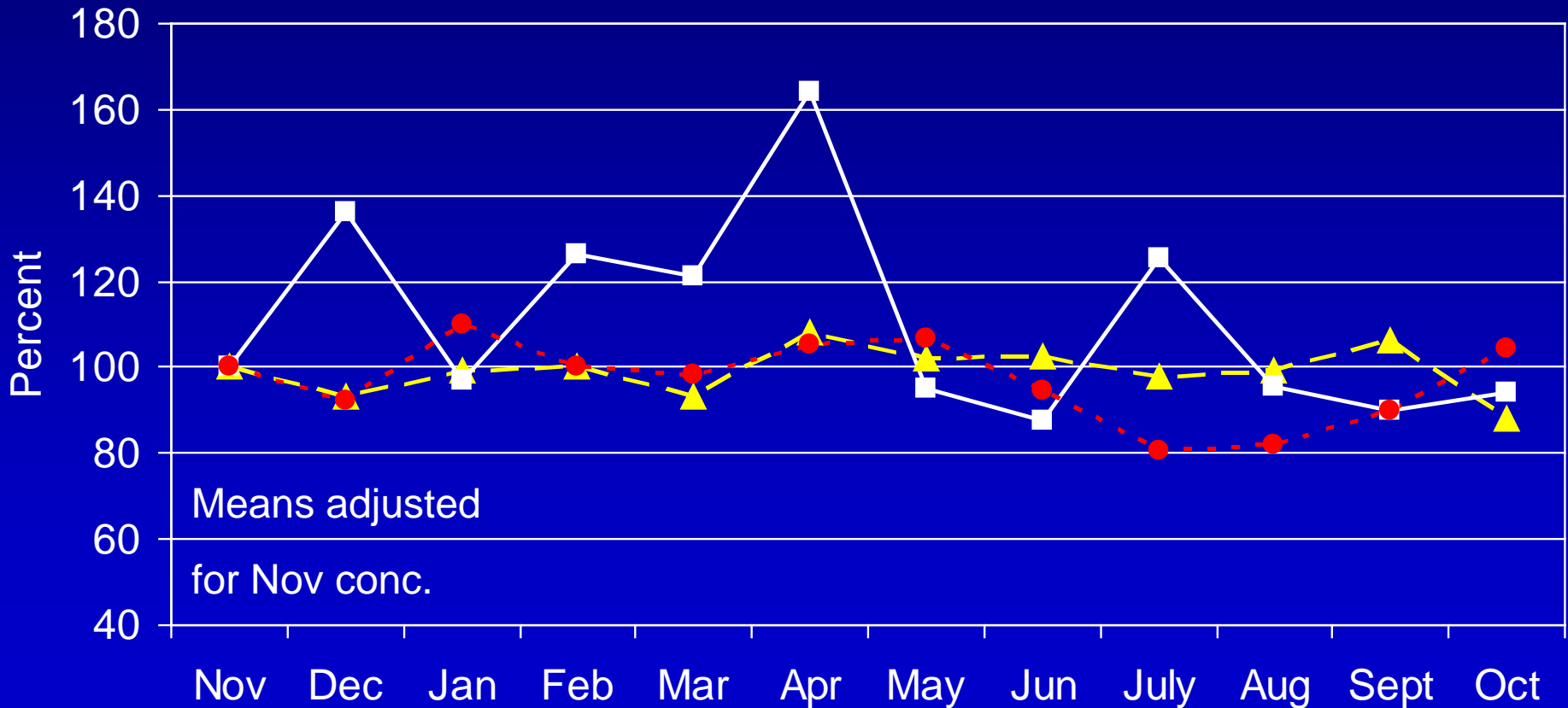
Calcium Nutrient Concentrations

—◆— W Pine -■- D Fir -●- P Pine



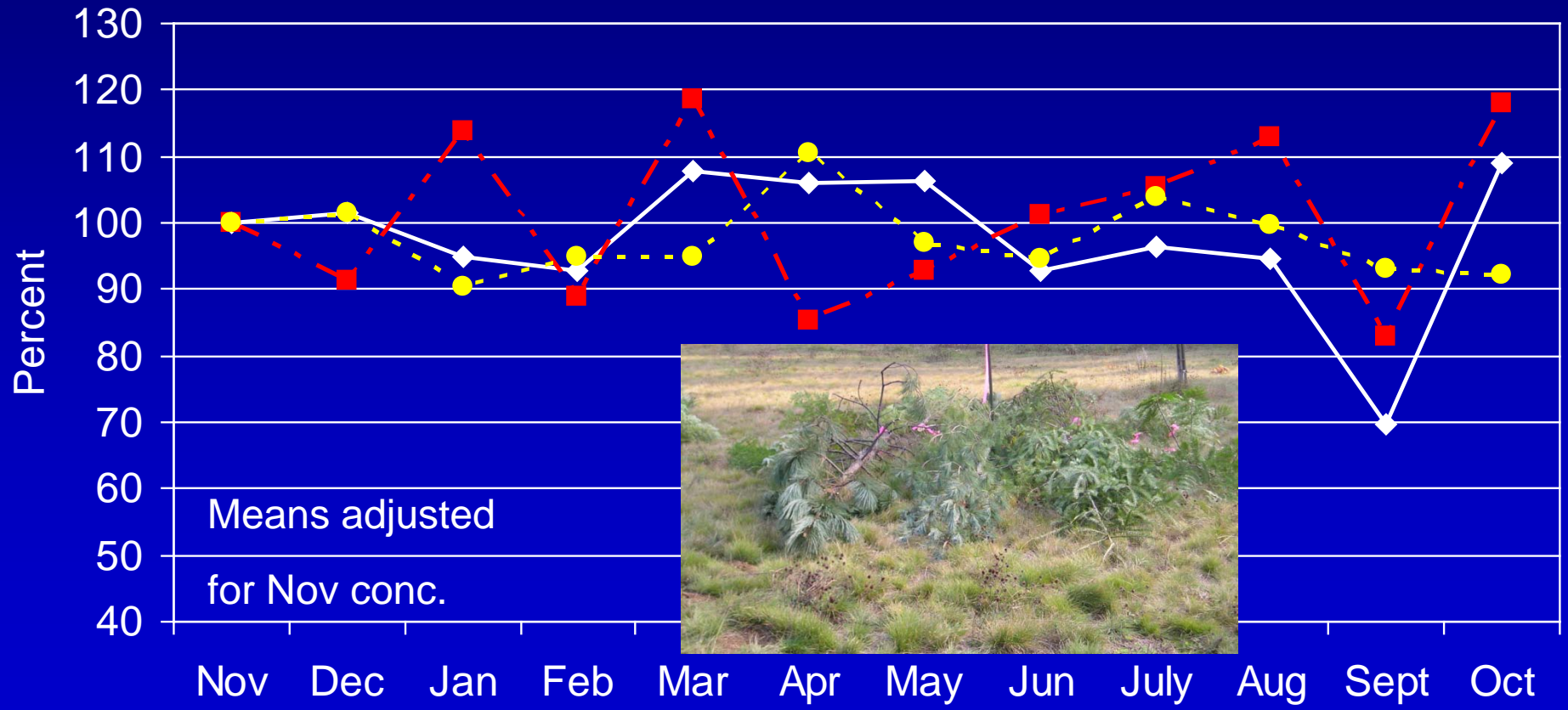


Calcium Nutrient Concentrations



Magnesium Nutrient Concentrations

—◆— W Pine -■- D Fir -●- P Pine

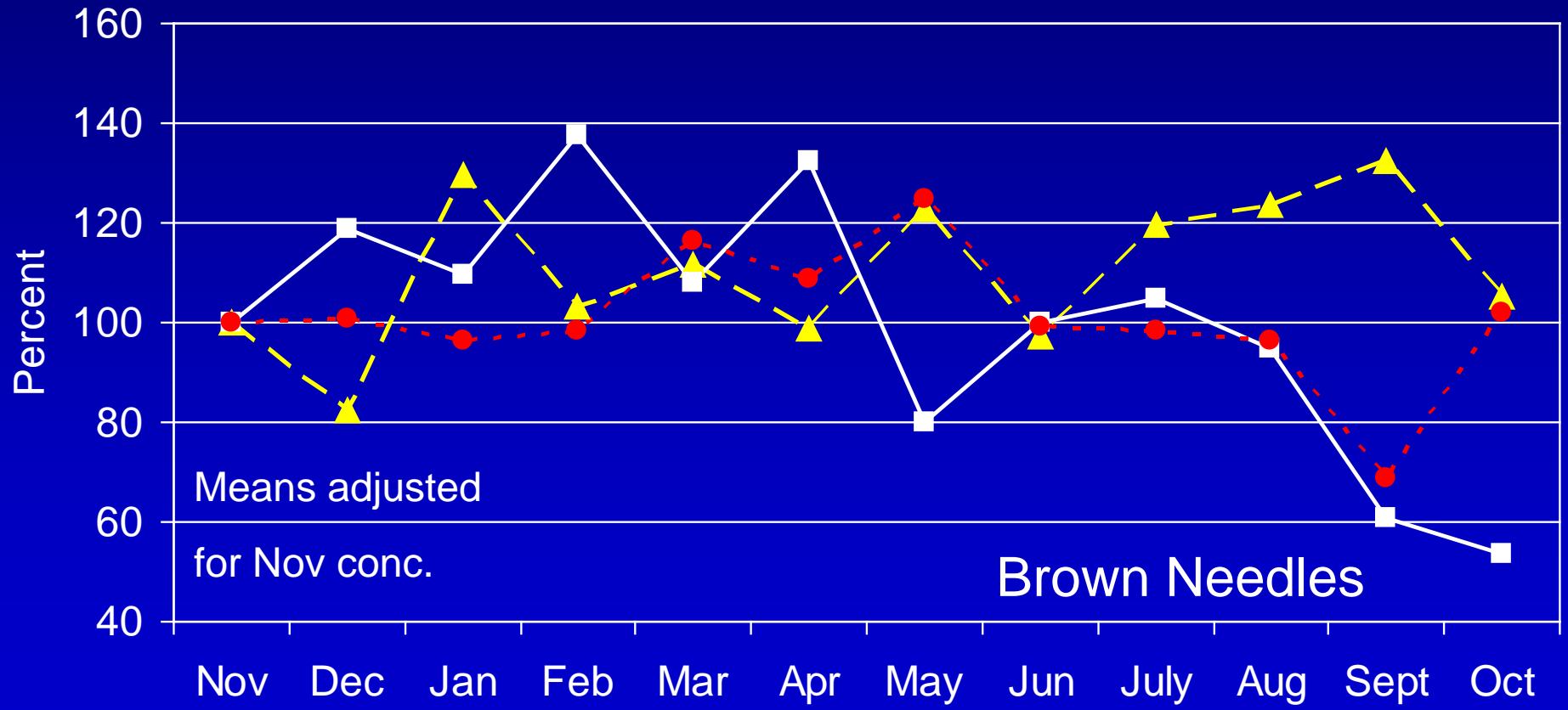




Magnesium Nutrient Concentrations

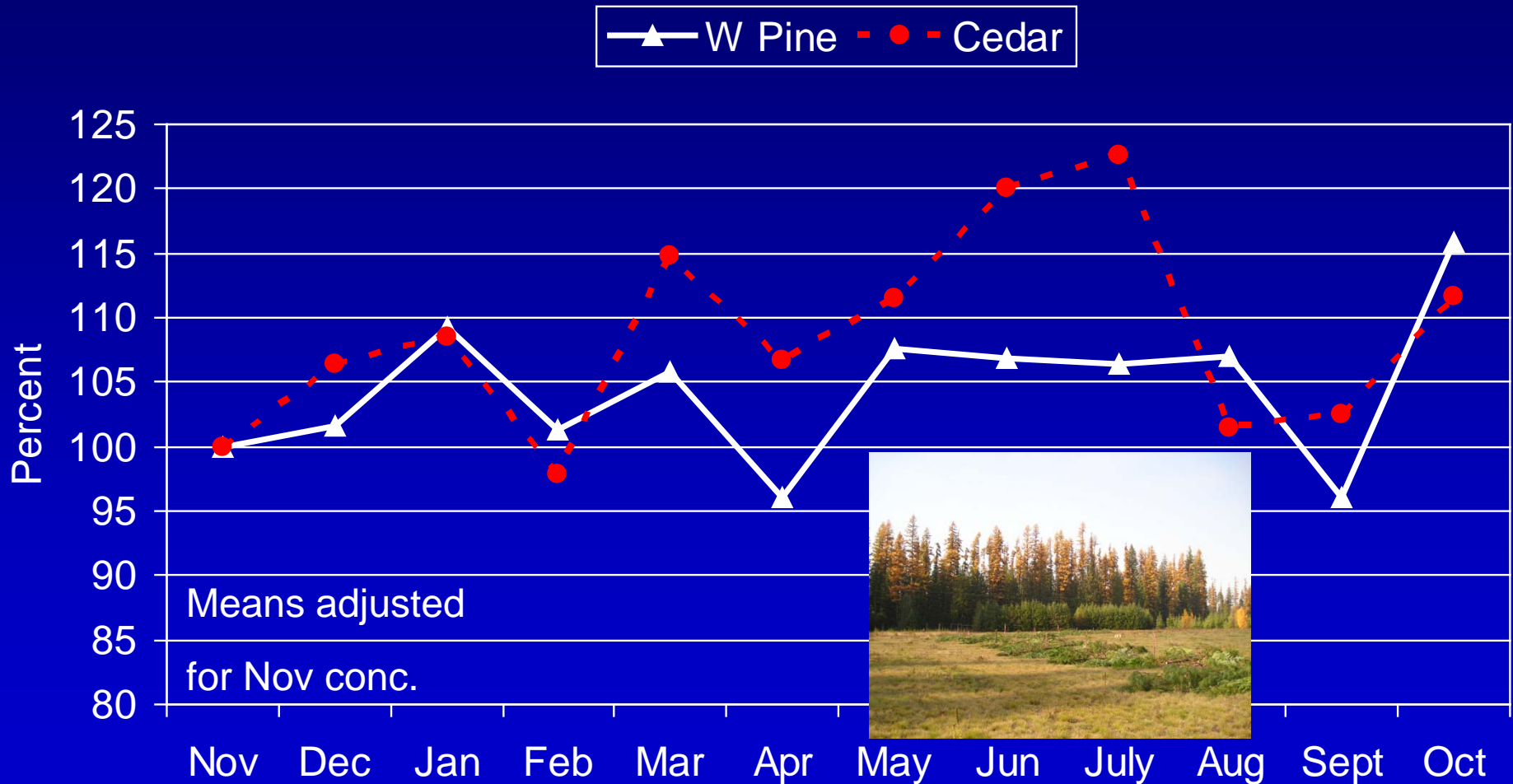


—▲— G Fir —■— Hemlock -●- Cedar



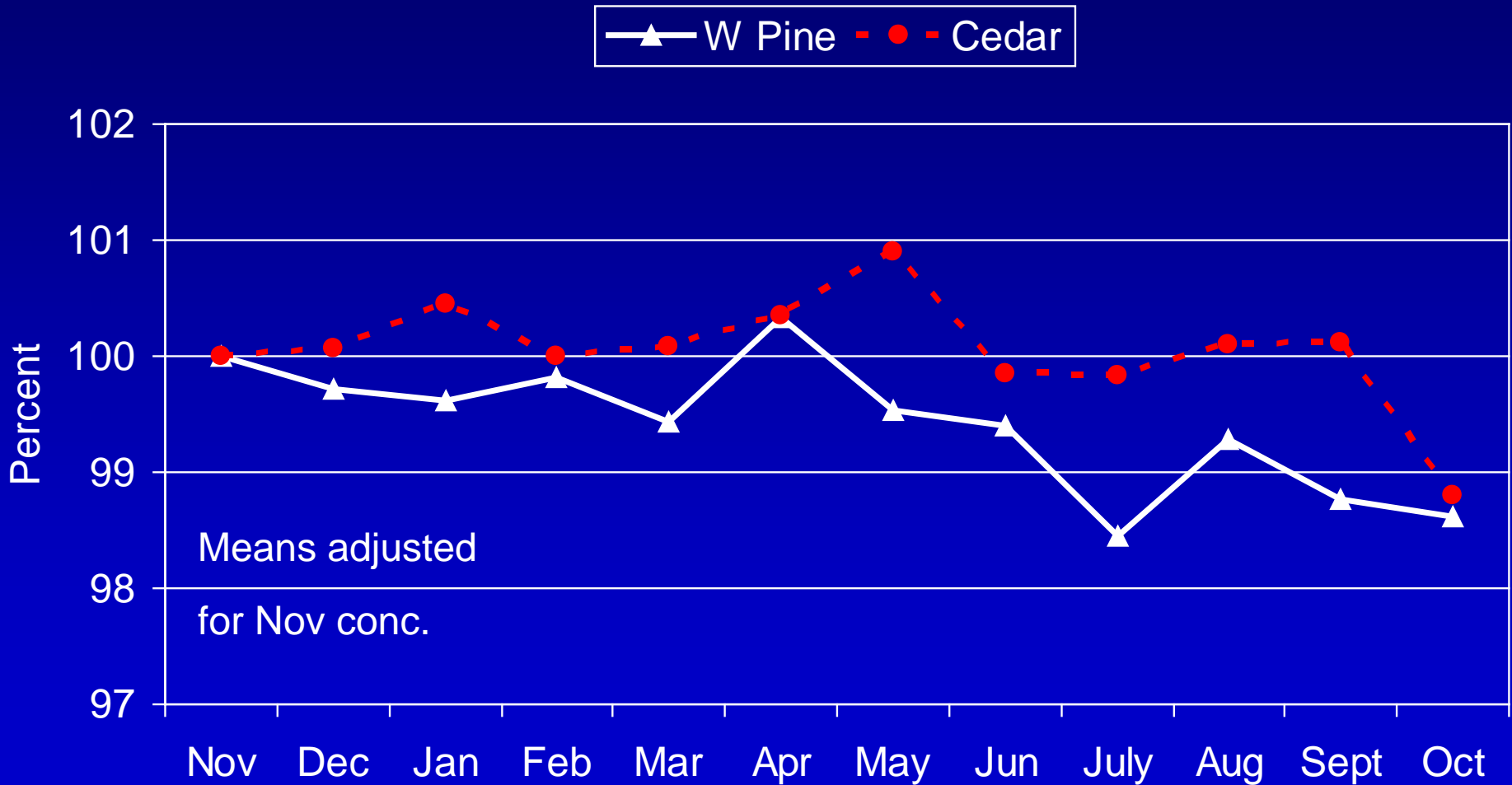


Nitrogen Nutrient Concentrations





Carbon Concentrations

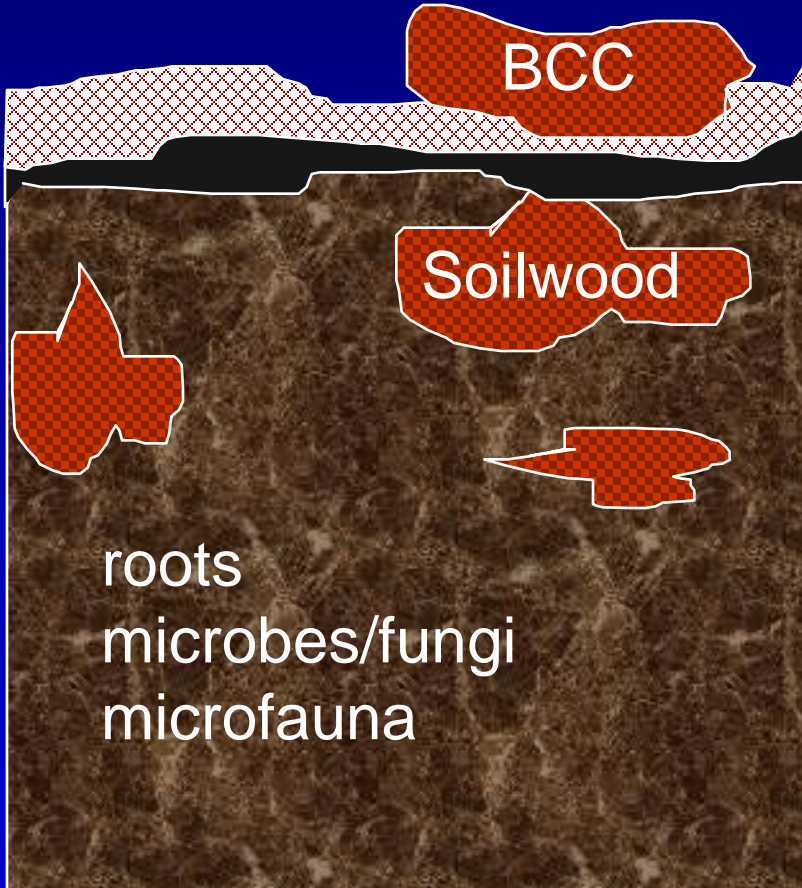




Forest Soil



Litter



BCC

Soilwood

Humus

Shallow mineral (0 – 5 cm)

Deep mineral (5 + cm)

roots

microbes/fungi

microfauna



Nitrogen Contents

Douglas-fir/ninebark




Component	Amount kg/ha/N	%
Residue	68	3
Soil wood	419	16
Forest floor	438	17
Mineral 0-5 cm	543	21
*Percent Vulnerable		56
Mineral 5-30 cm	1162	44



*Subject to displacement and volatilization from harvesting and site preparation

Ectomycorrhizae Distribution

Douglas-fir/ninebark

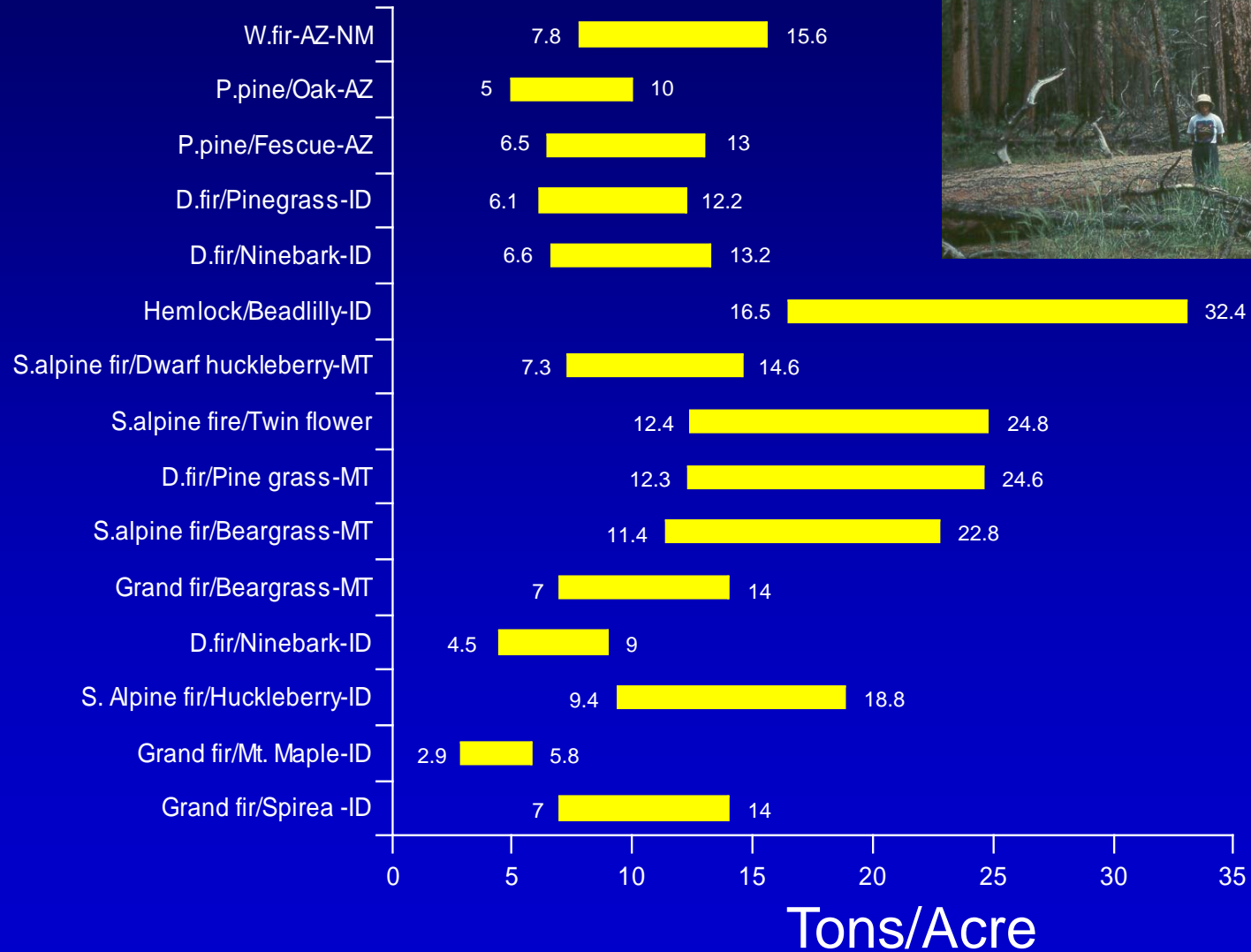
Component		Percent
Litter		14
Soil wood		33
Humus		30
*Vulnerable		77
Mineral soil		23

*Subject to displacement and volatilization from harvesting and site preparation



Coarse Woody Debris

Habitat Types



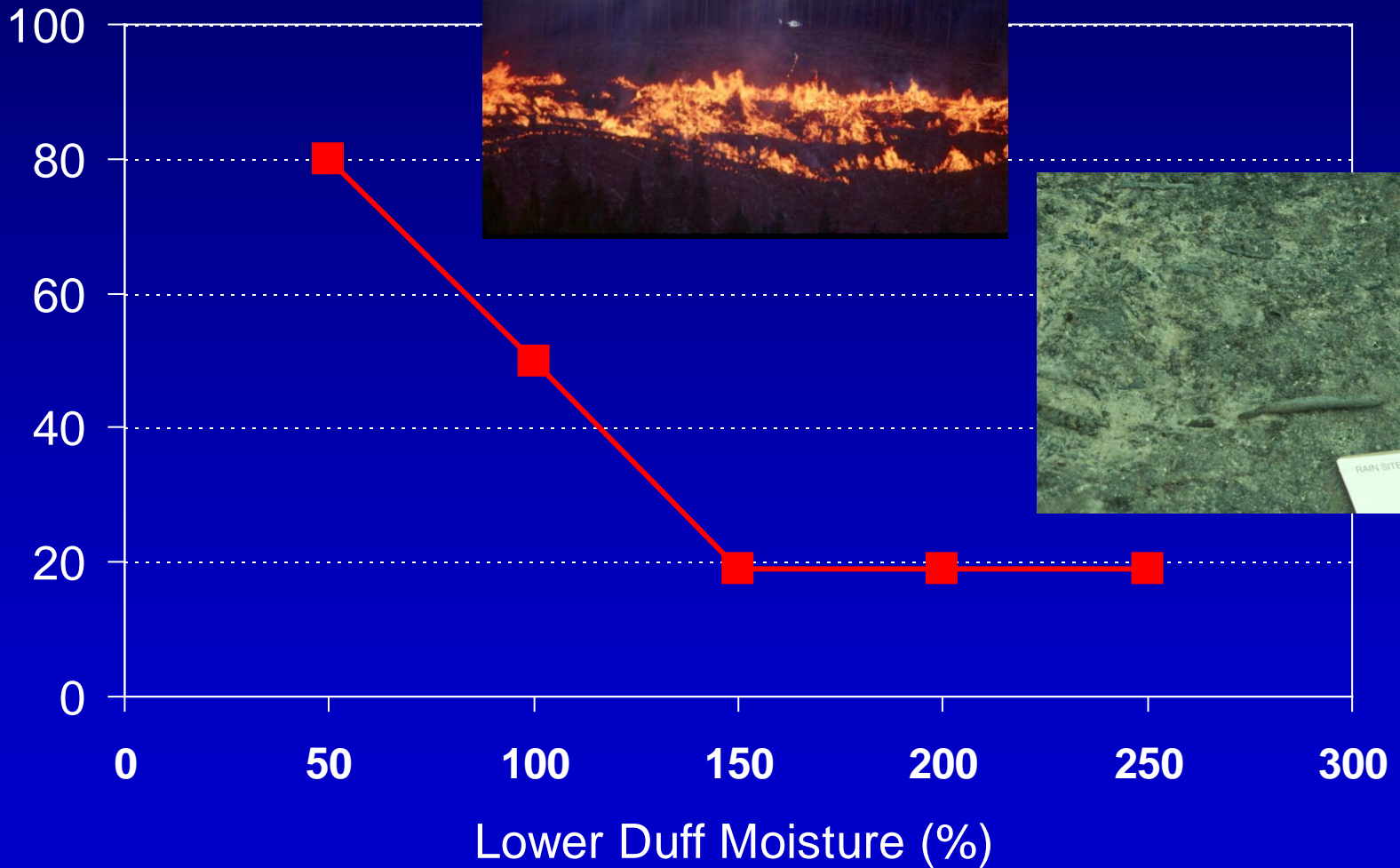


Prescribed Fire



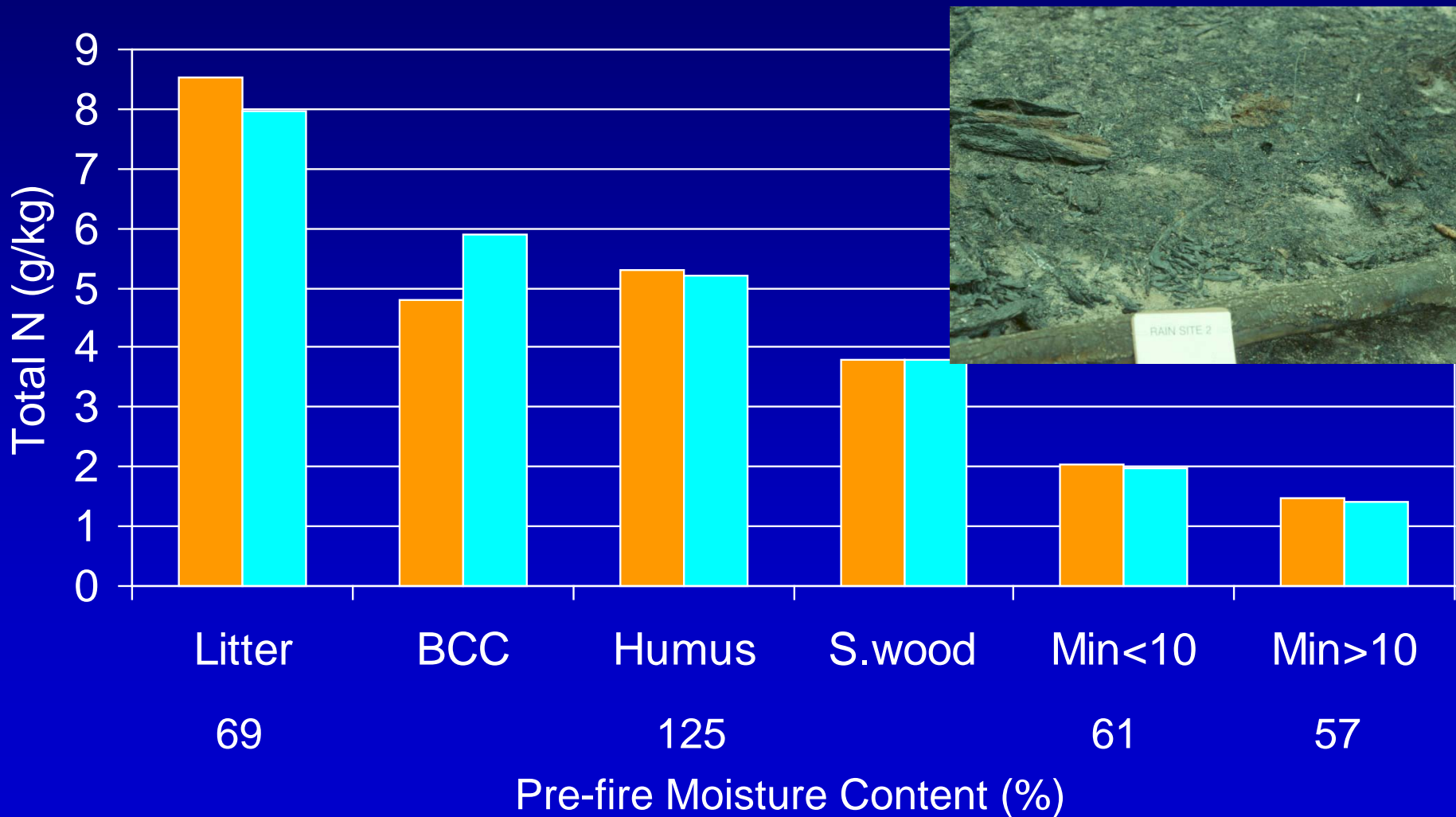
Duff Reduction

Duff Reduction %



Total N Spring Burn Hemlock CLUN/Ash Soils

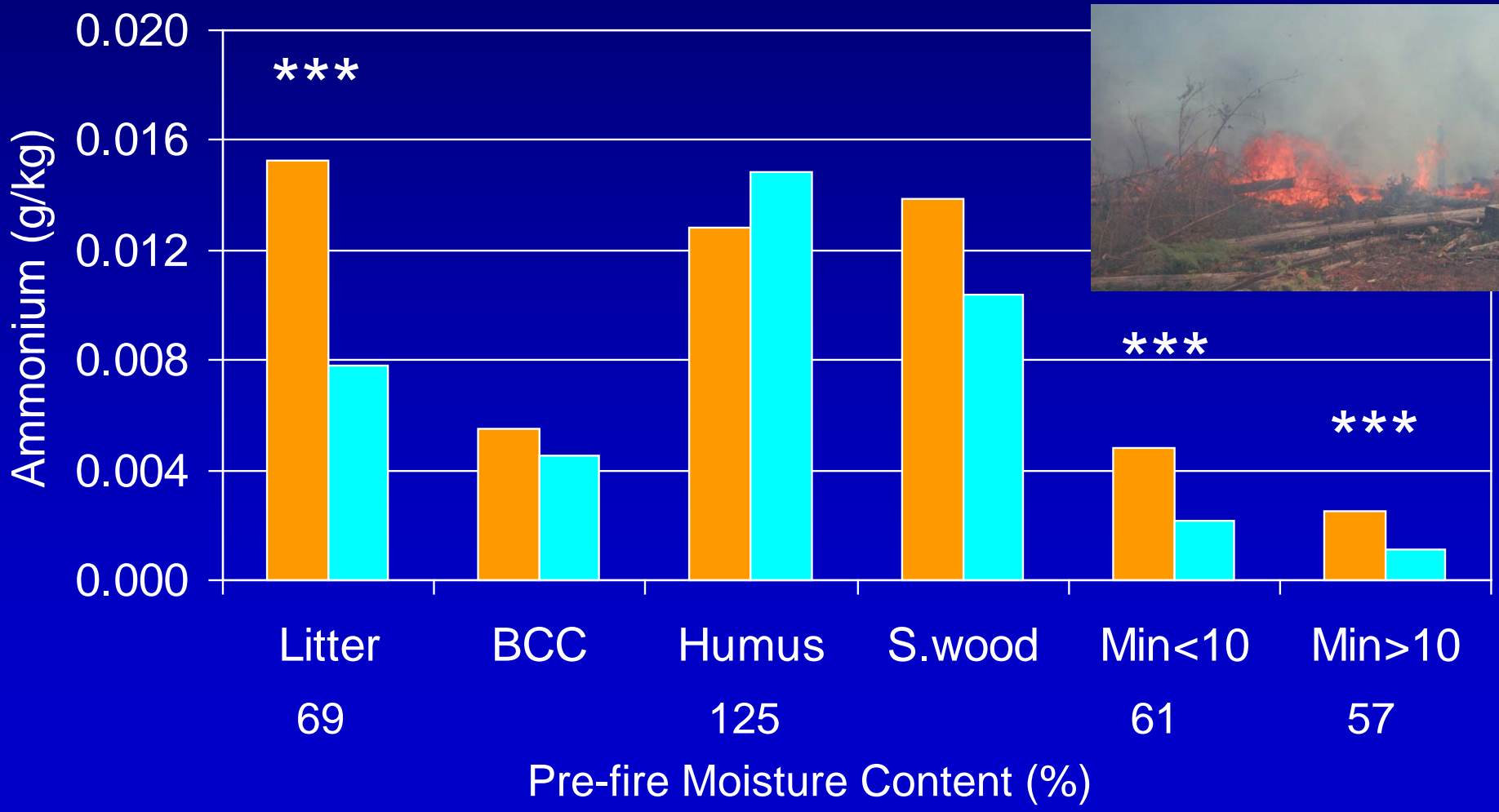
Pre-fire Post-fire



Ammonium (NH_4) Spring Burn Hemlock CLUN/Ash Soils



Pre-fire Post-fire

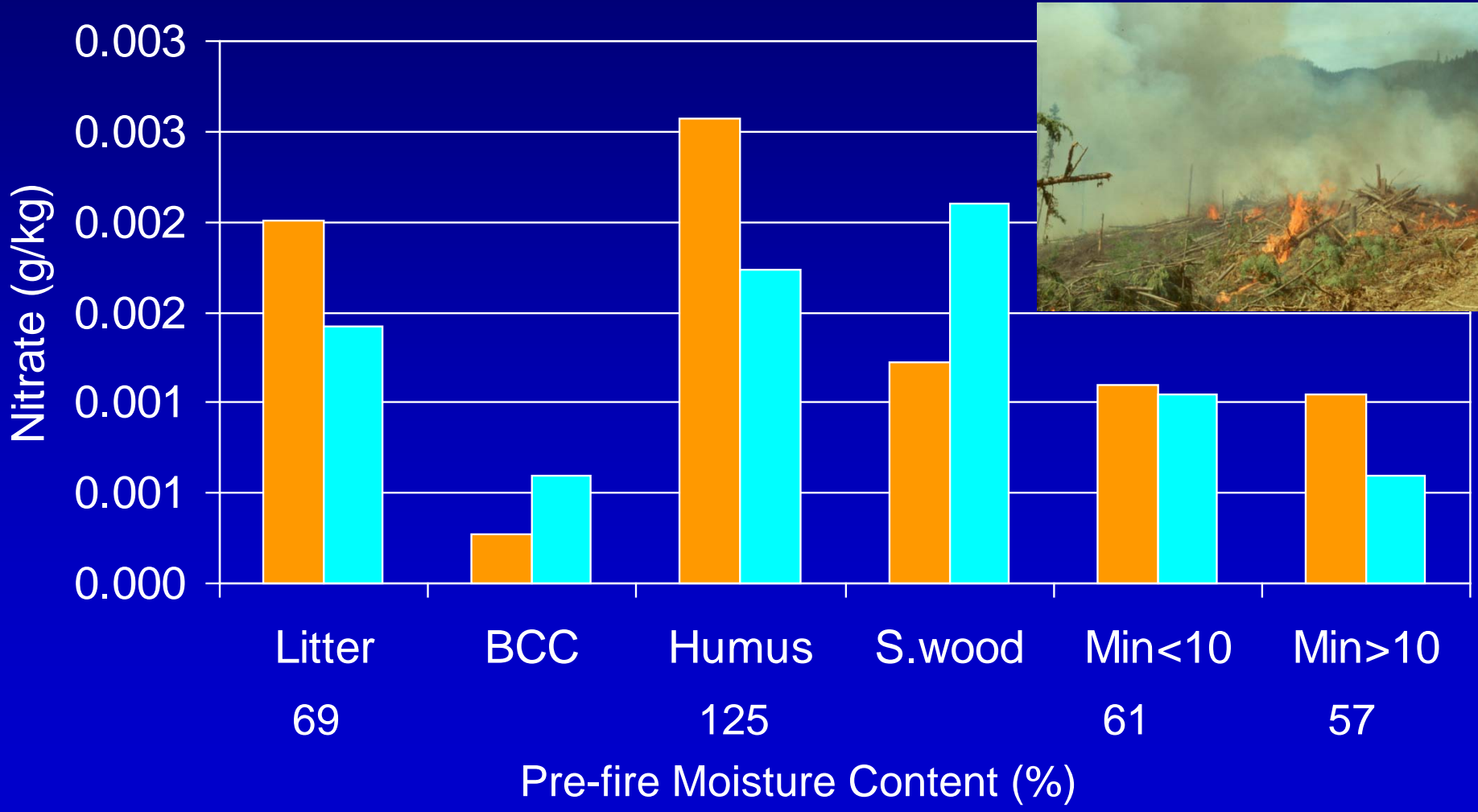




Nitrate (NO_3) Spring Burn Hemlock CLUN/Ash Soils



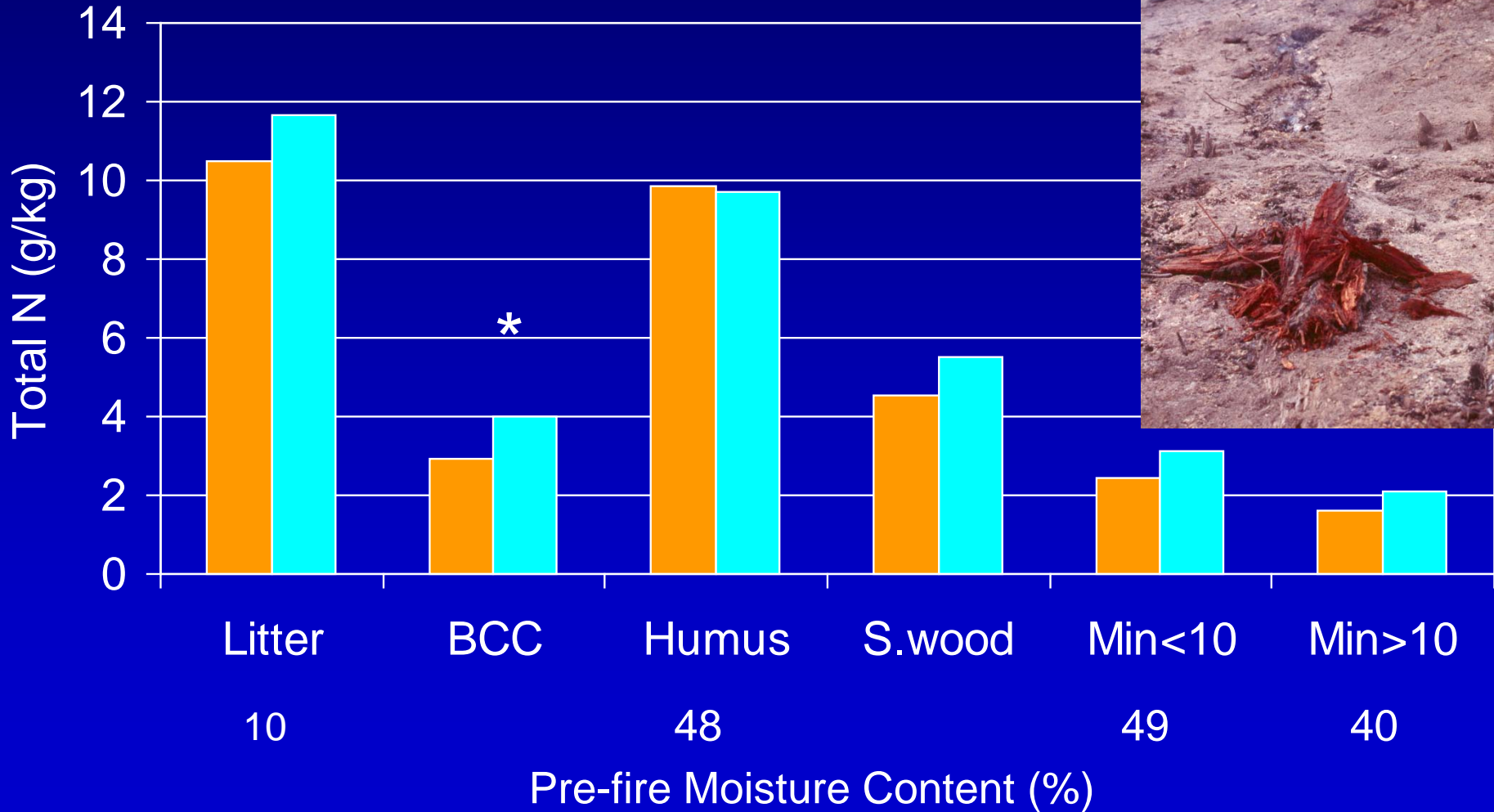
Pre-fire Post-fire



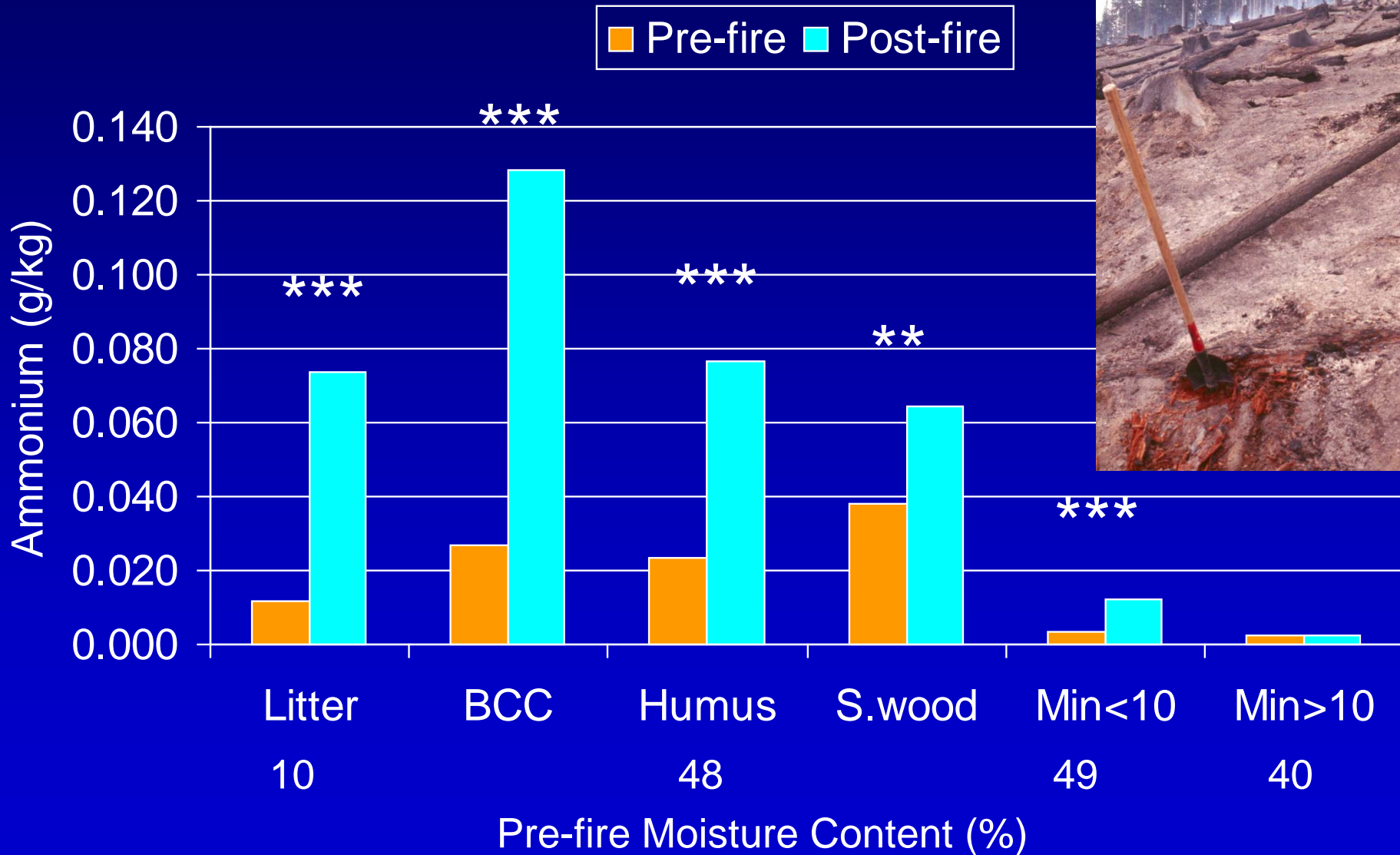
Total N Summer Burn Hemlock CLUN/Ash Soils



Pre-fire Post-fire

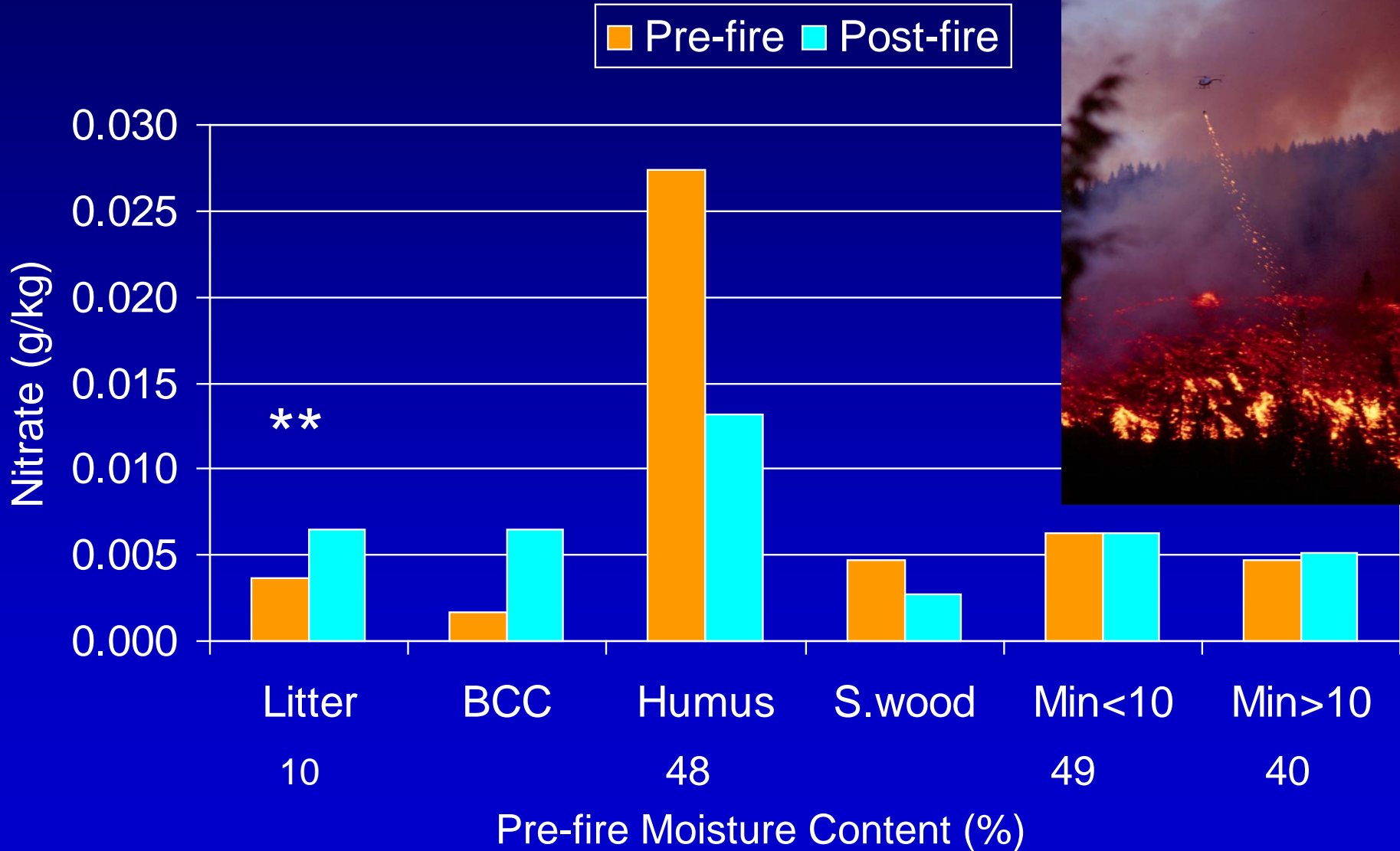


Ammonium (NH₄) Summer Burn Hemlock CLUN/Ash Soils





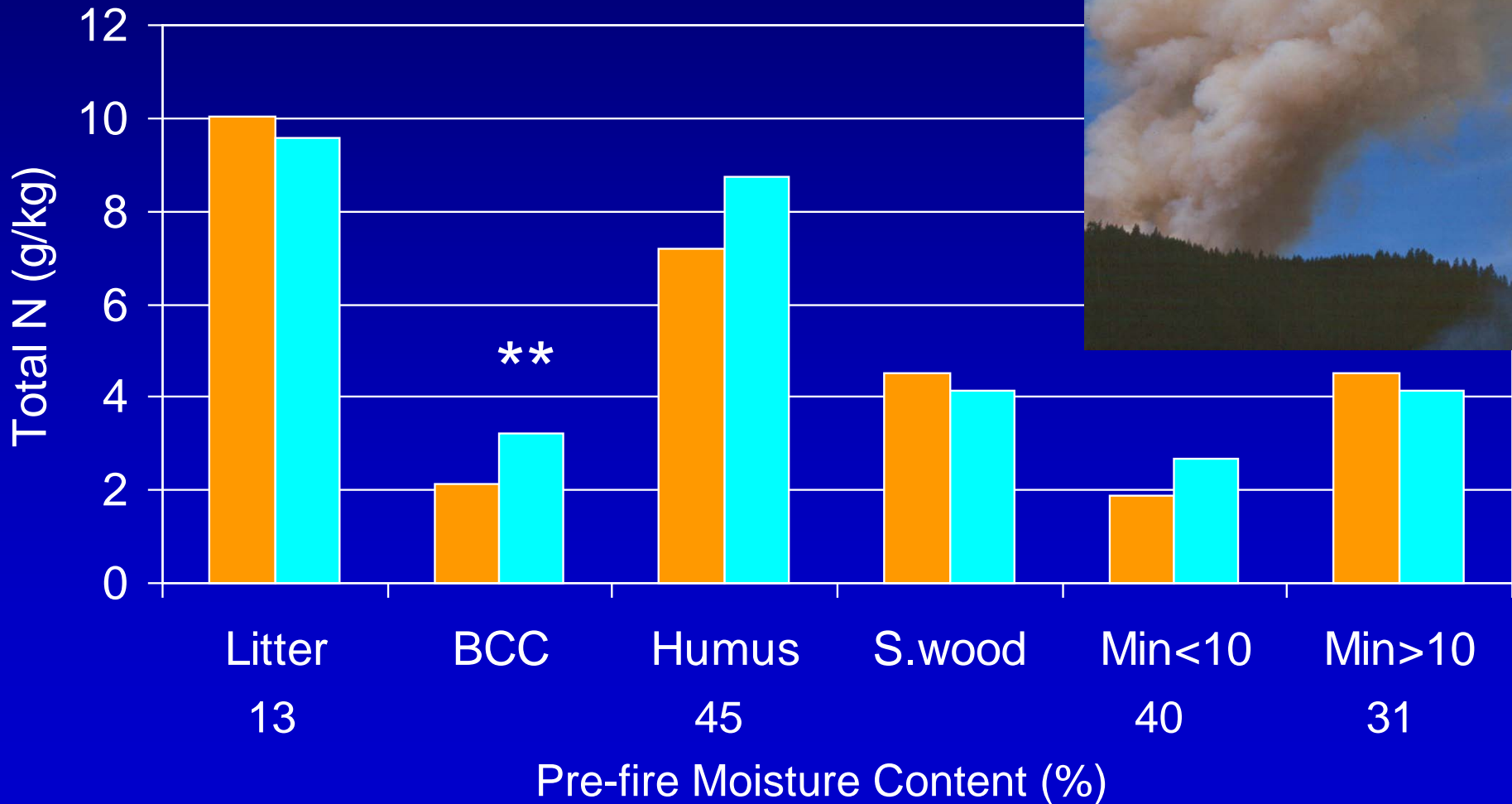
Nitrate (NO_3) Summer Burn Hemlock CLUN/Ash Soils



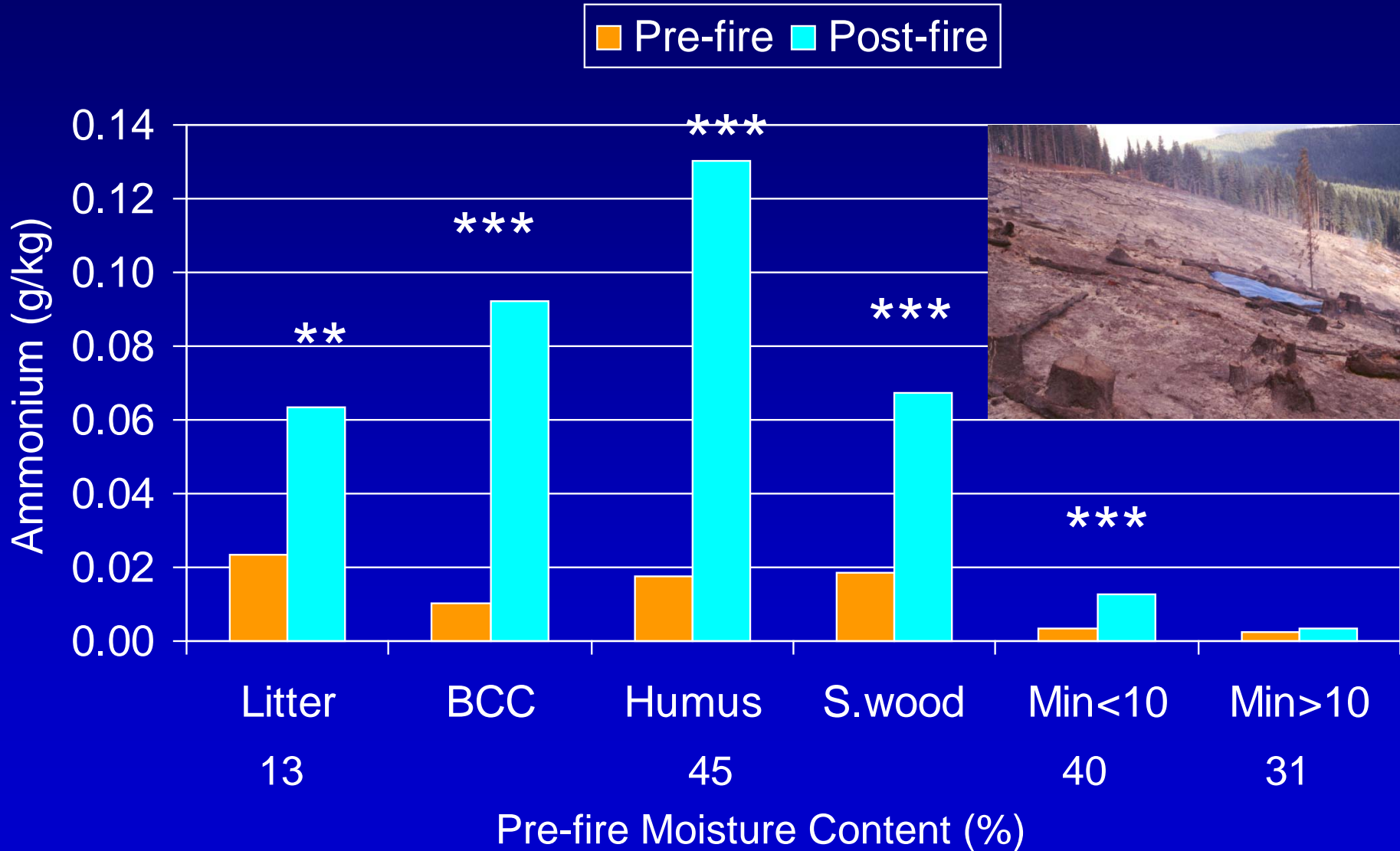


Total N Fall Burn Hemlock CLUN/Ash Soils

Pre-fire Post-fire

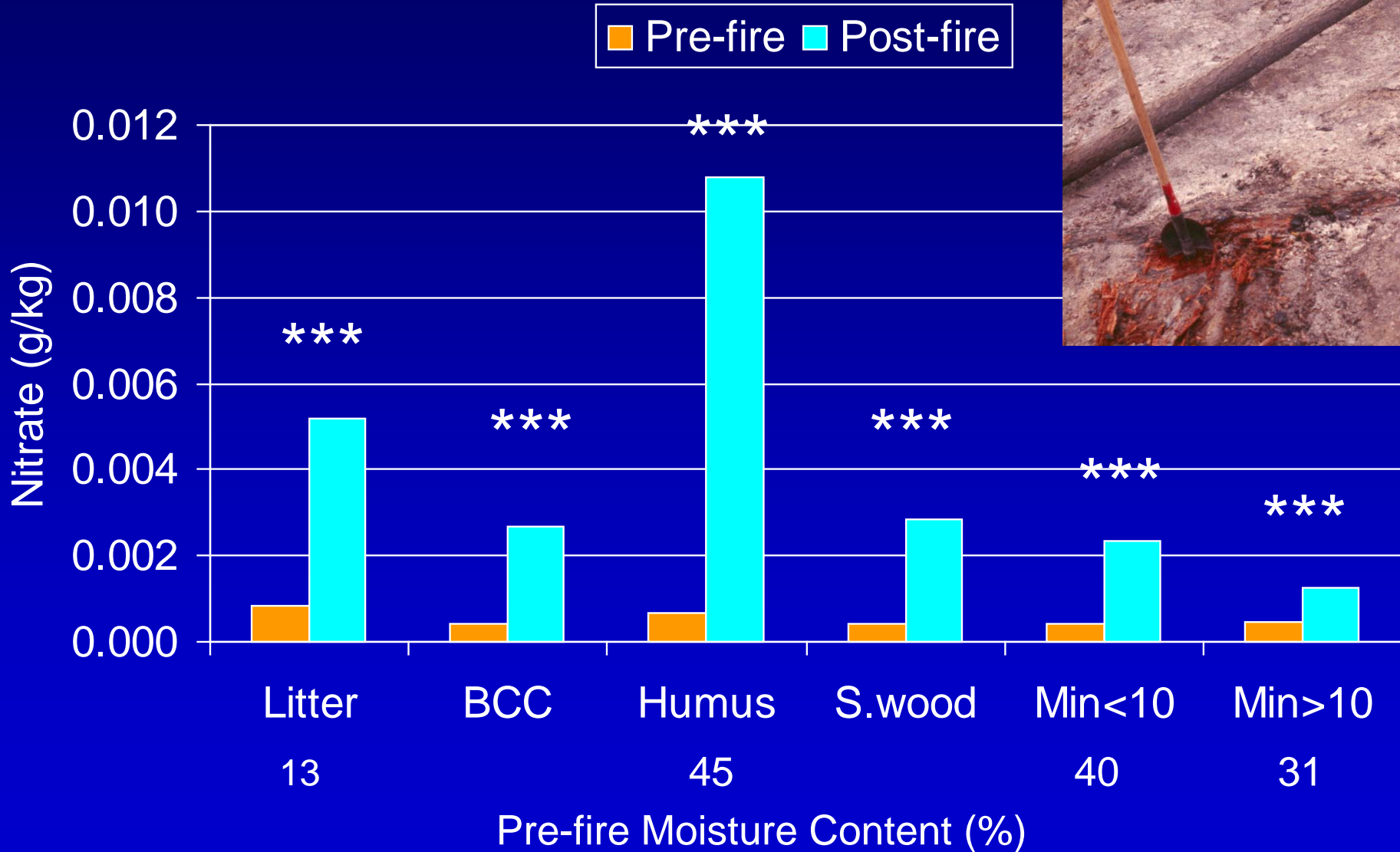


Ammonium (NH_4) Fall Burn Hemlock CLUN/Ash Soils





Nitrate (NO_3) Fall Burn Hemlock CLUN/Ash Soils





Mechanical



Tractor piling



Chipping and Chunking



Grapple piling



Dozers

Soil

- Compaction
- Displacement





Grapple Piling





Roller Chopping and Chipping

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





Decomposers

- Top rotters
- Bottom rotters
- Live rotters
- Dead rotters
- White rotters
- Brown rotters
- Rotter puppies

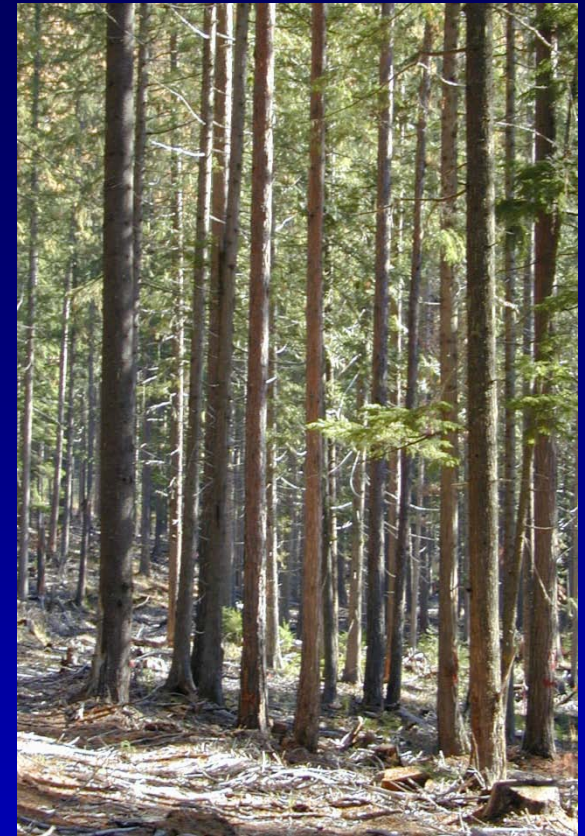


Chipping



Mastication



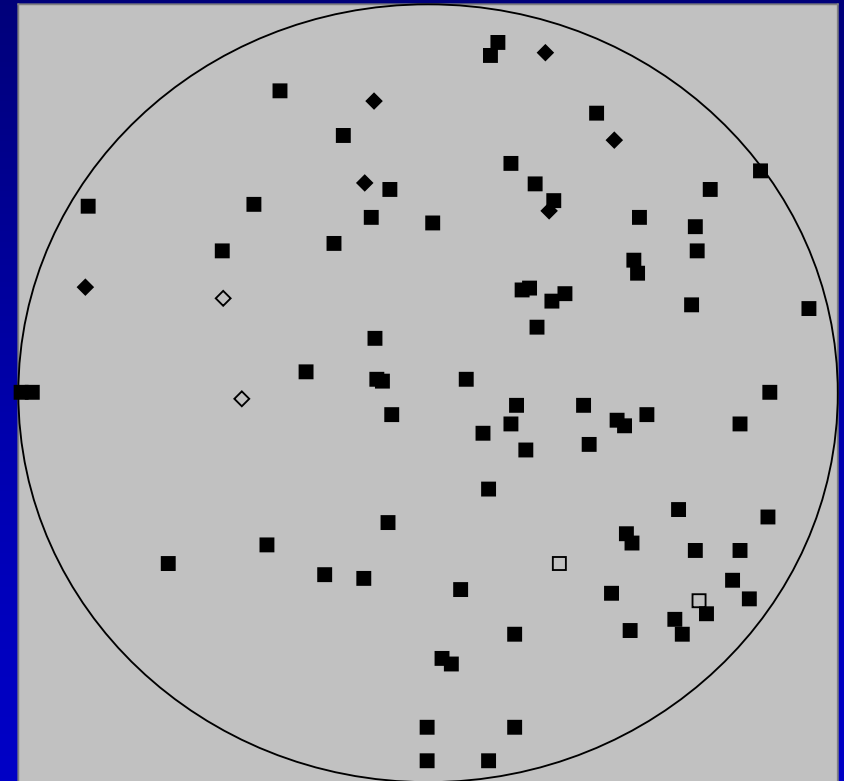


Moist Forest Treatments Urban Interface

Moist Forest WUI Treatments



CWD 33.8 Tons/Ac



179 Trees/Ac

121 Ft² BA/Ac

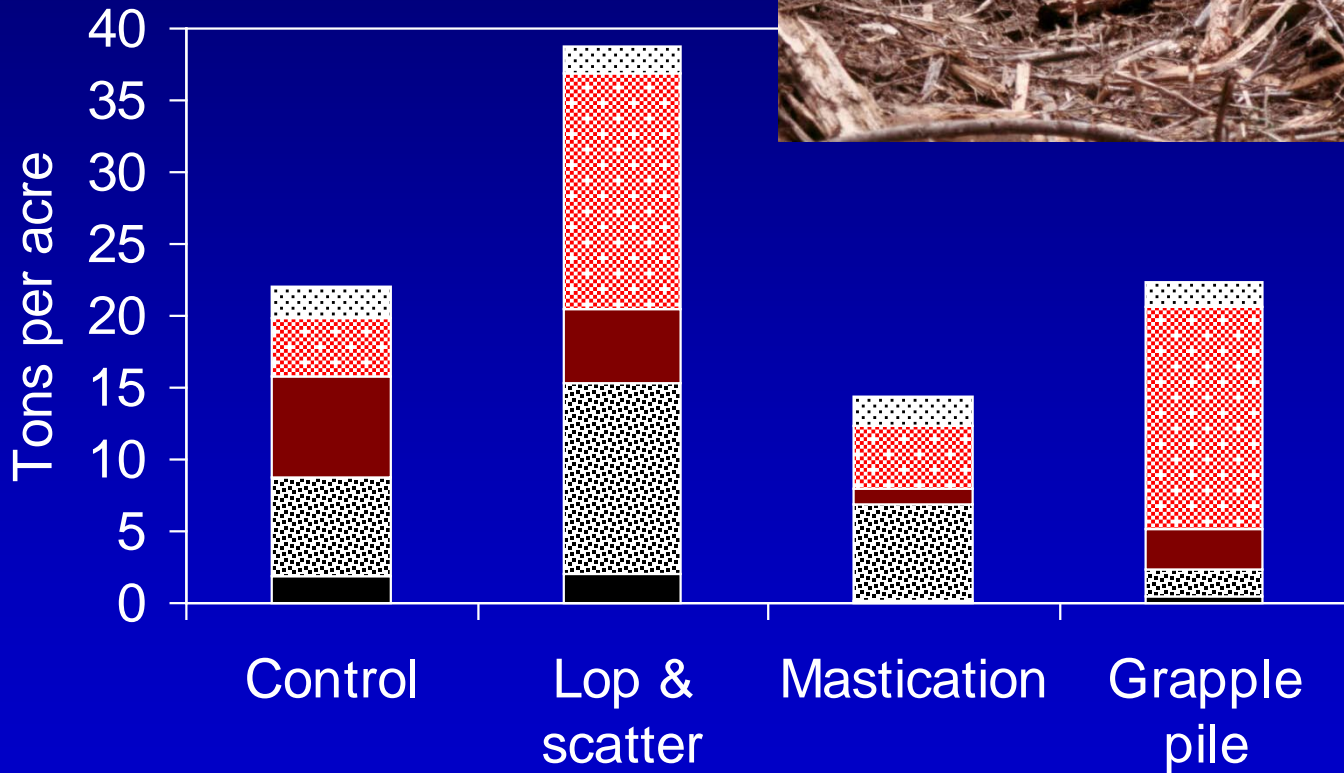


Slash Chunking





Woody Debris Post Mastication



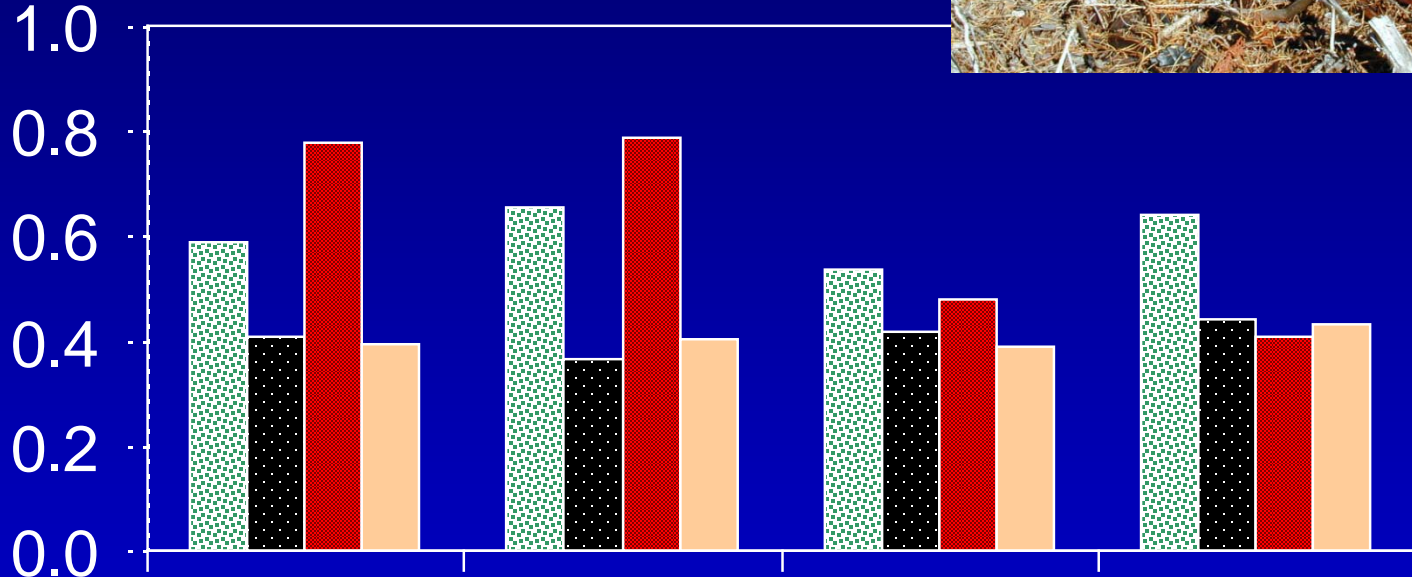
■ Bark tight ■ Bark loose ■ No bark ■ Rotten ■ < 3"



Forest Floor Nutrition Magnesium



Magnesium
(lb/ton)



Control

Lop &
scatter

Mastication

Grapple
pile

Litter

Humus

Soilwood

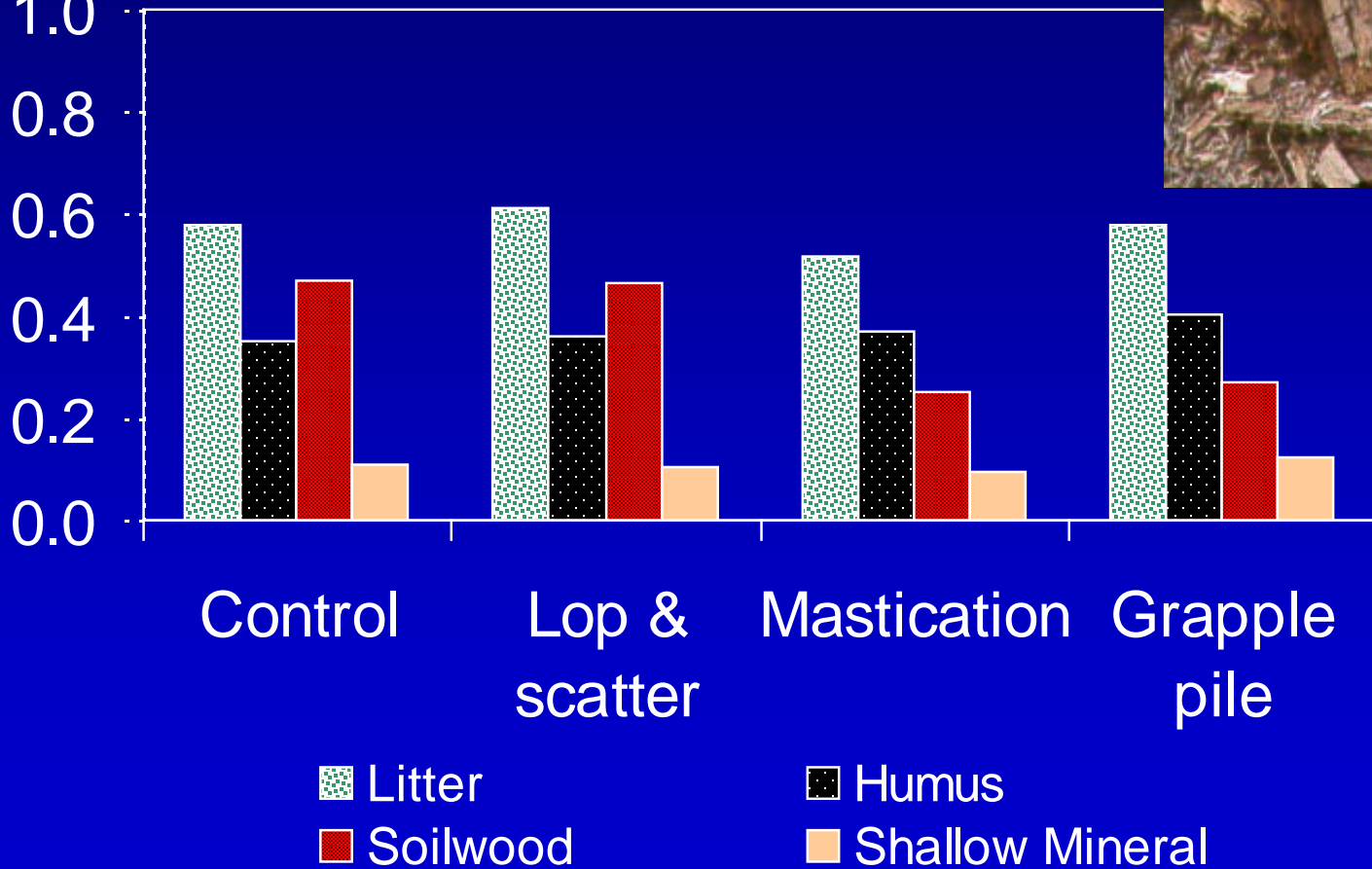
Shallow Mineral



Forest Floor Nutrition Nitrogen



Total Nitrogen
Percent 1.0





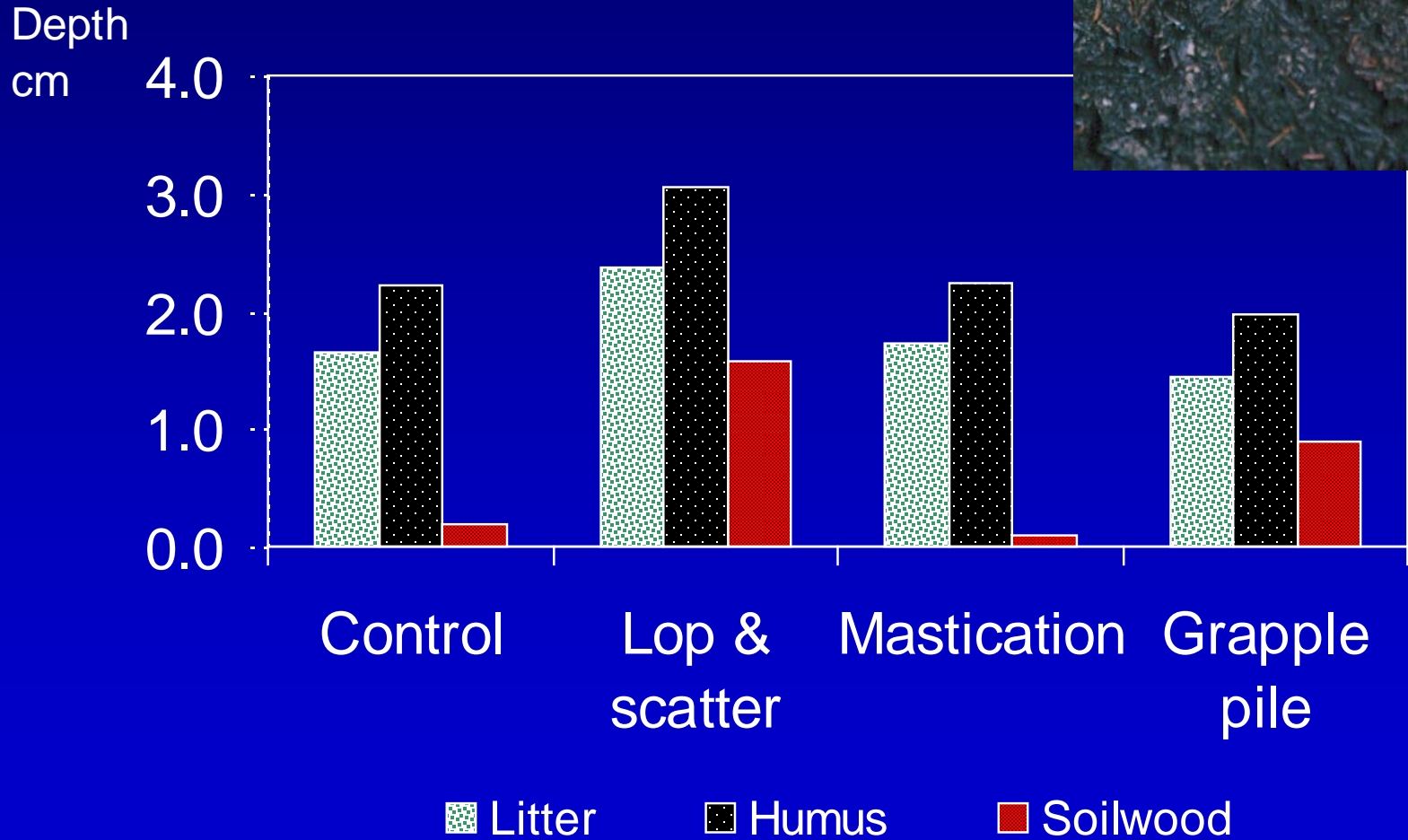
Forest Floor Carbon



Carbon
Percent

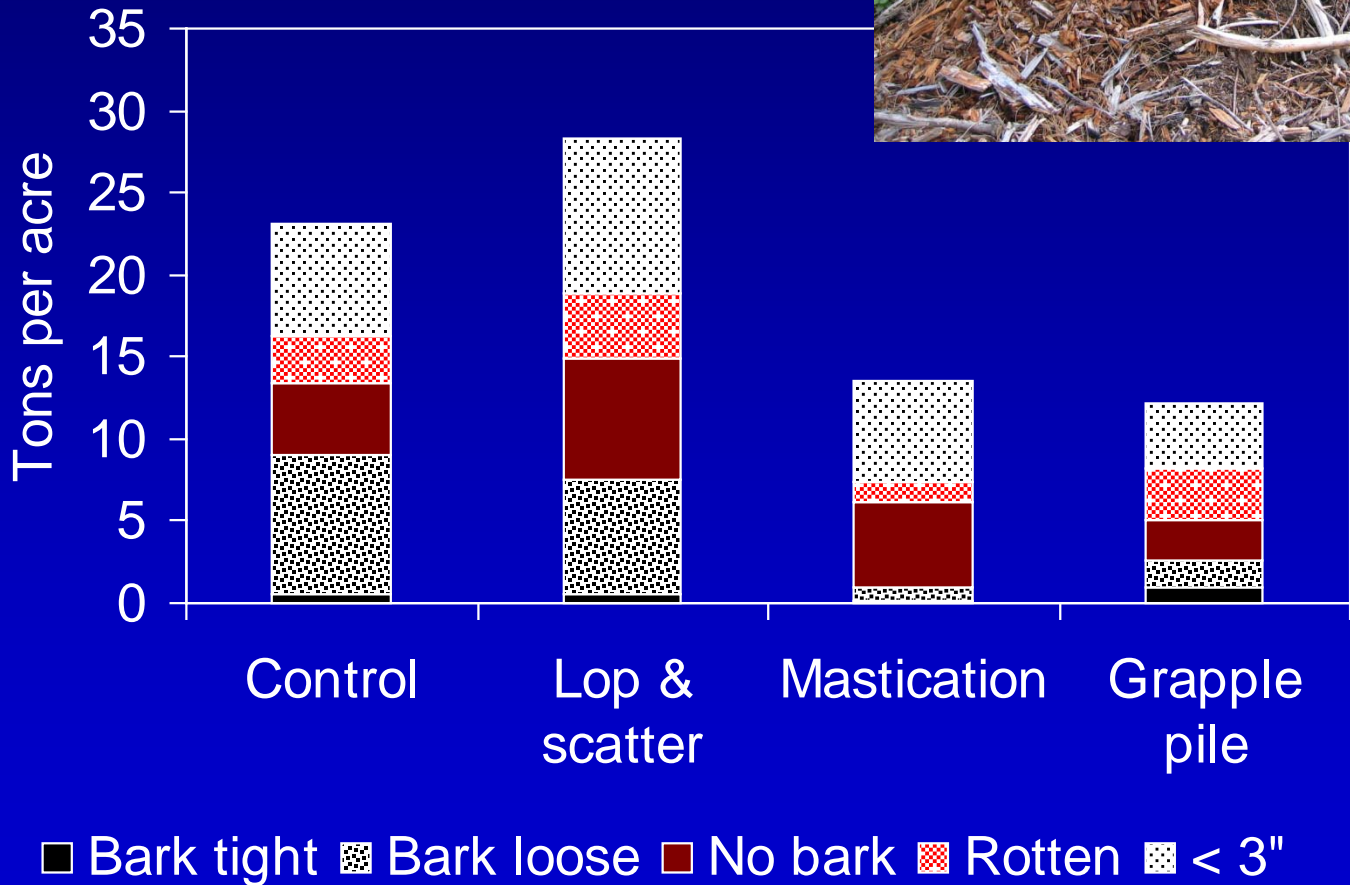


Duff Depth





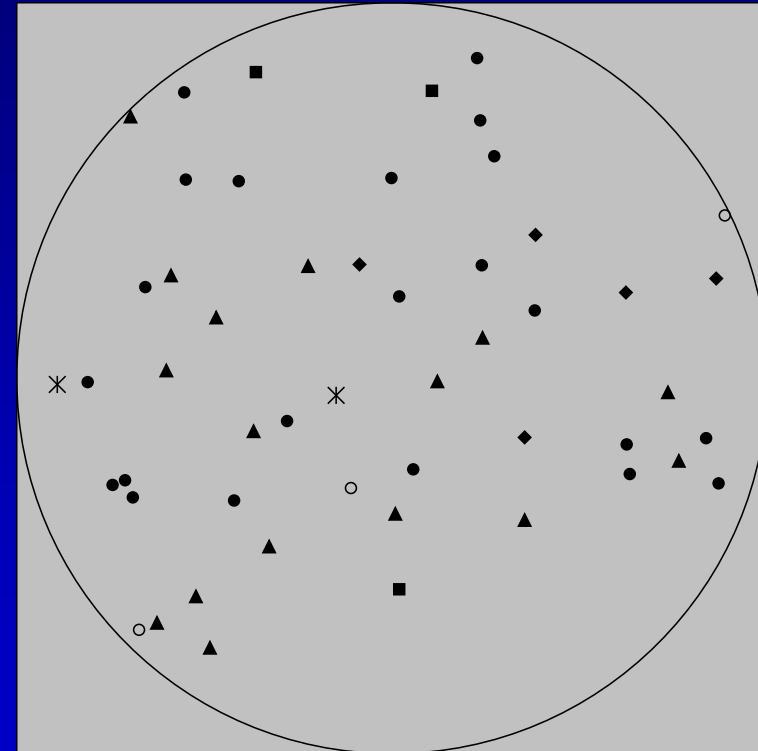
Woody Debris 2-Yrs Post Mastication



Moist Forest Treatments



CWD 16.2 tons/Ac



117 Trees/Ac
118 Ft² BA/Ac

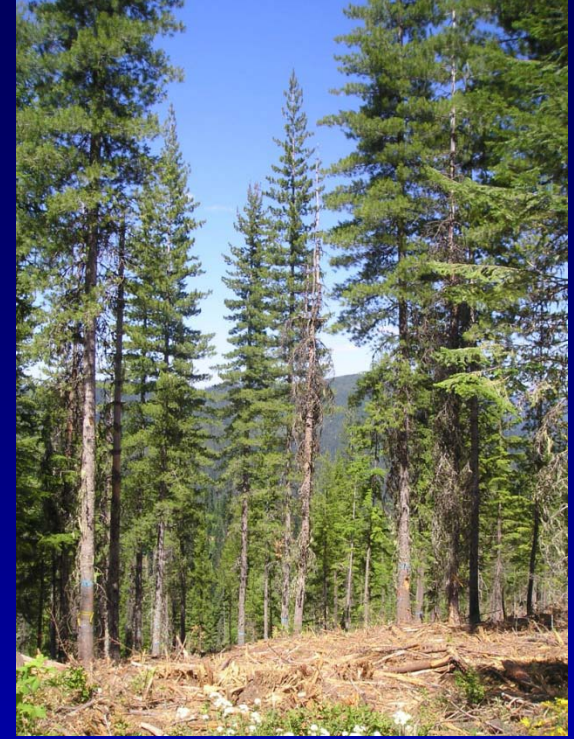


Treatments to Enhance Resistance



- 41 acres
 - 1933-clearcut
 - 1934-burned
- Planted
 - 1935-1938
 - 2-2 WP
- 11 acres
 - 1936-clearcut
 - 1938-burned
 - 1938-seeded
- Blister rust 1940-2000
- Harvested 2000
 - 2.4 MBF/ac.
 - 4.7 CCF/ac.





Young Moist Forest Treatments





Mastication Natural/artificial Regeneration



1286 Trees/Ac

57 Ft² BA/Ac

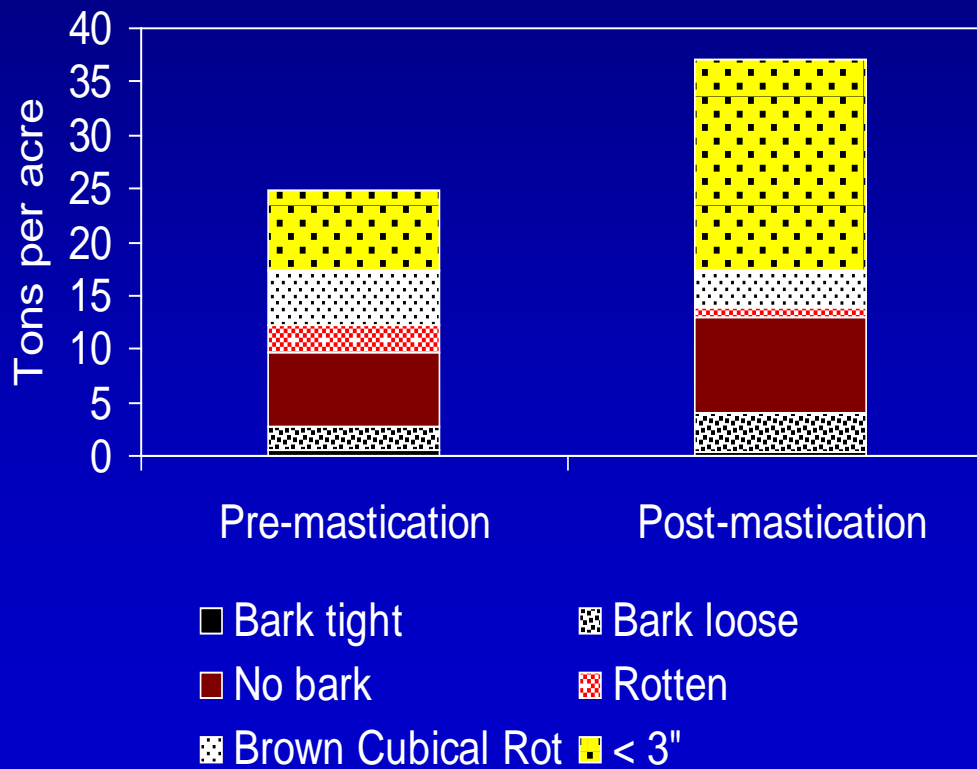
CWD 17.3 Tons/Ac



Post Mastication



Post Mastication DCEF



268 Trees/Ac

41 Ft² BA/Ac



PREF Moist Forest Restoration



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





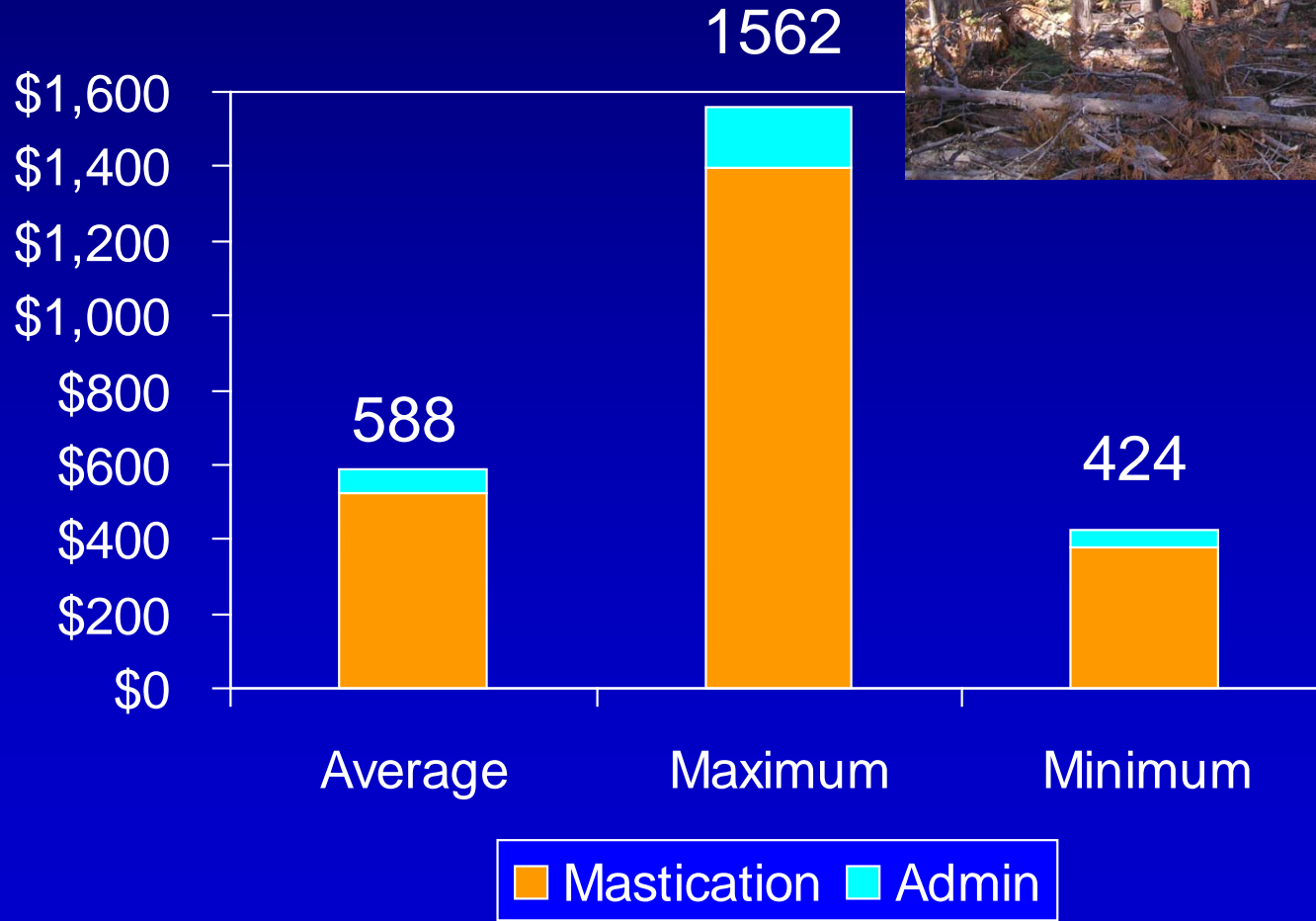
Post Harvesting Pre-mastication



137 Trees/Ac
118 Ft² BA/Ac



Mastication Cost Per Acre 37 Acres





Post Mastication



88 Trees/Ac
116 Ft² BA/Ac



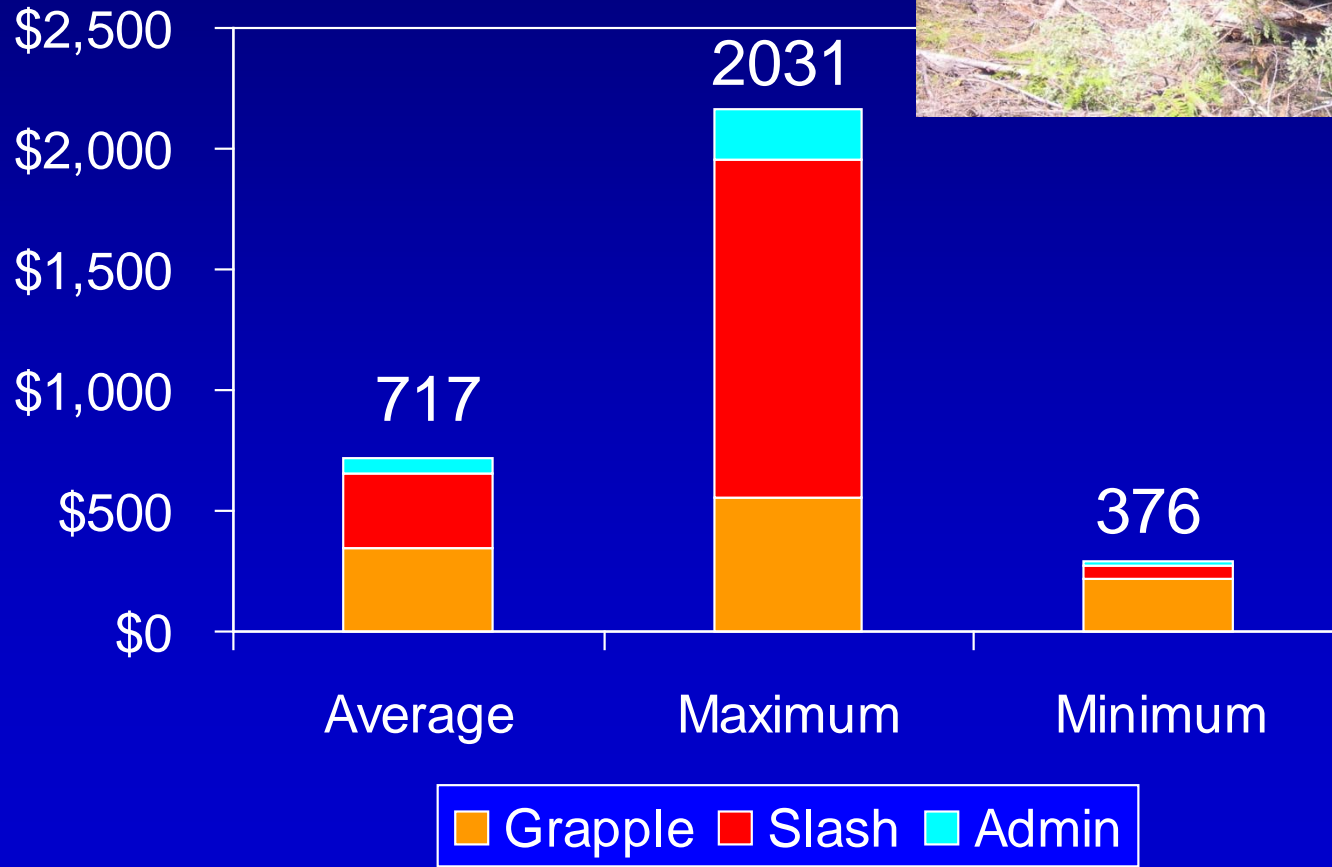
Post Harvesting Pre-grapple



150 Trees/Ac
90 Ft² BA/Ac



Grapple Cost Per Acre 41 Acres





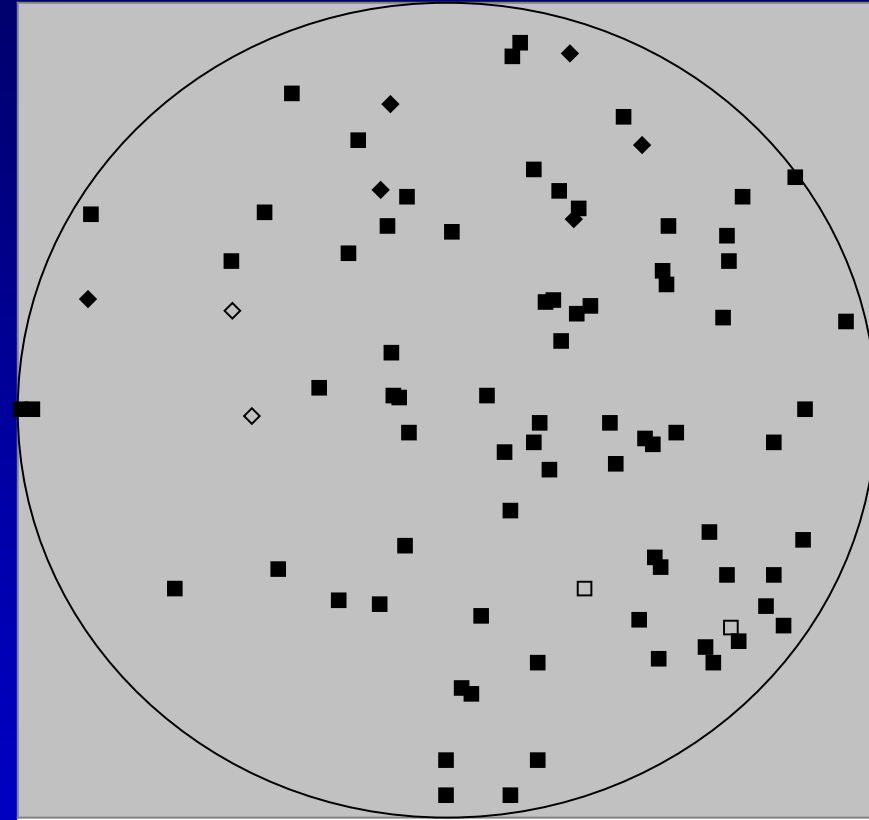
Post-grapple and Burning



75 Trees/Ac

120 Ft² BA/Ac

Dry Forest Treatments



575 Trees/Ac

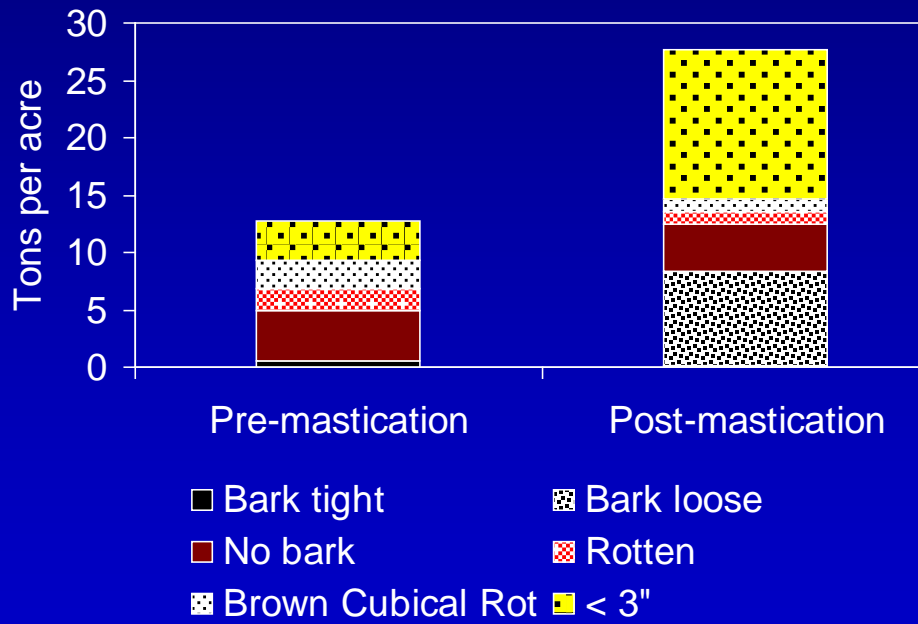
112 Ft² BA/Ac



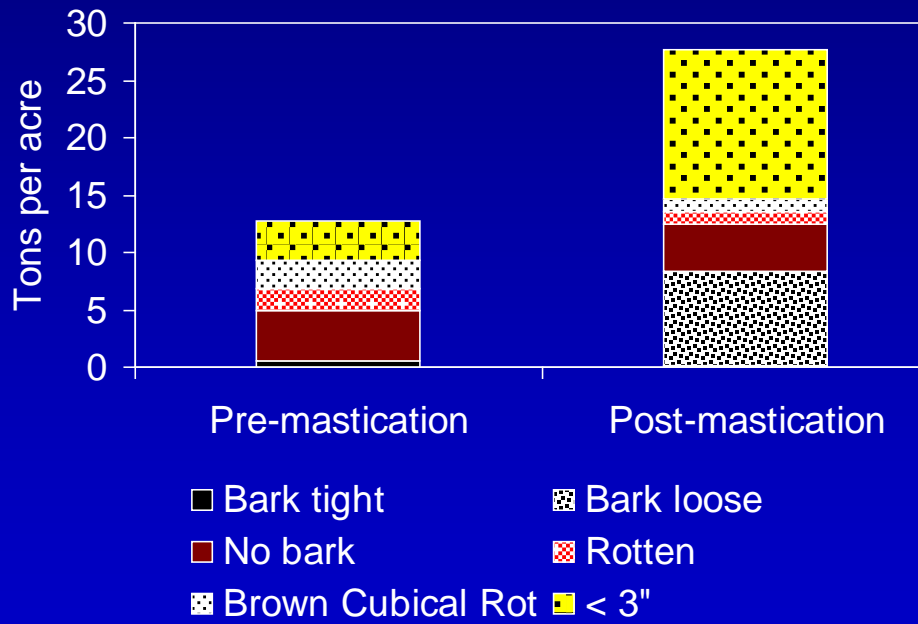
Chunking



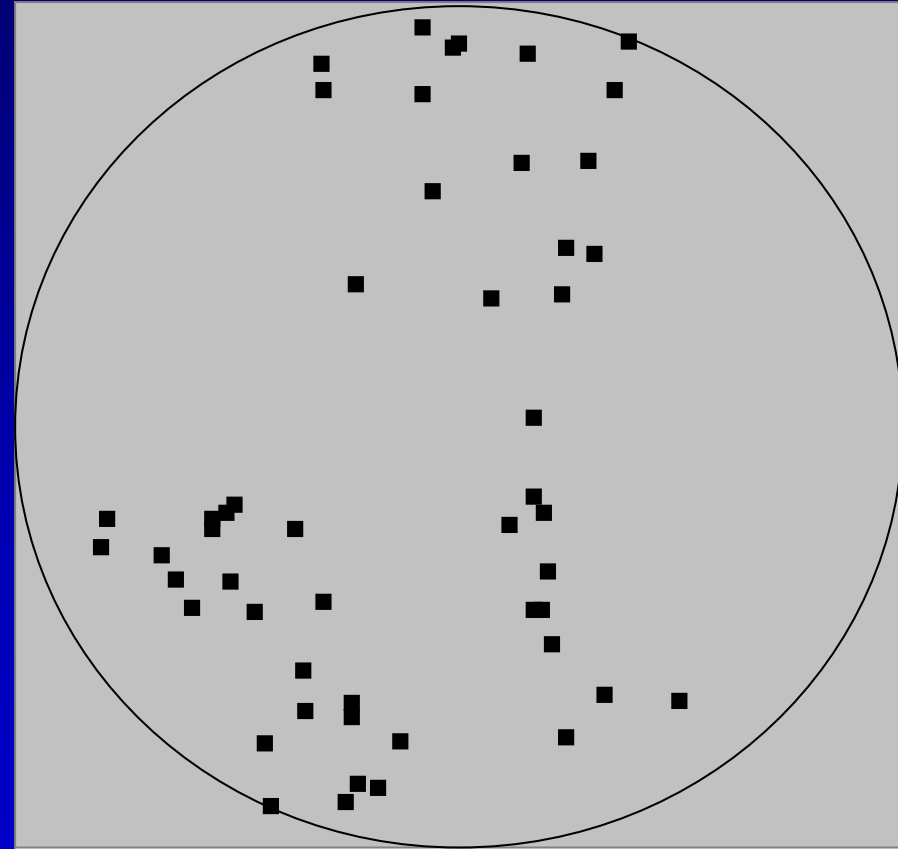
BBEF Pre-mastication



BBEF Post-mastication



Dry Forest Treatments



56 Trees/Ac
70 Ft² BA/Ac



Burning Post-mastication

- Lower duff
 - Moisture $> 100\%$
 - Temperature $< 40^{\circ} \text{F}$





9-months Later

Chunk



Chunk and Burn



Surface Organic Material Importance 1982

Low Elevation 2400'



Shallow ash layer
Alluvial deposits
Minimal BCC & soil wood

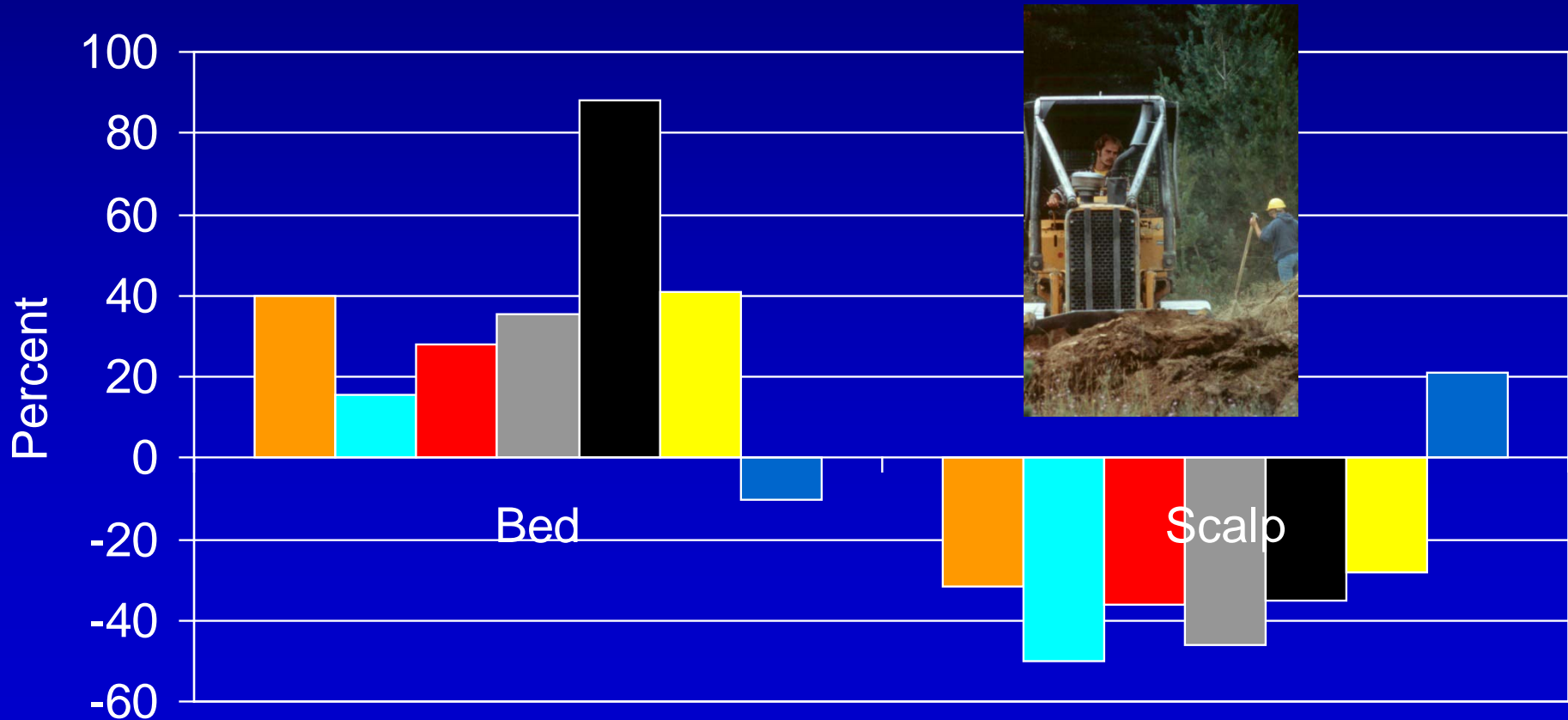


Forest Floor Changes (Low Elevation)

Relative to the Values For Undisturbed Sites

12.3% 2.6 g/kg 2.5 g/kg 7.6 mg/kg 1.7 mg/kg 3.2 mg/kg 0.76 Mg/m³

■ OM %
 ■ Tot N
 ■ Tot P
 ■ Ca
 ■ Mg
 ■ K
 ■ BD





Surface Organic Material Importance 1982 High Elevation 4000'

Deep ash soils

Abundant BCC and soil wood

Abundant surface litter



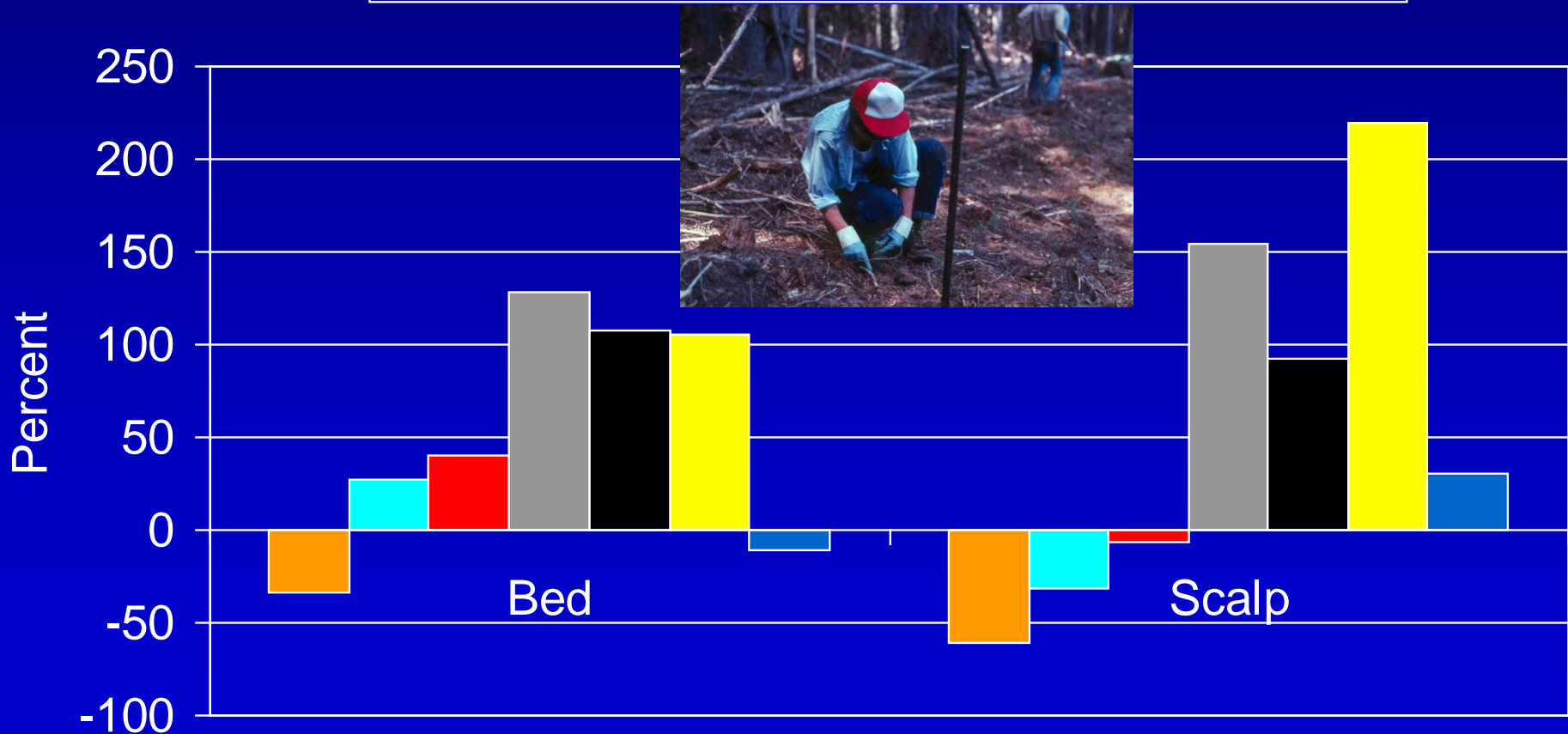
Forest Floor Changes

High Elevation

Relative to the Values For Undisturbed Sites

27.4% 2.2 g/kg 1.5 g/kg 3.9 mg/kg 1.3 mg/kg 2.0 mg/kg 0.65 Mg/m³

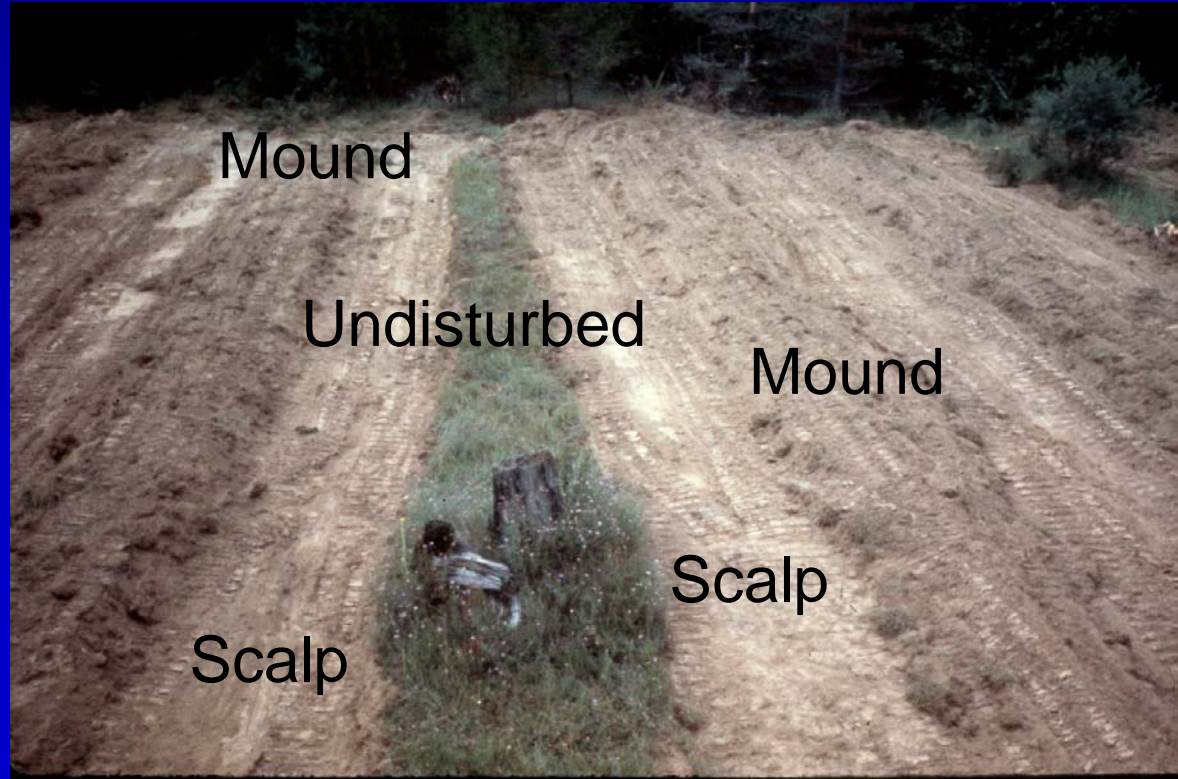
■ OM %
 ■ Tot N
 ■ Tot P
 ■ Ca
 ■ Mg
 ■ K
 ■ BD





Surface Organic Material Importance 1983-2006

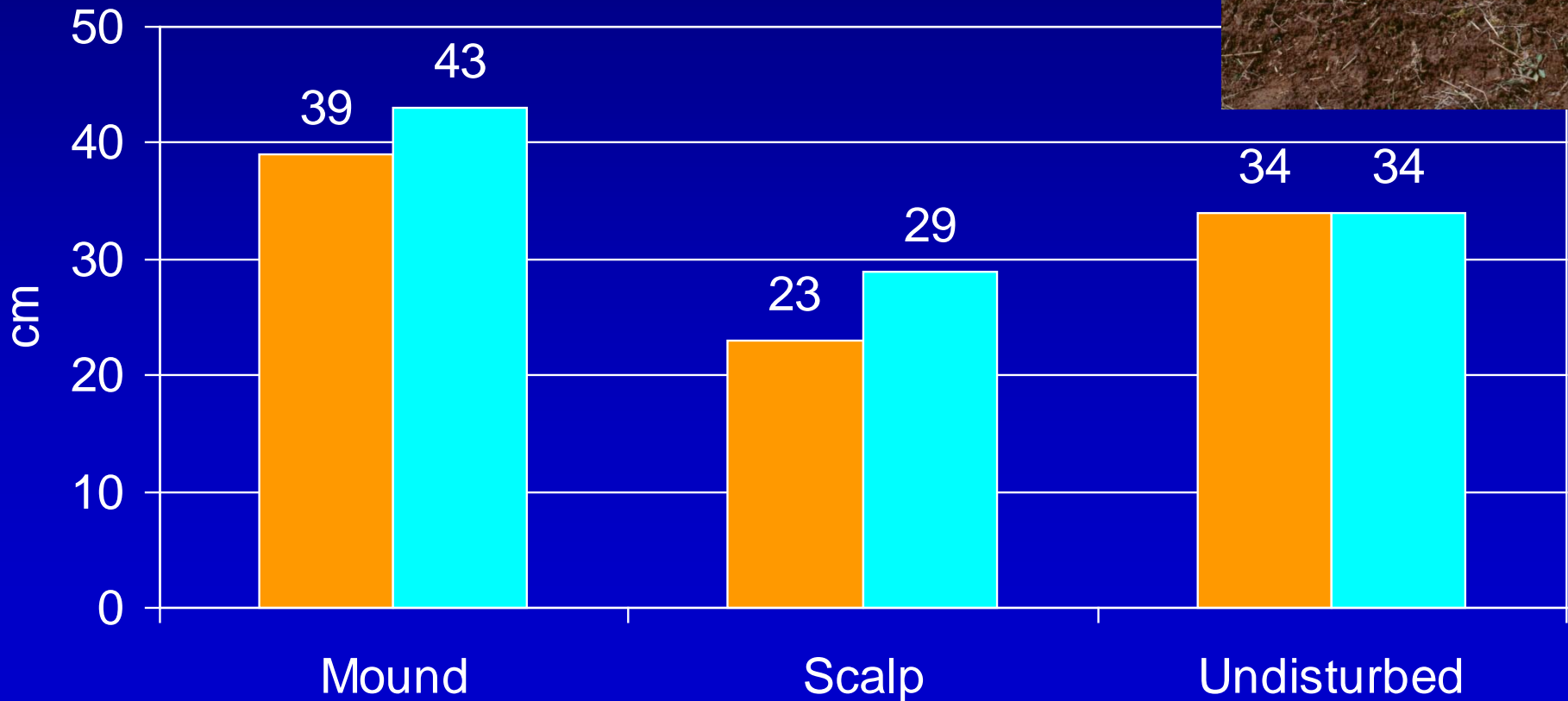
Low Elevation 2400'



Seedling Height Low Elevation 3-yrs



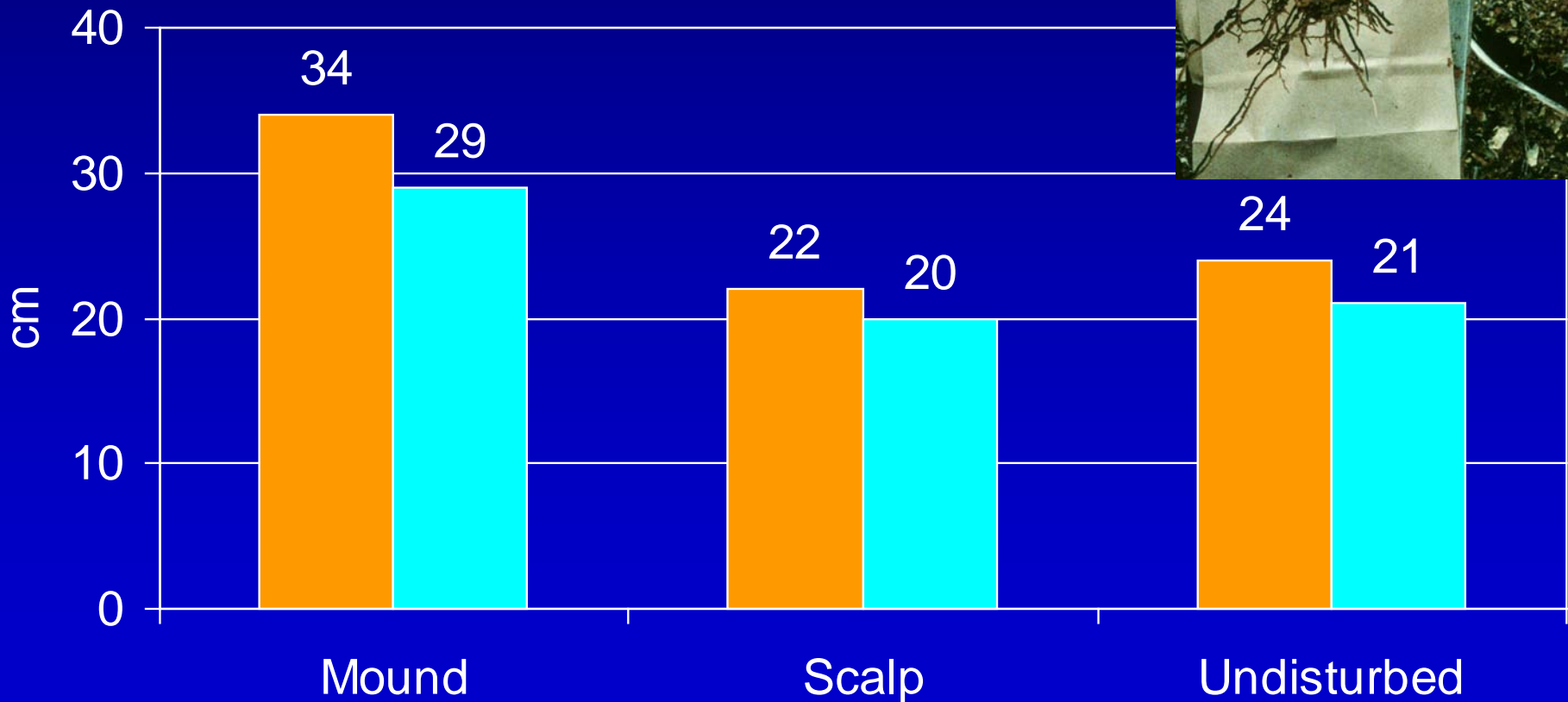
■ W.pine ■ D. fir





Rooting Depth Low Elevation 3-yrs

■ W.pine ■ D. fir



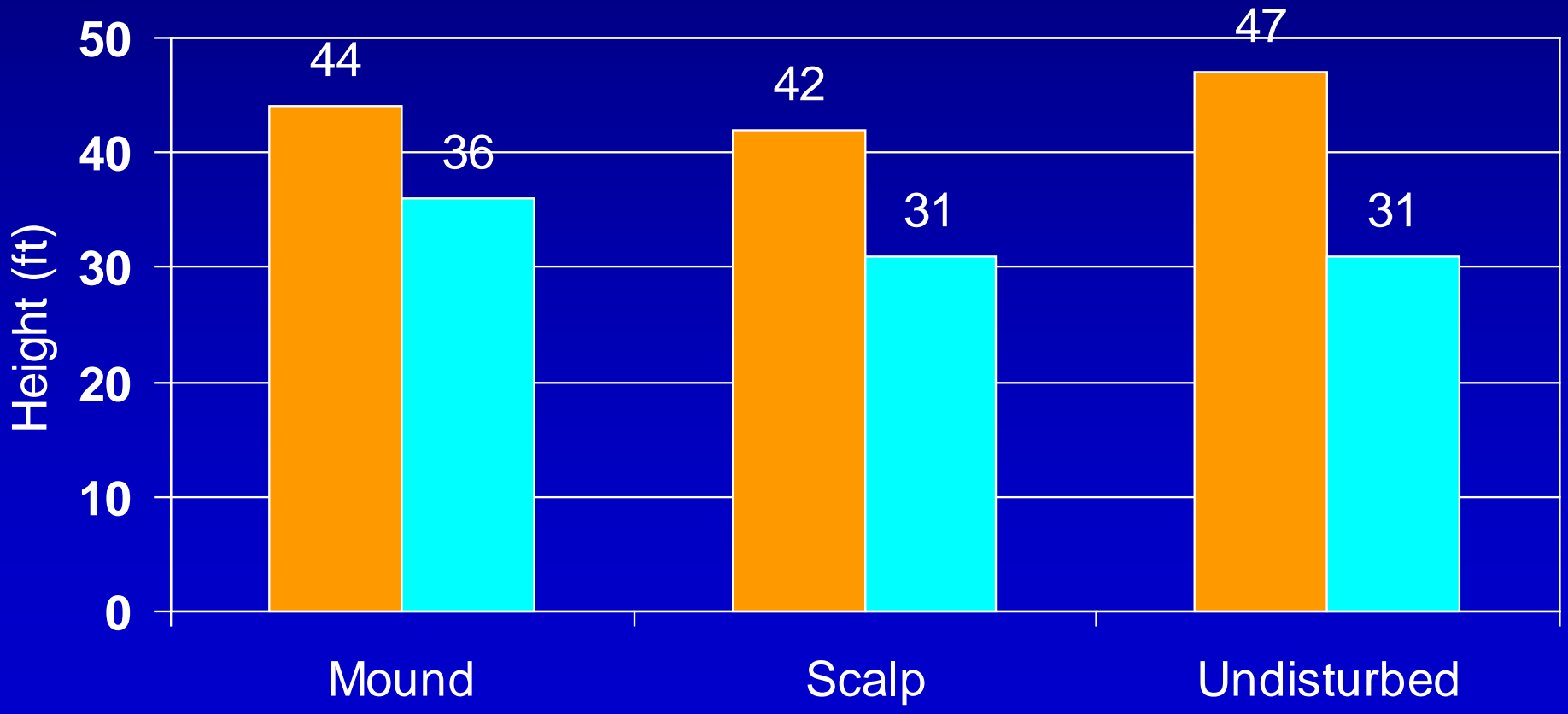


Height

Low Elevation 23-yr old



■ W.pine ■ D. fir



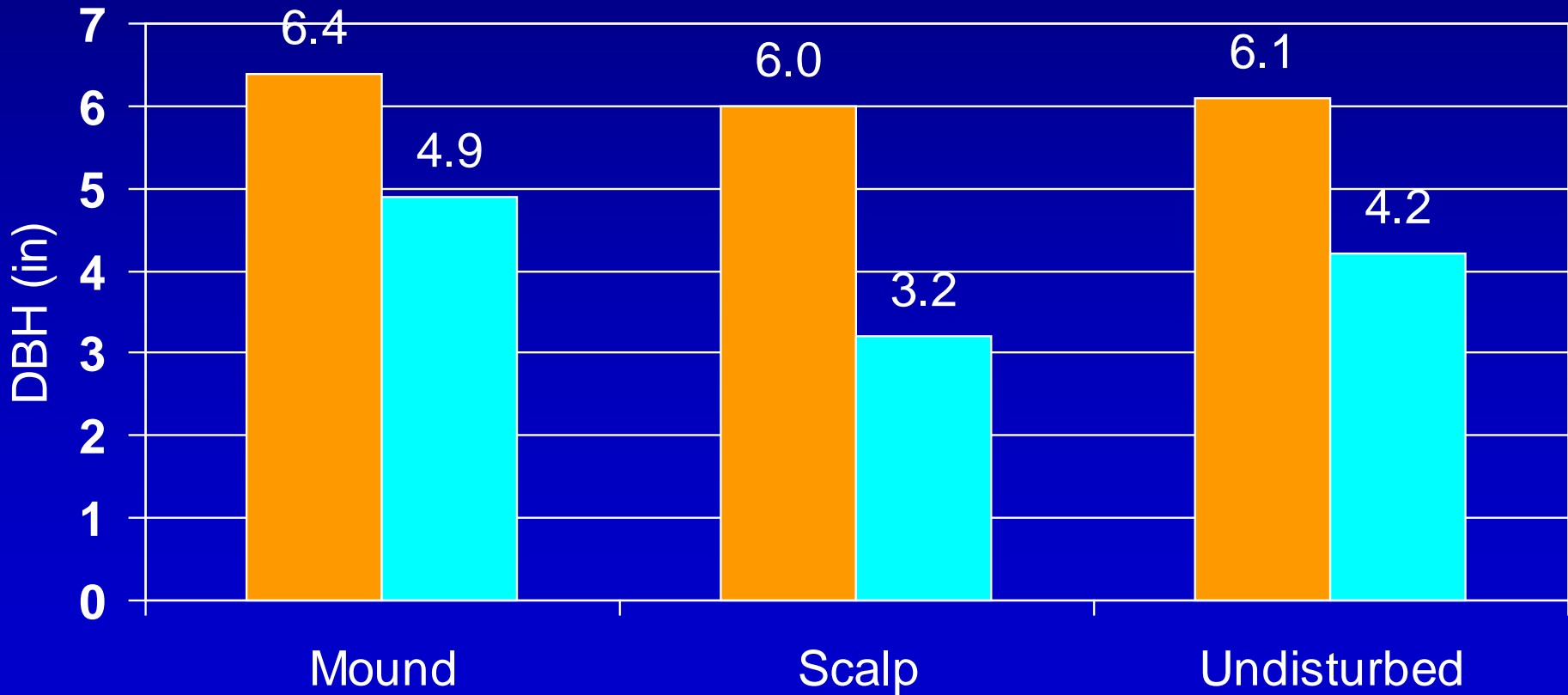


Diameter

Low Elevation 23-yr old



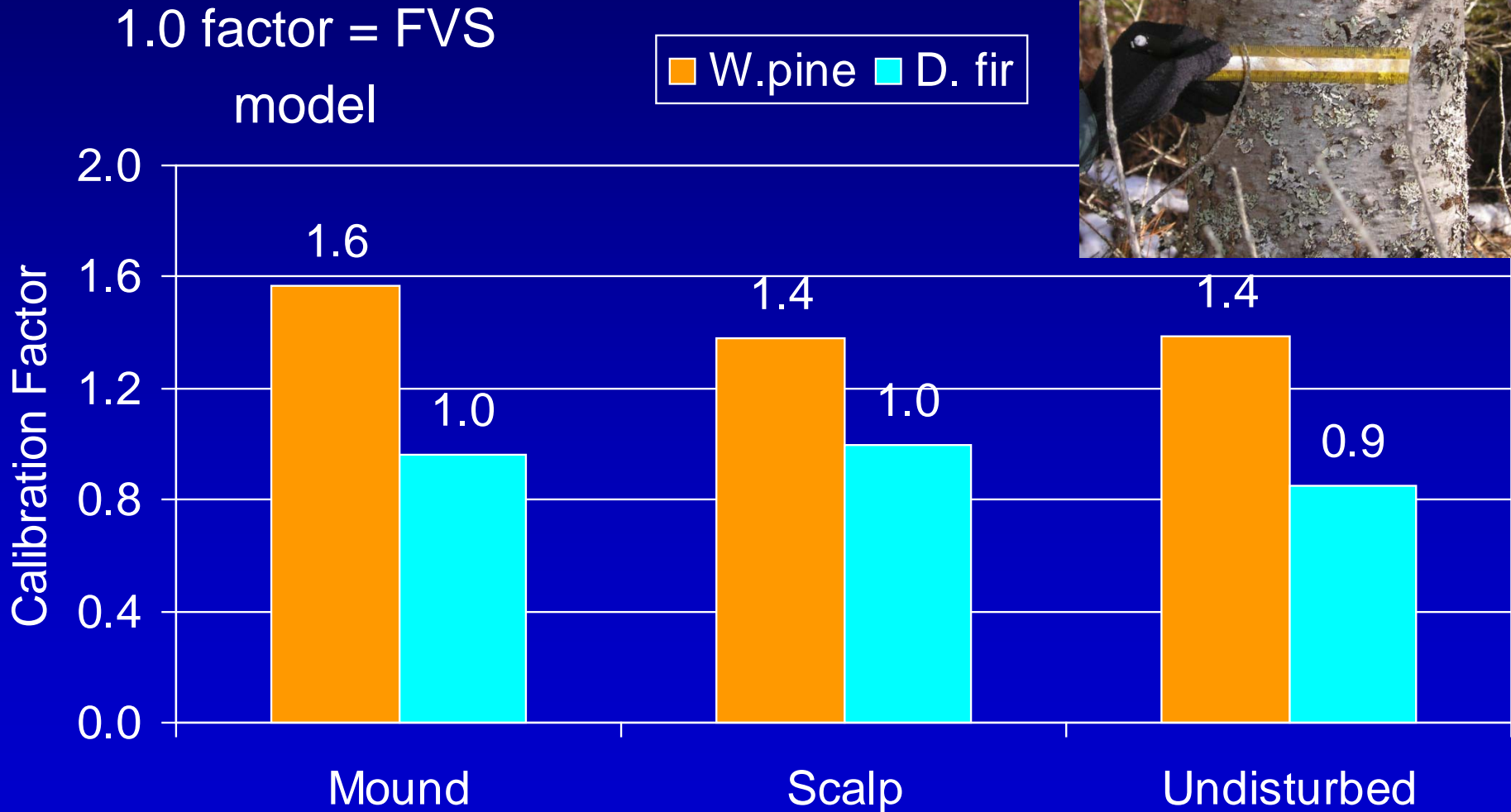
W.pine D. fir





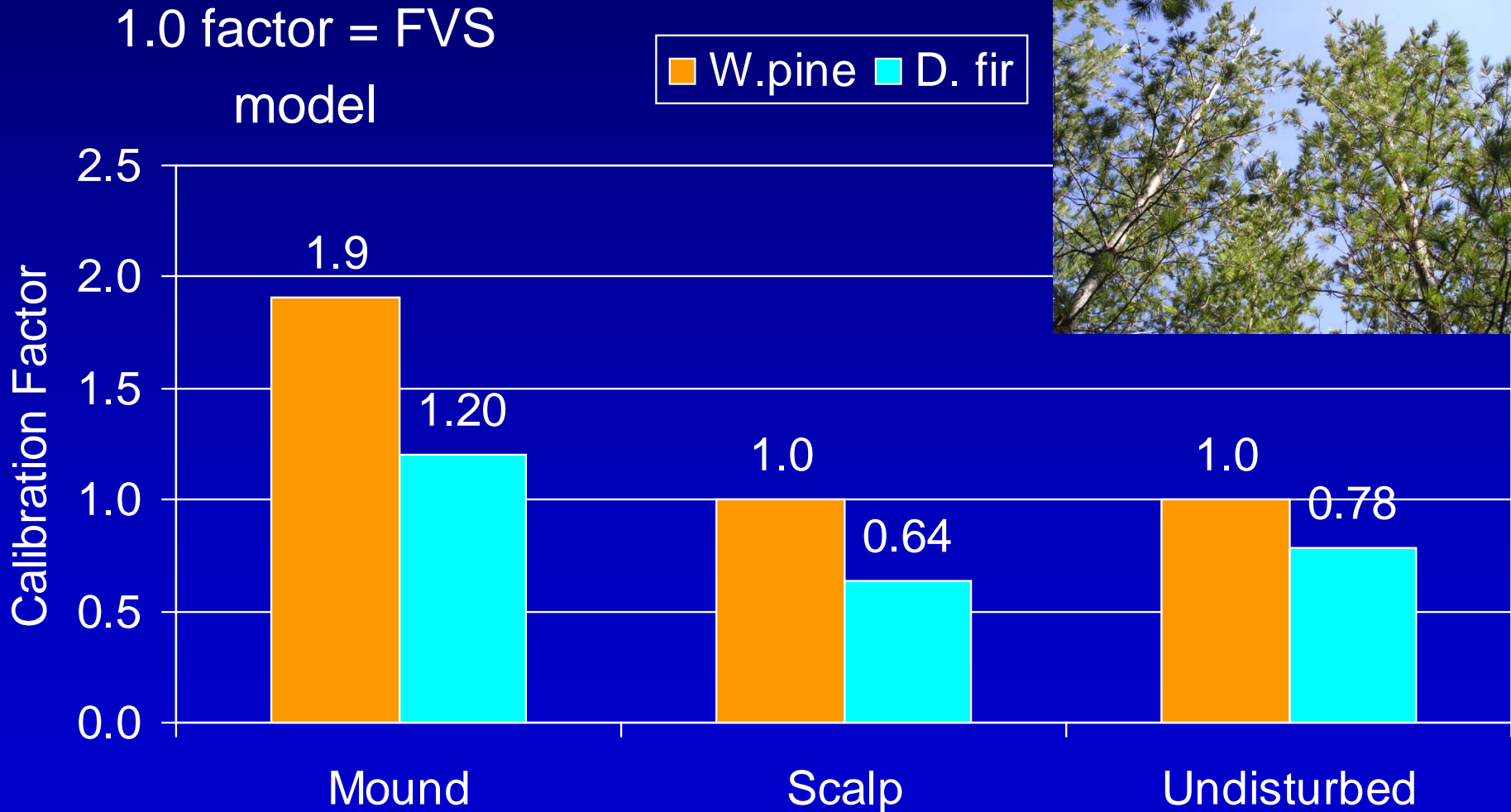
FVS DBH Calibration (Last 5-yr)

Low Elevation 23-yr old





FVS Height Calibration (Last 5-yrs) Low Elevation 23-yrs old

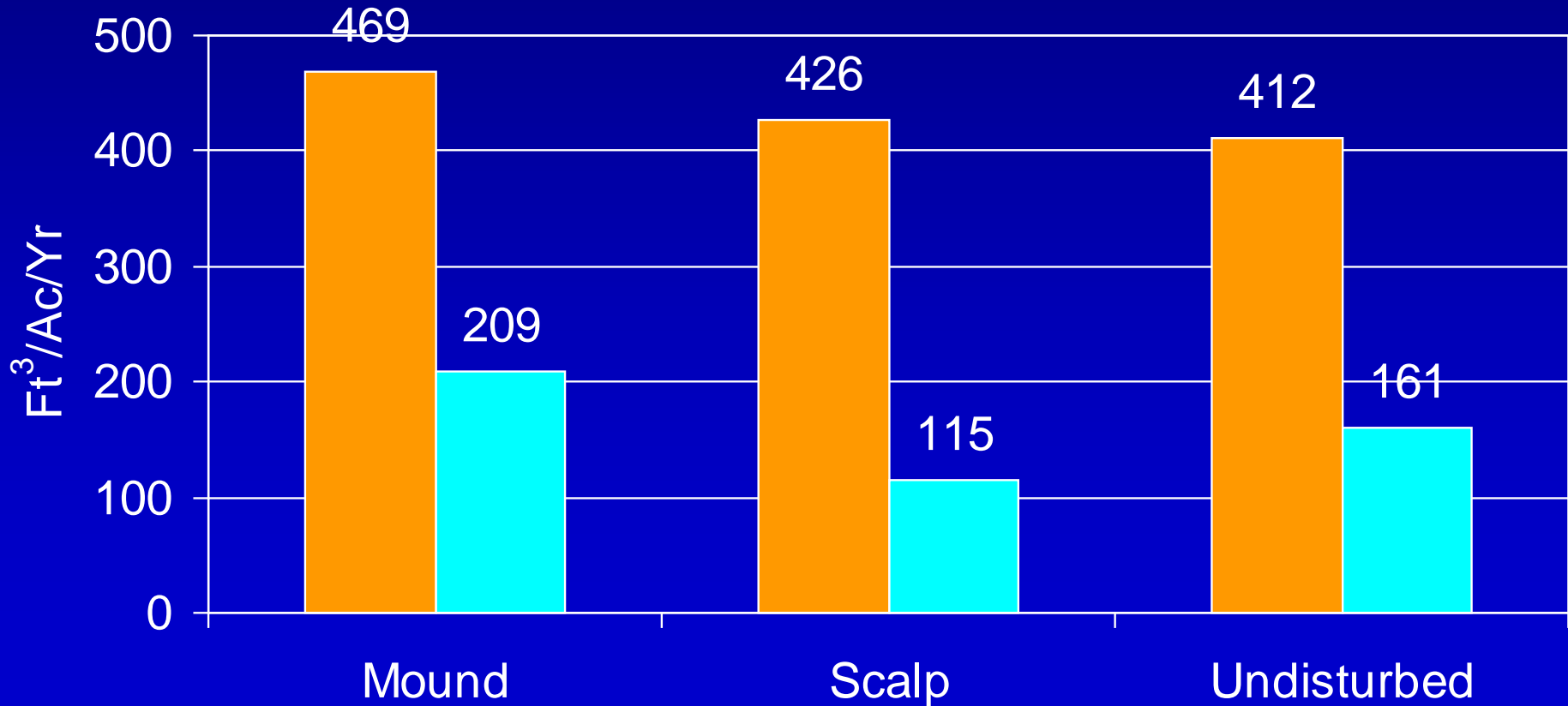




Productivity (Last 5-yrs) Low Elevation 23-yrs old



■ W.pine ■ D. fir





Prescribed Fire



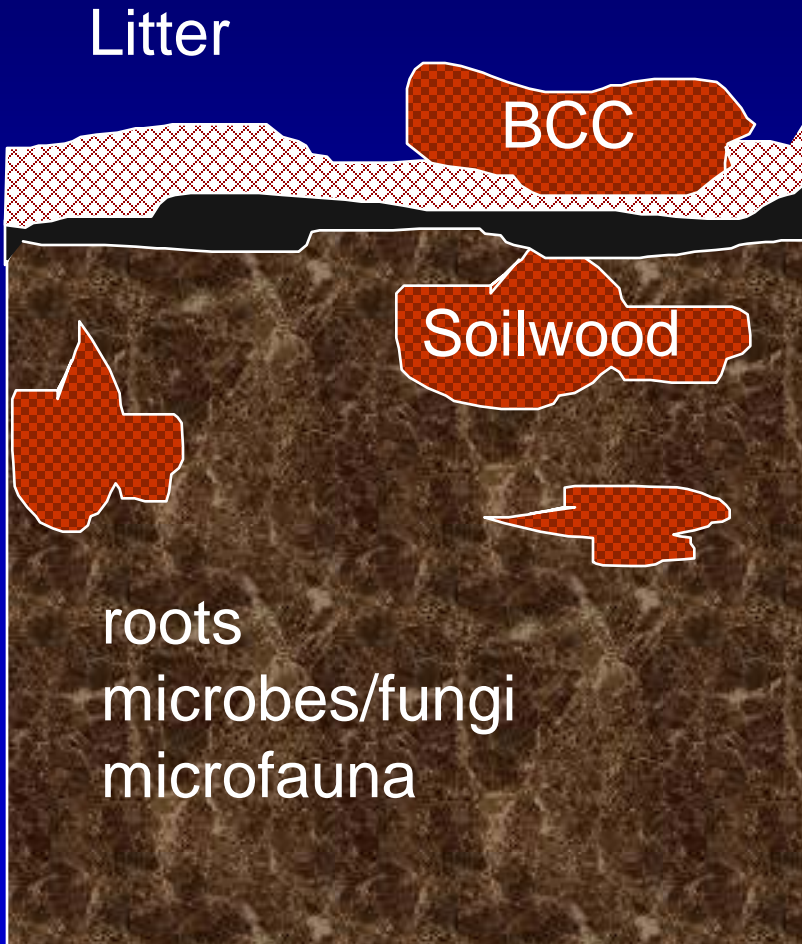


Mechanical





Forest Soil





Silviculture



The art and science of controlling the establishment, growth, composition, health, and quality of forests and woodlands to meet the diverse needs and values of landowners and society on a sustainable basis



