Effect of Boron
Seedling Establishment Study

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Effect of Boron

Facts about Boron

- Essential nutrient of vascular plants
- Important in sugar translocation and water absorption and transpiration plus synthesis of RNA and DNA
- Important in cell elongation and development of apical meristematic tissue

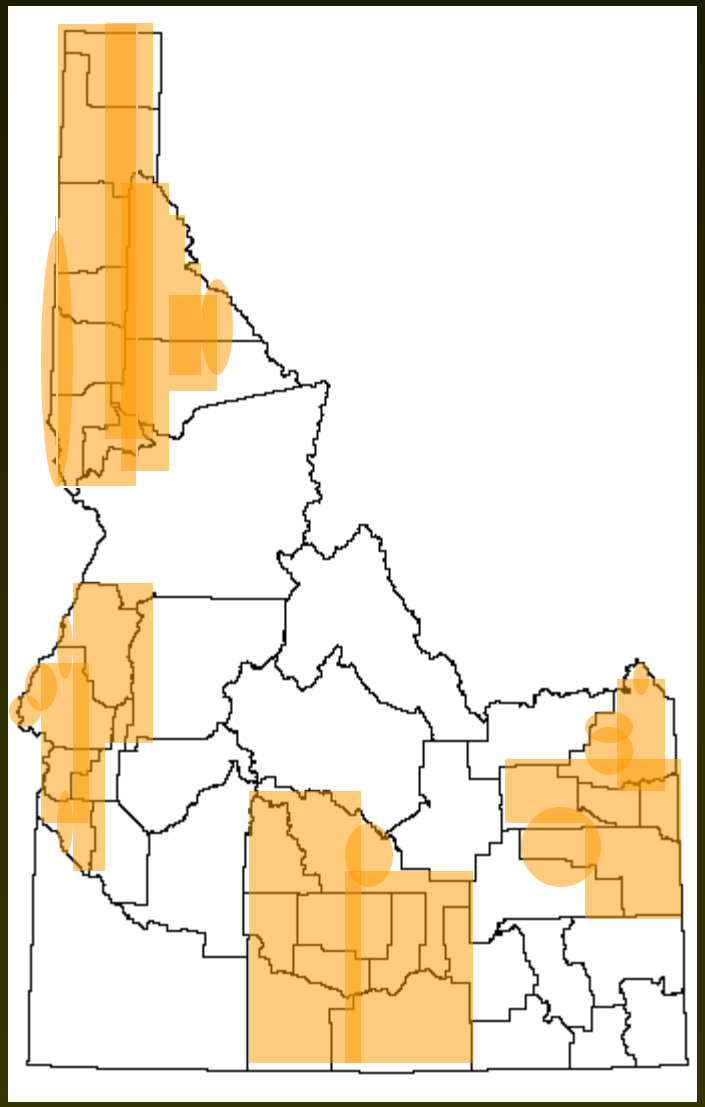
Effect of Boron

Boron Deficiencies

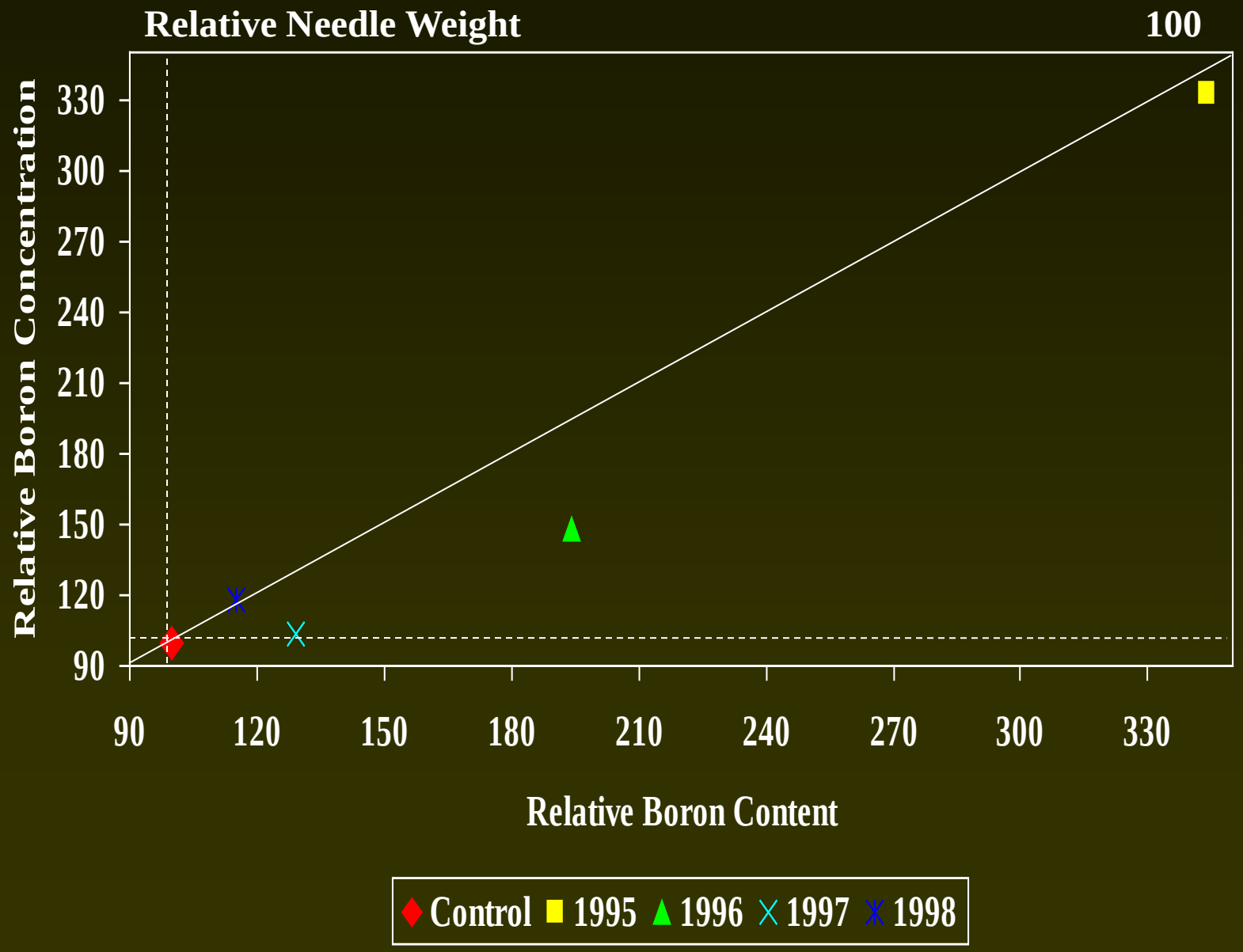
- Results in disturbance of apical dominance, top die back, reduced height growth and trees with “brush-like appearance
- Common on coarse textured soils (ie. – glacial, granitic)
  - Leaching common in wetter climates
- Depend on soil organic matter and moisture content plus the rock type
- Most widespread of the micronutrients
- Common in the Inland NW

Effect of Boron

Boron Deficiencies in Idaho



Effect of Boron
Operational Fertilization - Boron Vector Analysis



Effect of Boron

Foliar Vector Analysis

Boron Deficiencies in Inland NW

Inland NW Screening Trials		
No. Sites	Boron Deficiencies	Rock Type
75	54	16 Basalt 22 Granites 9 Glacial 7 Metasediments


Effect of Boron in the
Seedling Establishment Study

Seedling Establishment/Nutrition Experiment

Region	Site	Name	Rock Type
Northeast Washington	401	Trail Divide	Clay schist (bad)
	402	Scoop Mountain	Granite (good)
Central Washington	403	Jungle Creek	Pyroclastics (bad)
	404	Indian Creek	Sandstone (good)
South-Central Washington	405	Holmes Creek	Andesite (bad)
	406	North Quigley Butte	Basalt (good)
North Idaho	408	Flat Creek Metased.	Quartzite (bad)
	407	Flat Creek Basalt	Basalt (good)
Central Idaho	409	Paddy Flats Granite	Granite (bad)
	410	Paddy Flats Basalt	Basalt (good)
Northeast Oregon	411	Glass Hill	Andesite (bad)
	412	Noregaard	Basalt (good)

Initial (1998) Fertilization

Sub-Surface Controlled-Release

- **No fertilizer (Control)**
- **16gN (N)**
- **16gN + 12gK + 4.8gS (NKS)**
- **16gN + 4.8gS (NS)**
- **12gK + 4.8gS (KS)**
- **16gN + 12gK+ 4.8gS + 4.1gP + 0.61gMg + 0.01gB + 0.03gCu + 0.26gFe + 0.04gMn + 0.01gMo (Multi)**

Seedling Establishment/Nutrition Experiment

Ponderosa Pine	1	2	3	1	2	3	**Douglas-fir**
	4	5	6	4	5	6	
Douglas-fir	1	2	3	1	2	3	**Ponderosa Pine**
	4	5	6	4	5	6	

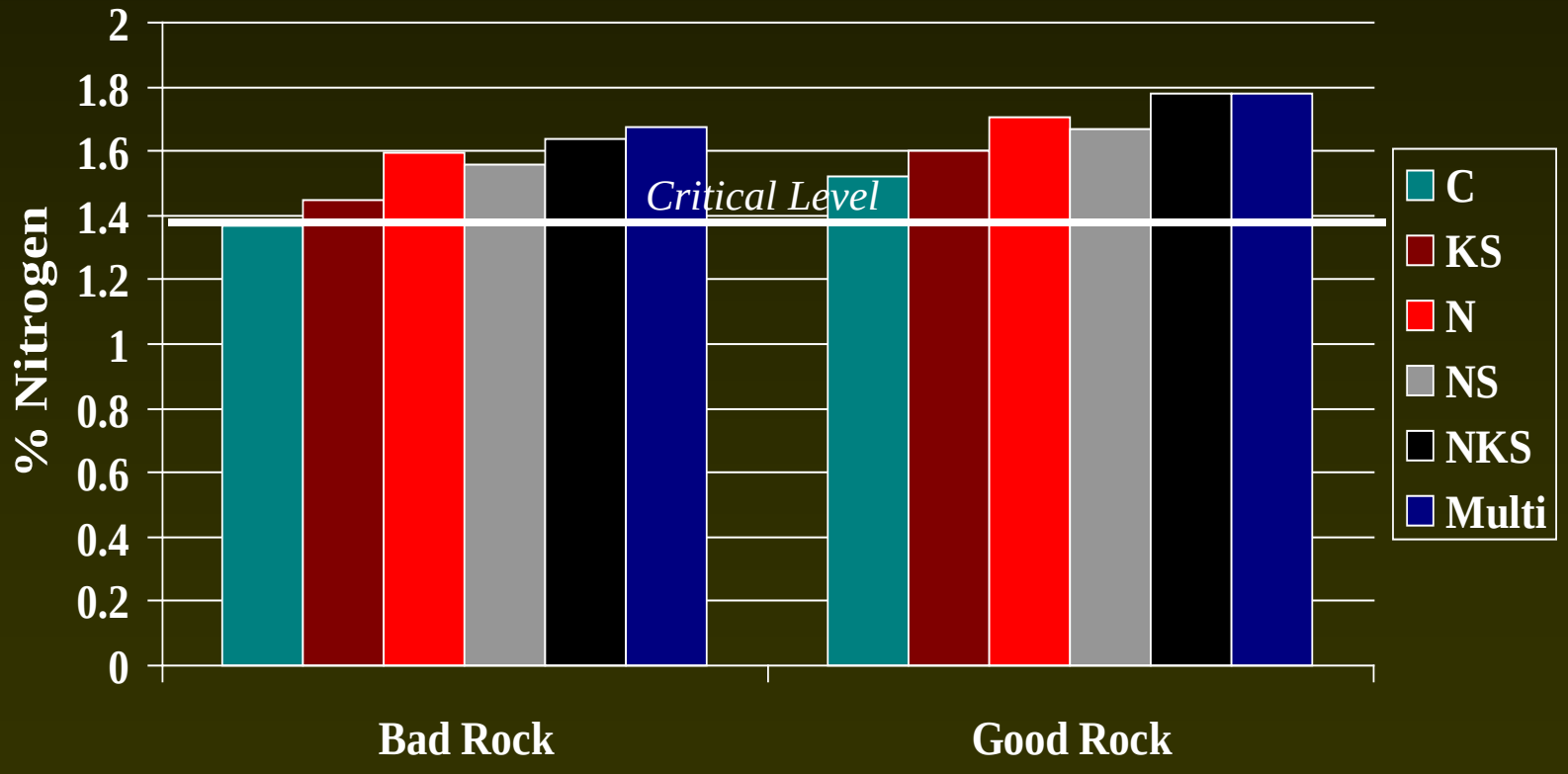
Study Design

-2 reps x 2 species x 6 treatments
-4 blocks x 6 plots x 121 trees

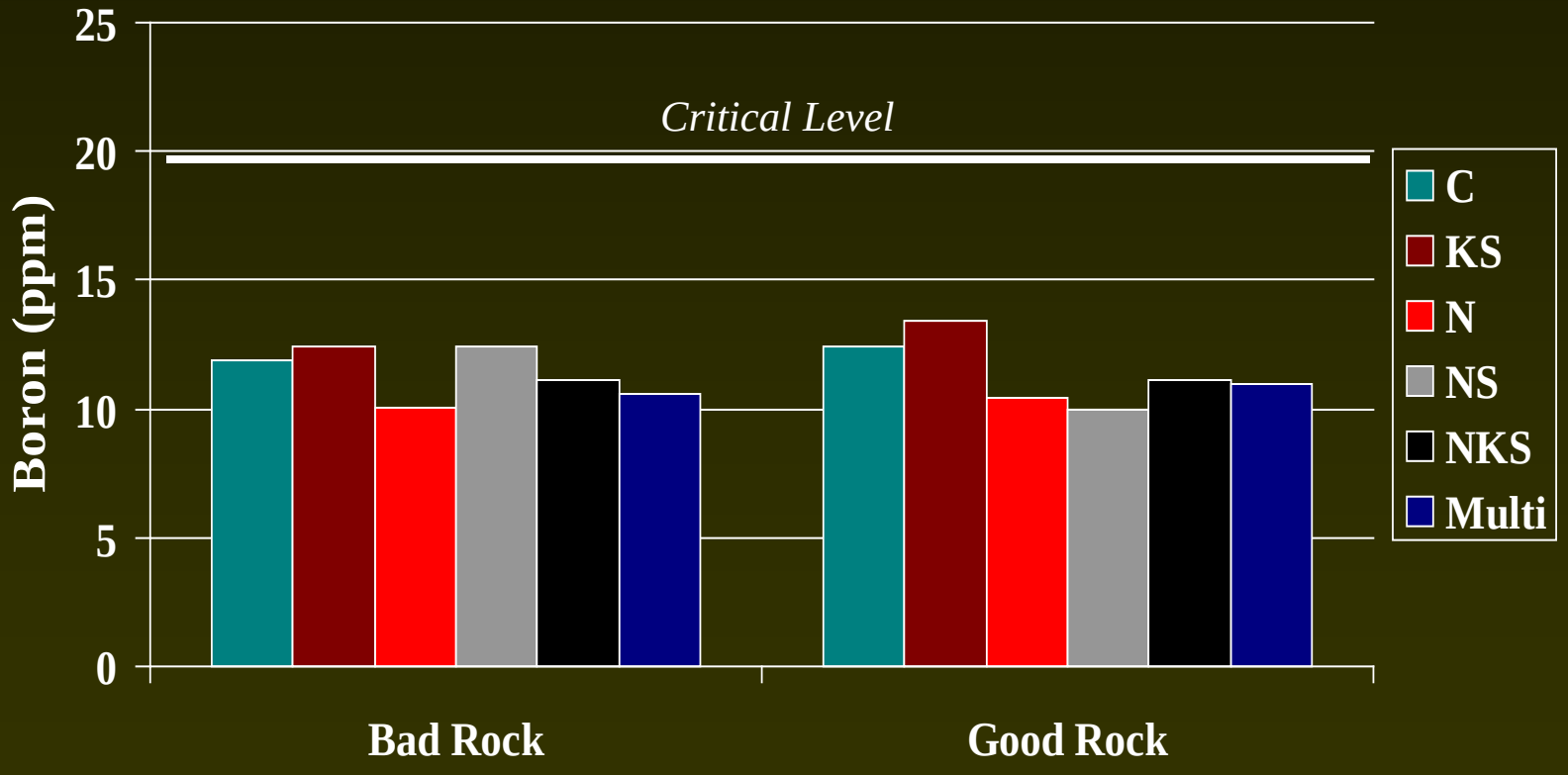
Paired Site Design

-Aspect, slope, elevation vegetation series and seed source were common for paired “bad / good” rock sites

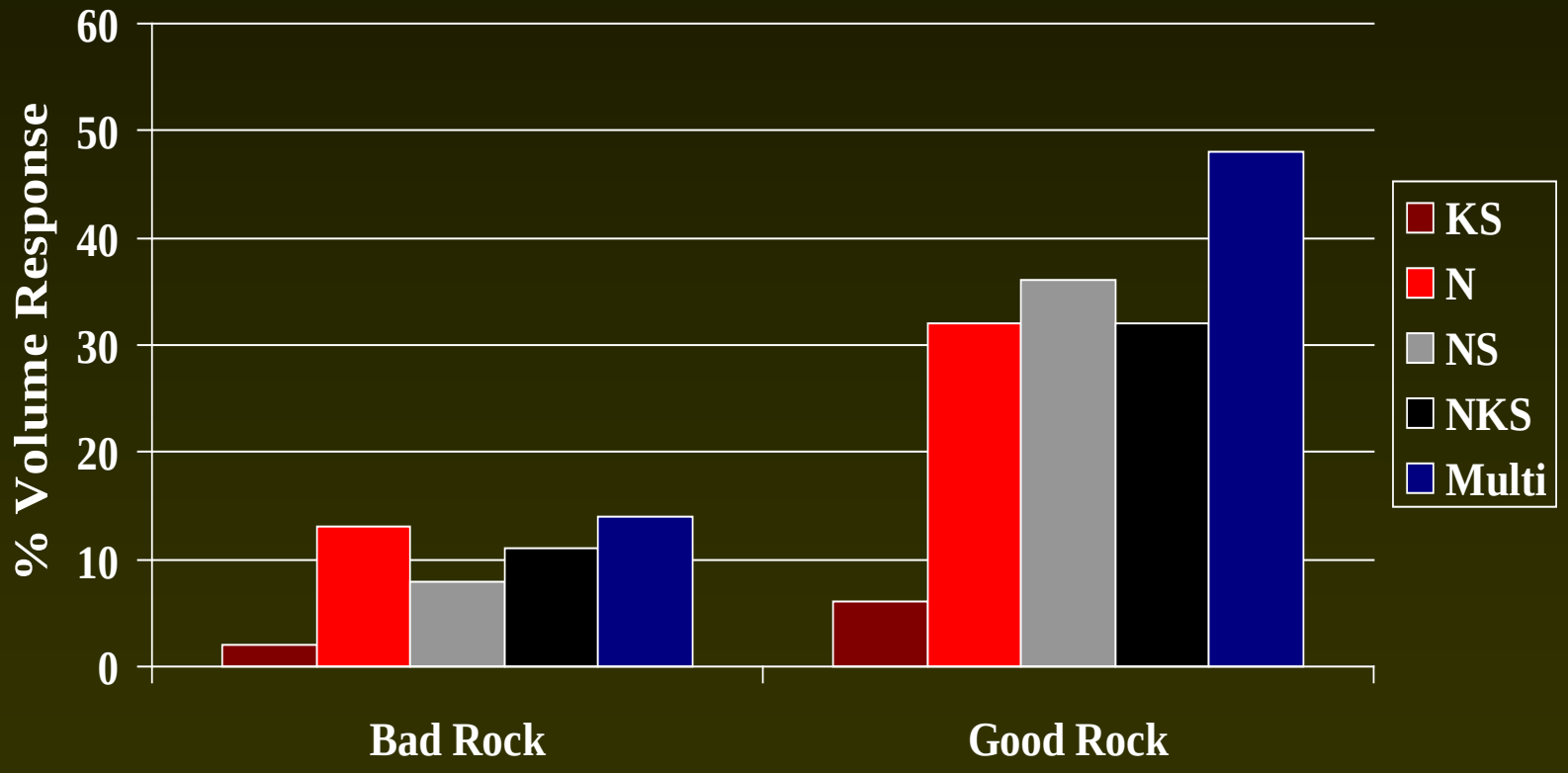
Douglas-fir Nitrogen Concentrations 1 Year after Initial Treatment



Douglas-fir Boron Concentrations
1 Year after Initial Treatment



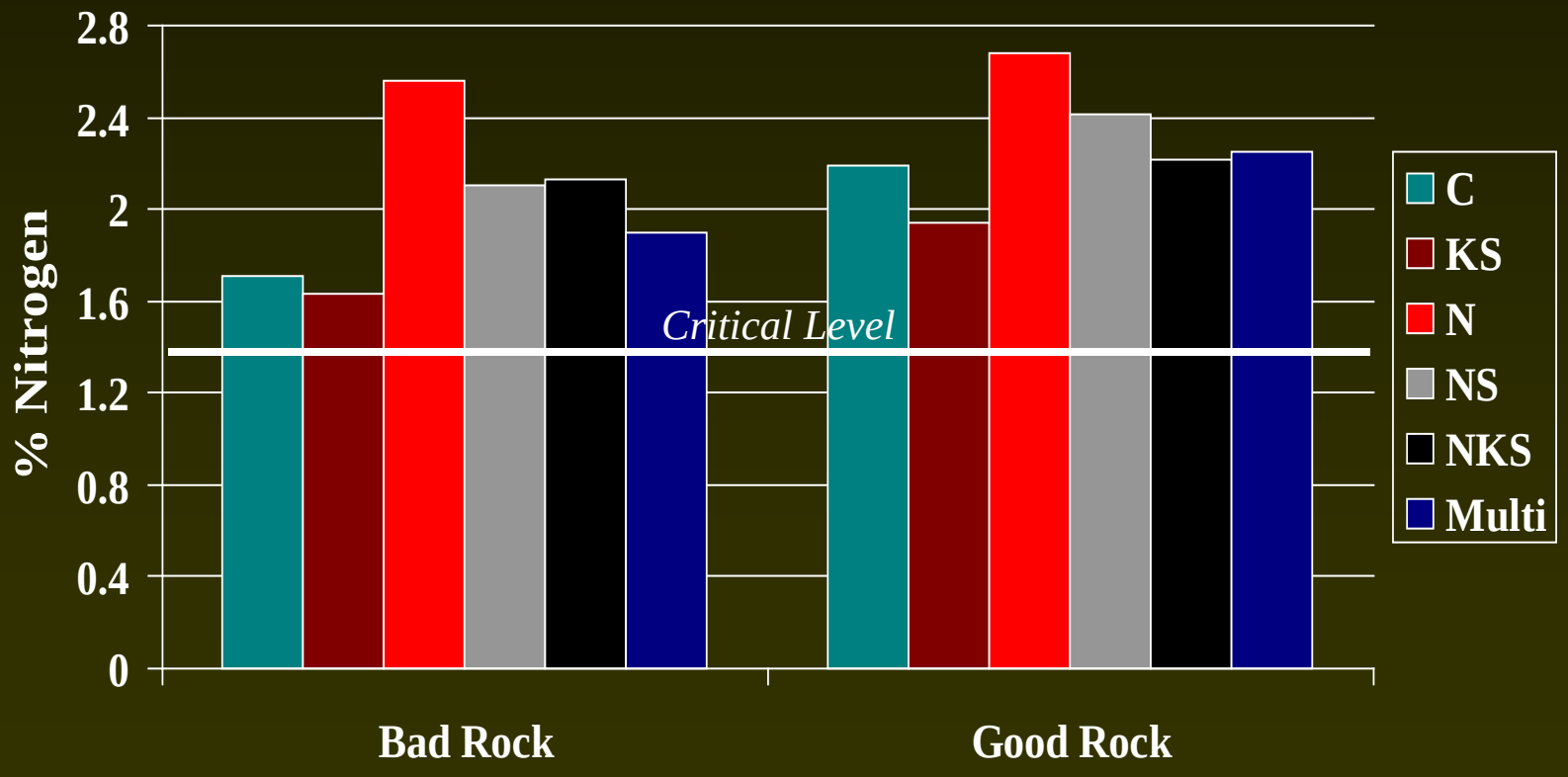
1-Year % Volume Response



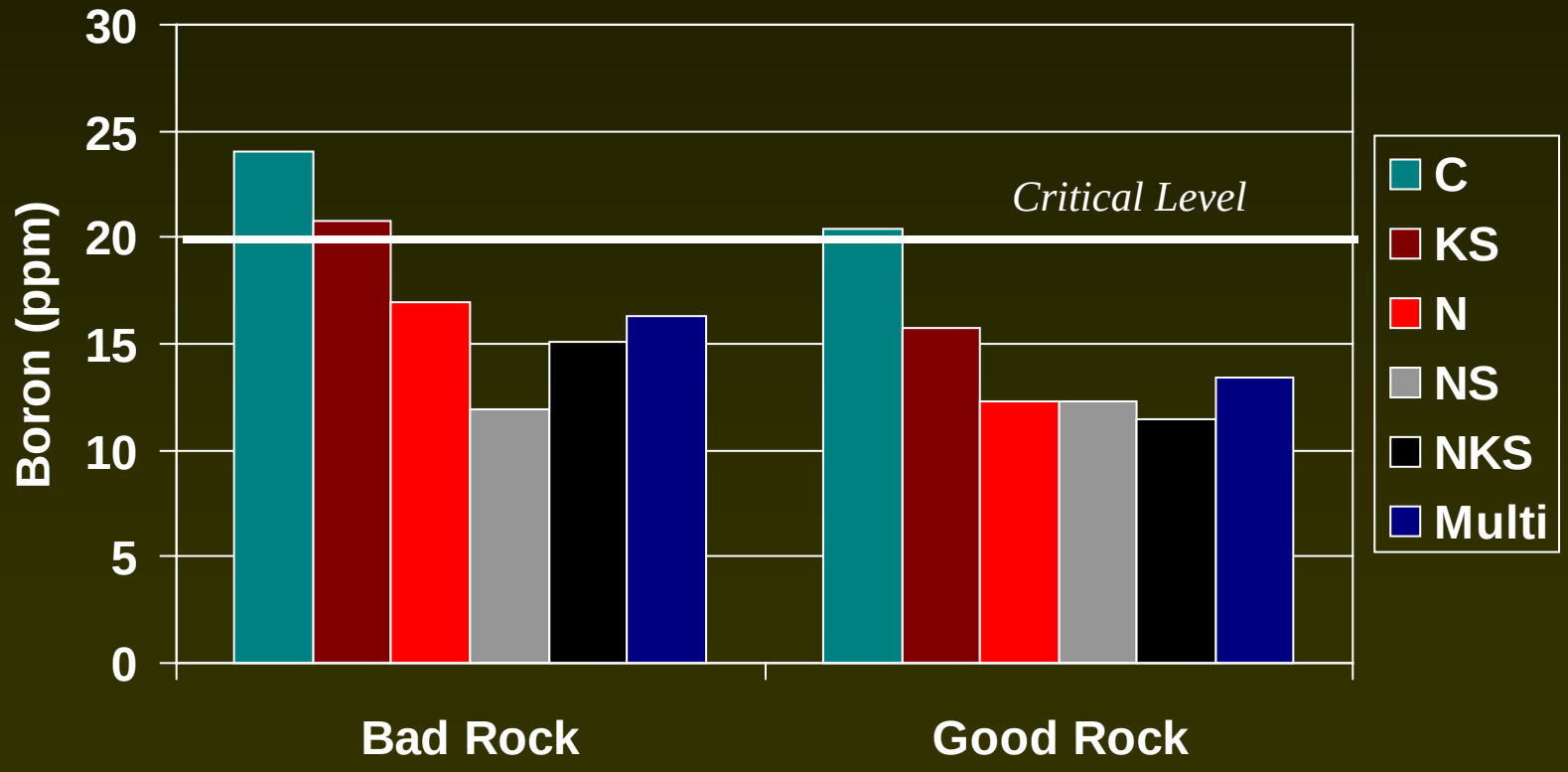
Second (1999) Fertilization
Spot Broadcast

- **No fertilizer (Control)**
- **32gN (N)**
- **32gN + 24gK + 9.6gS (NKS)**
- **32gN + 9.6gS (NS)**
- **24gK + 9.6gS (KS)**
- **32gN + 24gK + 9.6gS + 8.2gP + 1.22gMg + 0.02gB + 0.06gCu + 0.52gFe + 0.08gMn + 0.02gMo (Multi)**

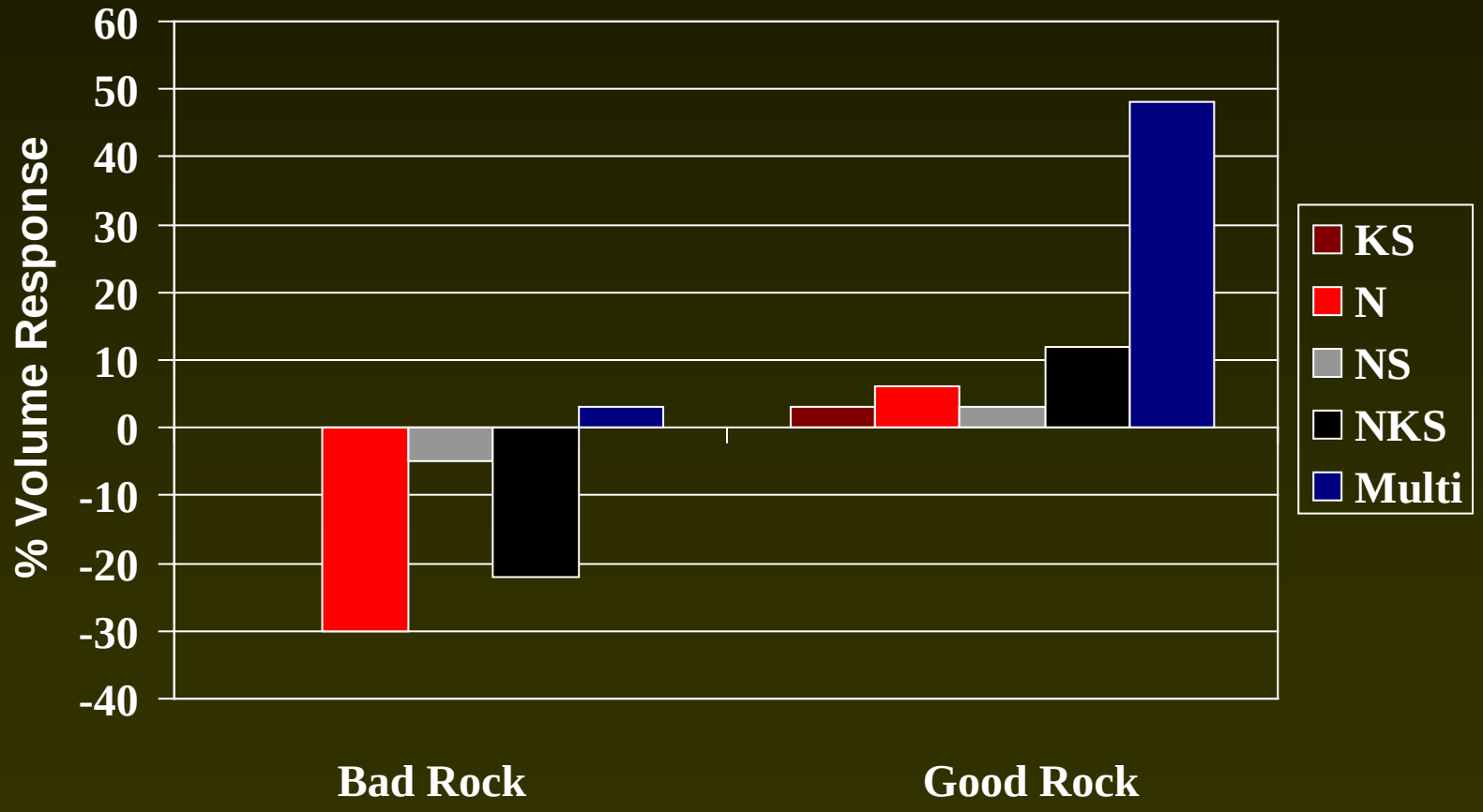
Douglas-fir Nitrogen Concentrations 1-Year after 2nd Treatment



Douglas-fir Boron Concentrations
1-Year after 2nd Treatment



3-Year % Volume Response



Is it the rocks?

- What is it about the rocks?
  - Nutrient treatments did not have the hypothesized effects.
  - Was it low boron?
  - Are there differences in soil chemistry by rock class?
  - Are there differences in the soil biotic community by rock class?

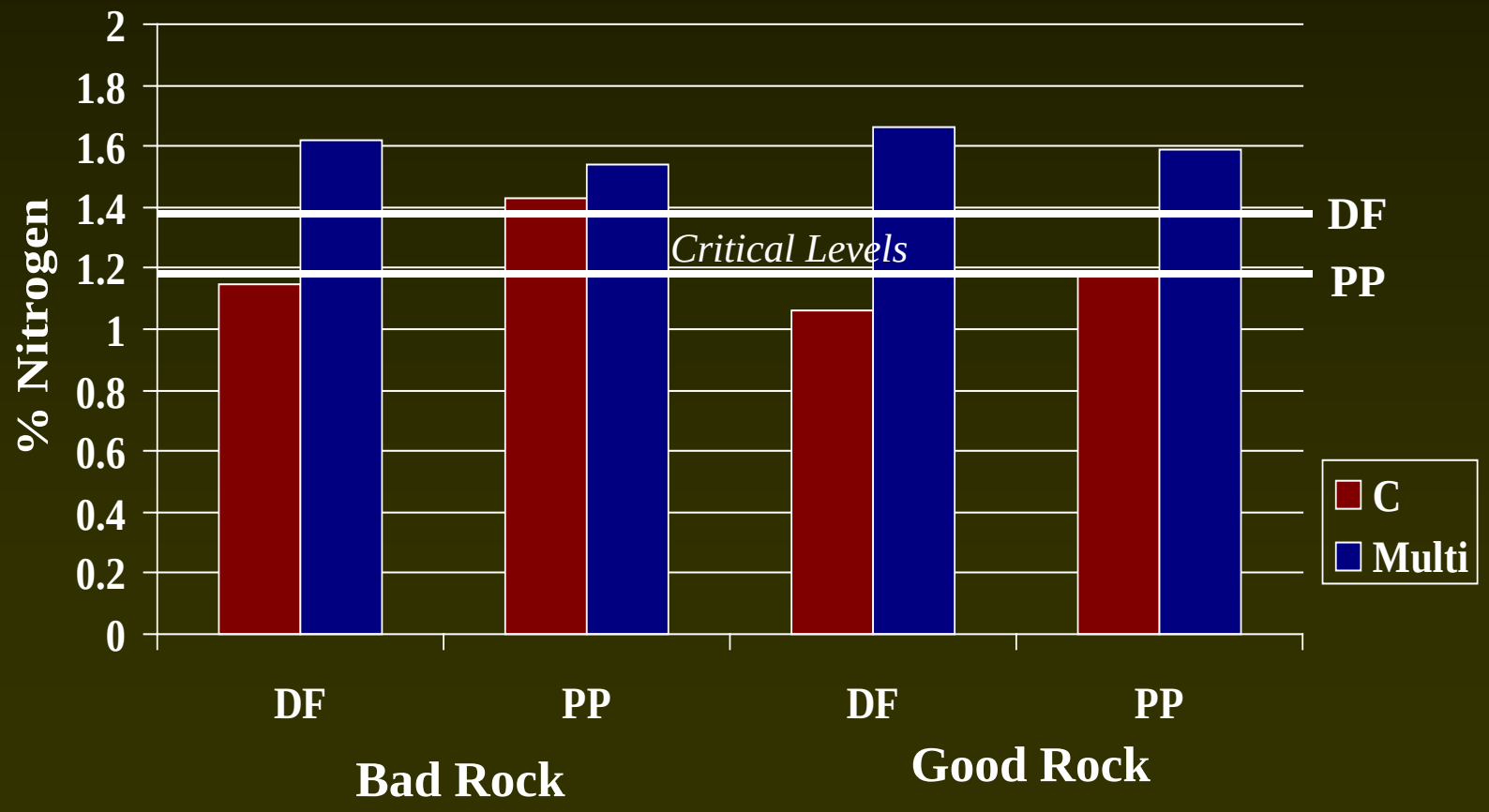
Third (2001) Fertilization

Metasediment “Bad Rock” & Granite “Good Rock”

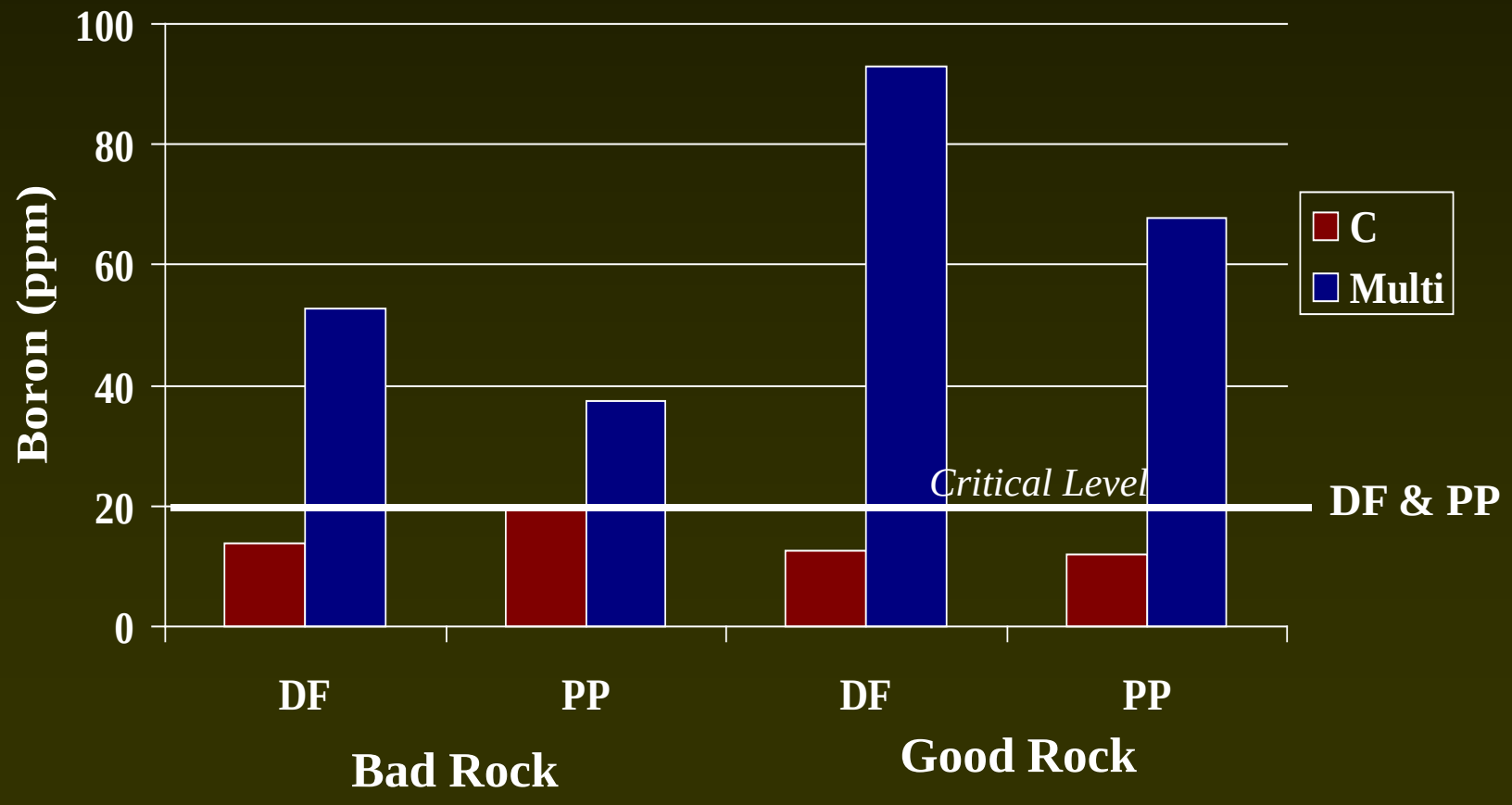
Surface Broadcast

Treatment	Rate lbs/ac
Nitrogen	50
Potassium	200
Sulfur	50
Boron	3
Copper	10
Zinc	10
Iron	10
Pronone	3

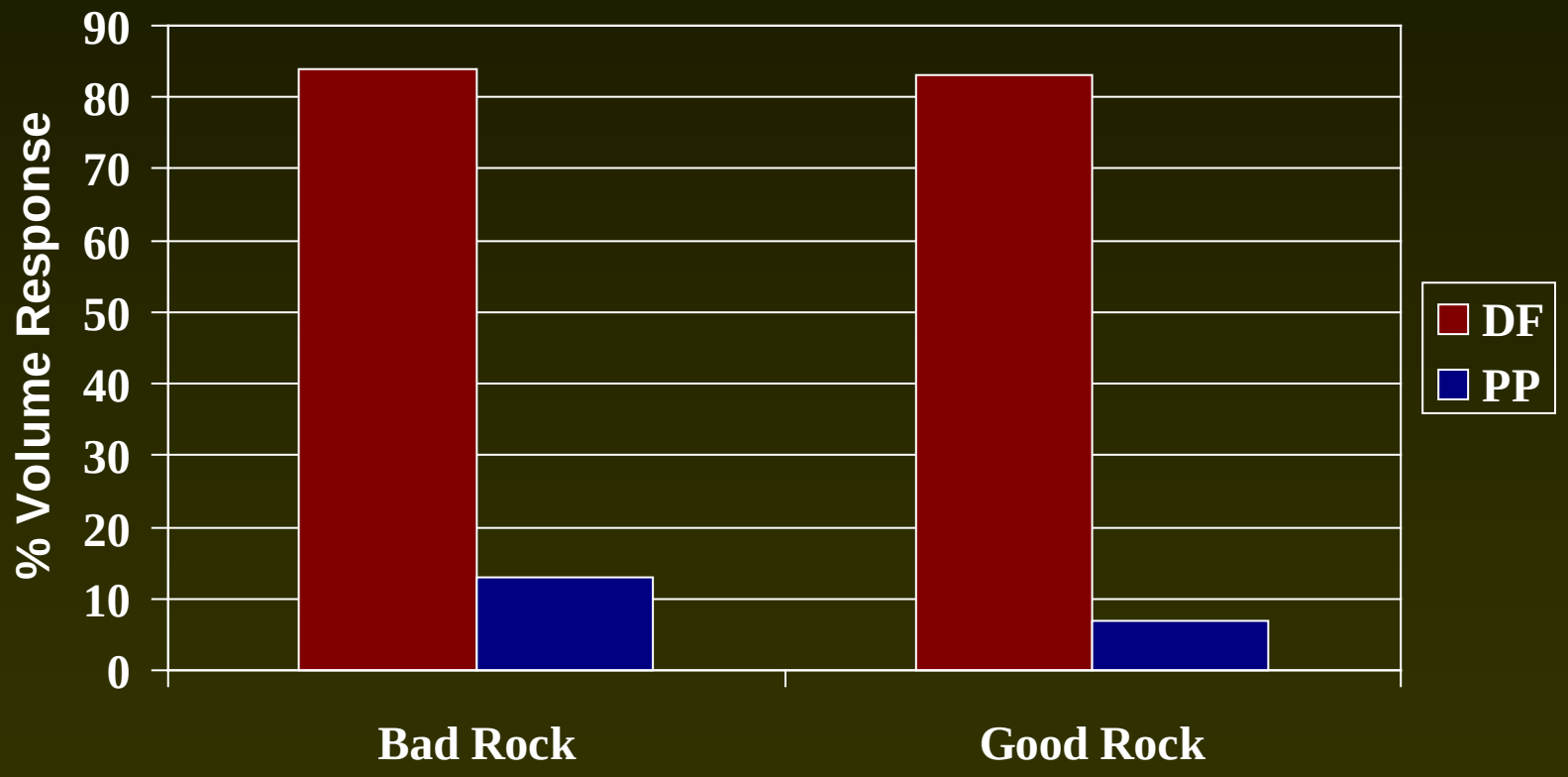
Nitrogen Concentrations 1 Year after Third Treatment for Douglas-fir and Ponderosa Pine



Boron Concentrations 1 Year after Third Treatment for Douglas-fir and Ponderosa Pine



% Volume Response 1 Year after Third Treatment for Douglas-fir & Ponderosa Pine

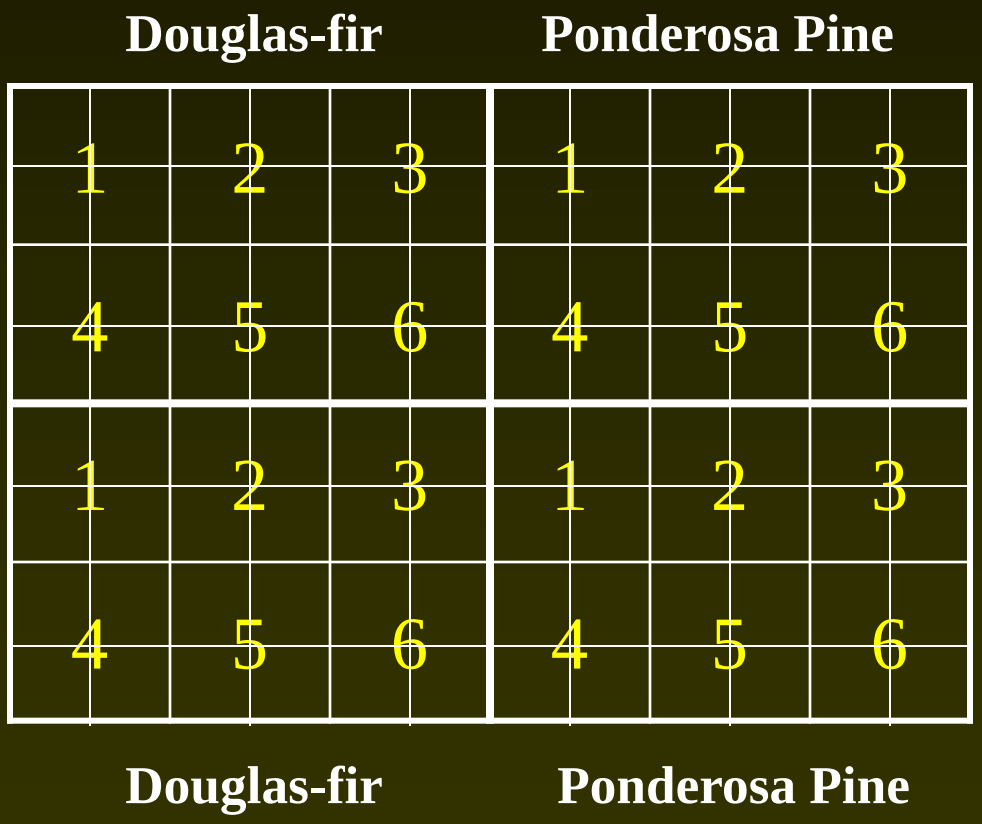


Third (2003) Fertilization

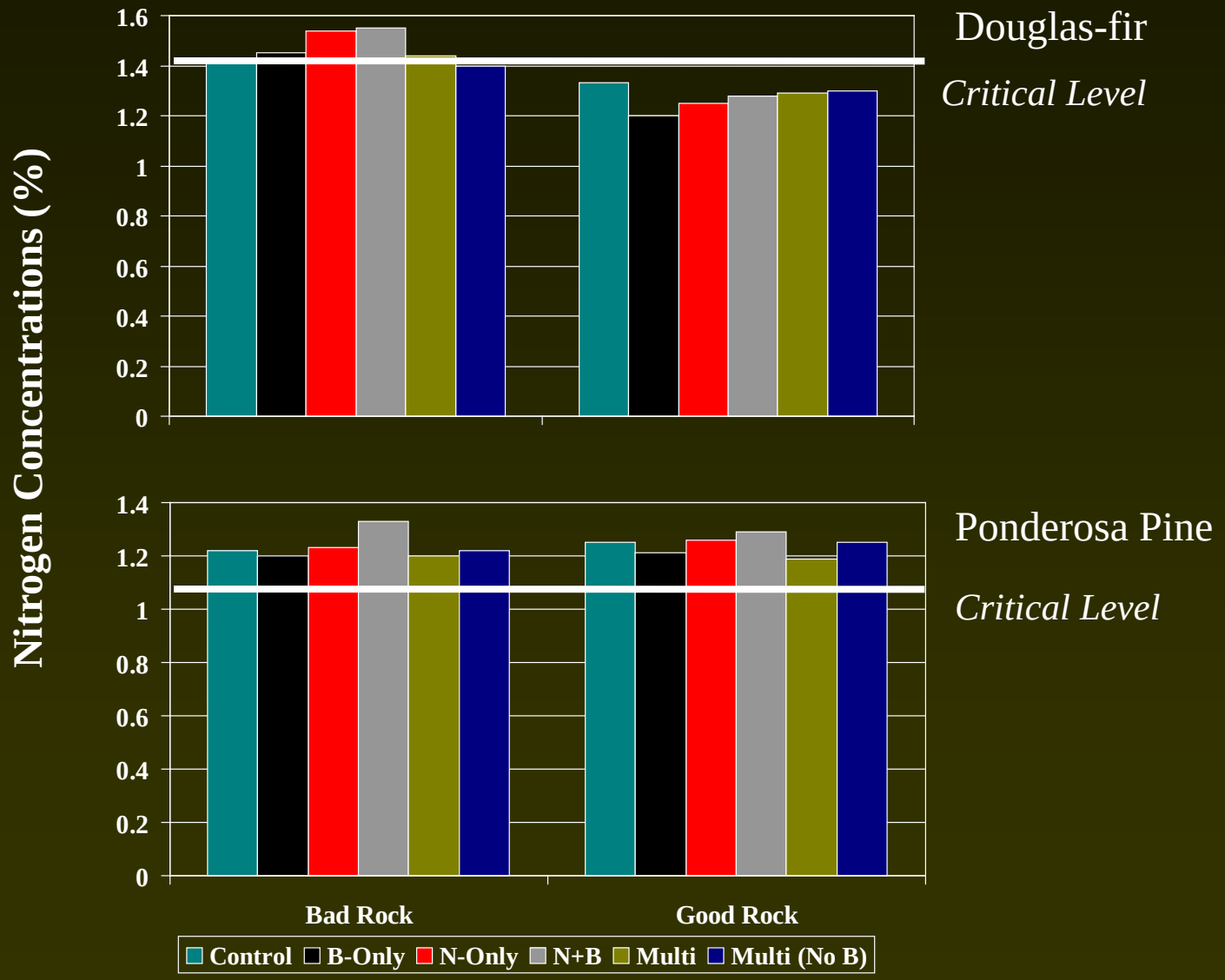
Andesite “Bad Rock” & Basalt “Good Rock”

Sub-Plot Broadcast

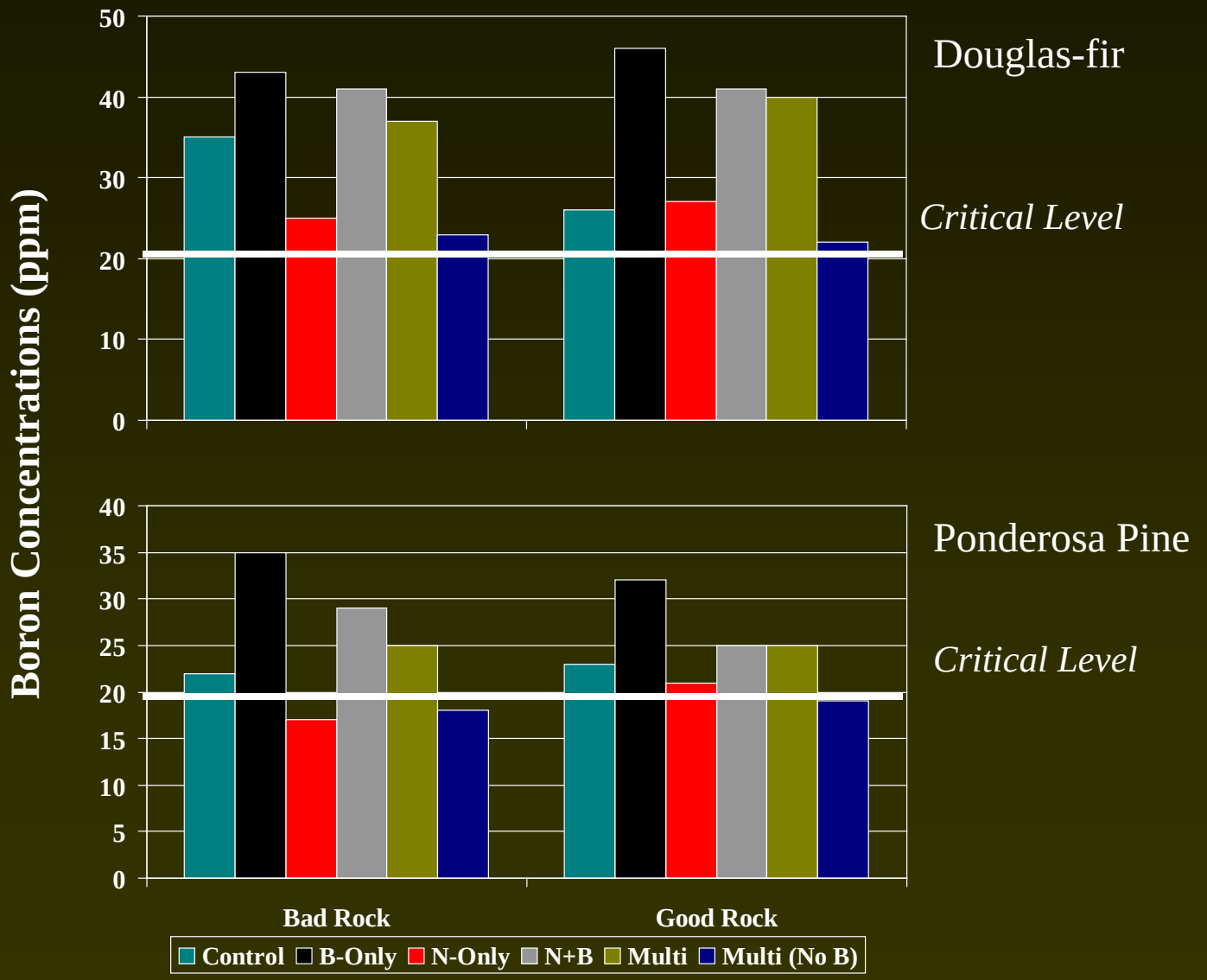
Treatment
Control
Boron Only
Nitrogen Only
Nitrogen + Boron
Multi-Nutrient + Boron
Multi-Nutrient w/o Boron



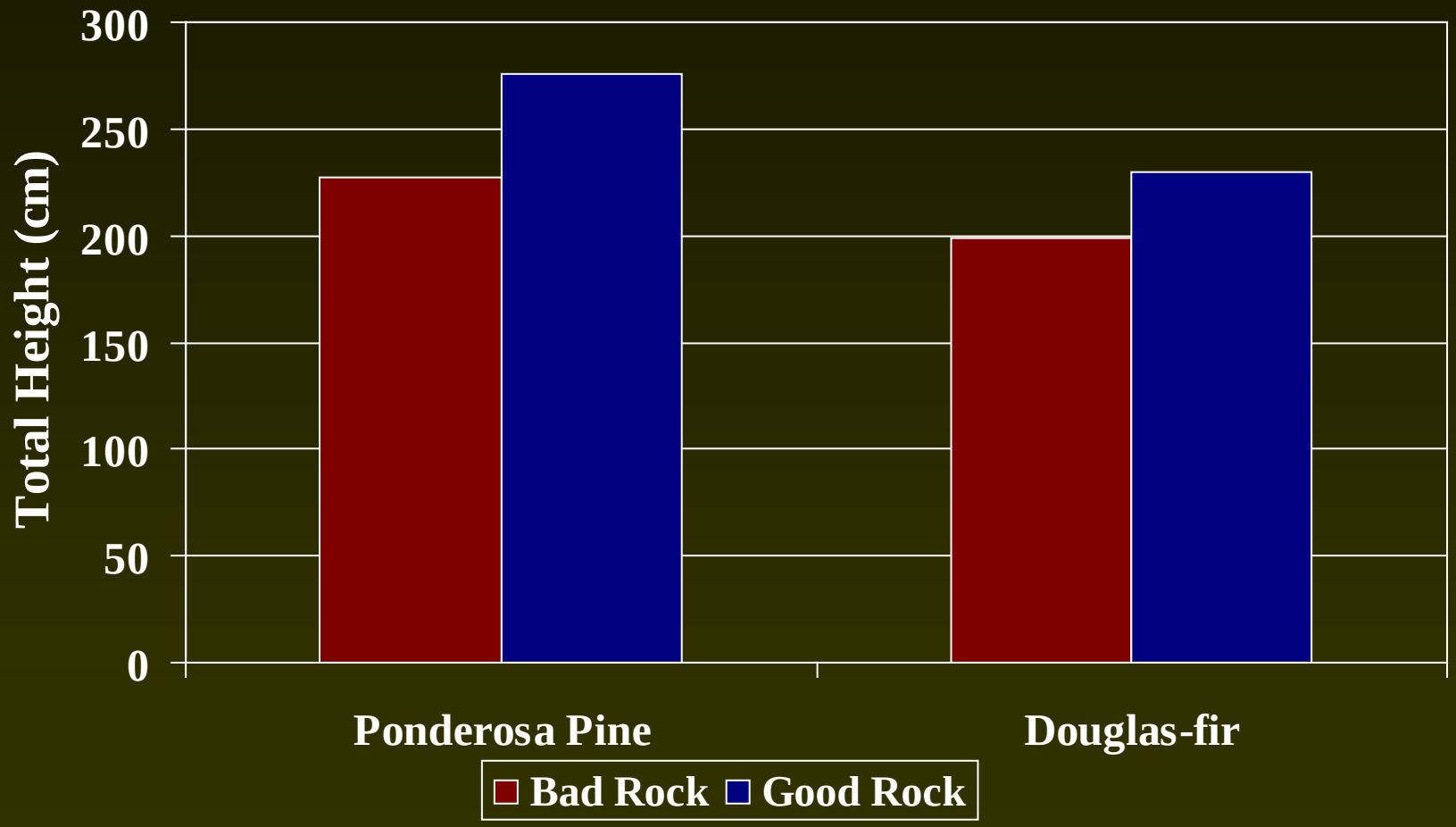
Nitrogen Concentrations 1 Year after Third Treatment



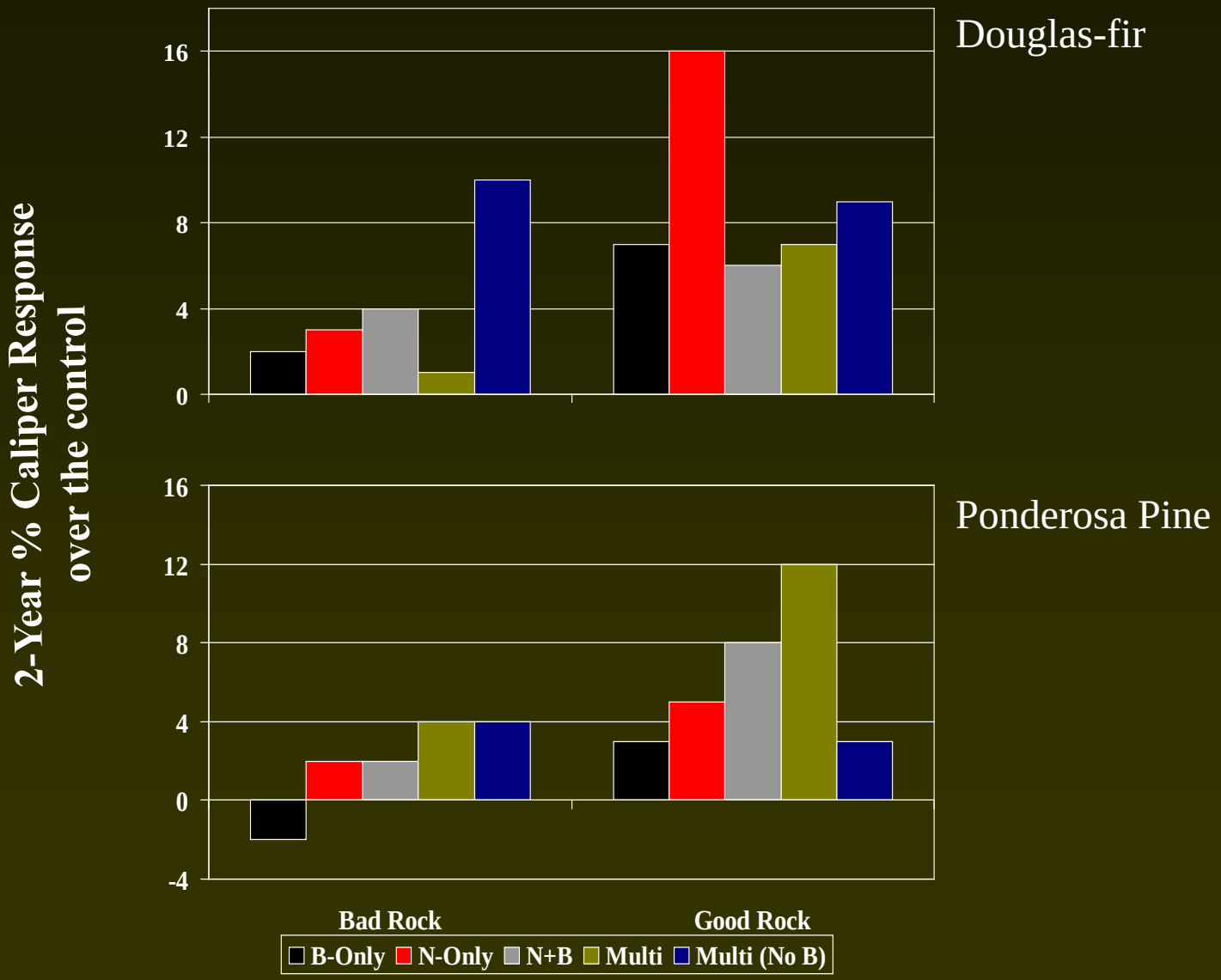
Boron Concentrations 1 Year after Third Treatment



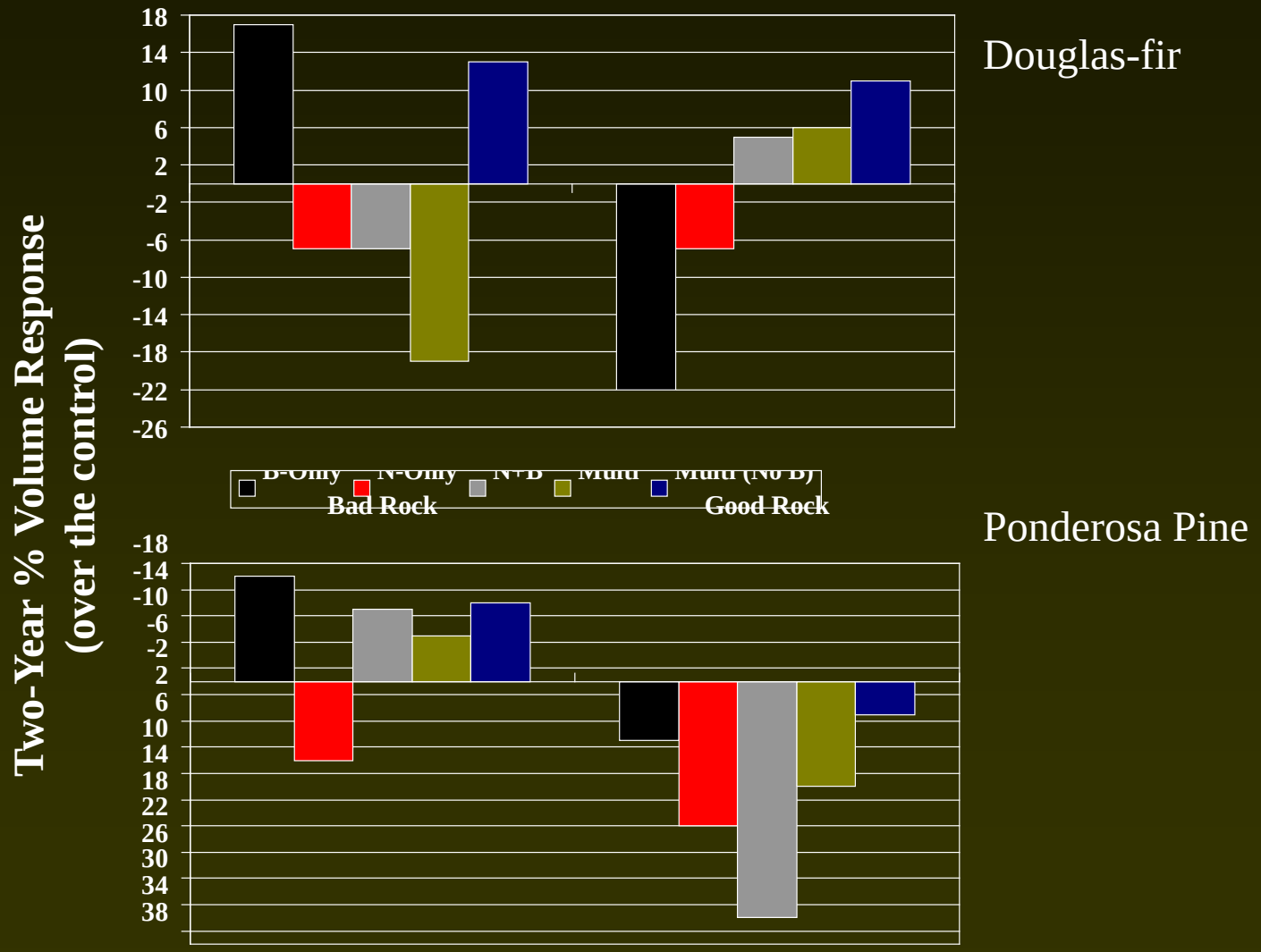
Total Height 7-Years after Initial Treatment



% Caliper Response 2-Years after Third Treatment



% Volume Response 2-Years after Third Treatment



Douglas-fir

Ponderosa Pine

SUMMARY

- Foliar nutrient response was generally low for the first two treatment applications.
- Boron application rates applied at the nursery and during the initial and second field treatments were inadequate.
- Both species showed good foliar nutrient response for both third retreatment studies.
- Growth response was higher on the good rock than the bad rock for the initial, second and third (andesite v basalt) treatments but lower than the bad rock on the third (metasediment v granite) treatment.
- Douglas-fir growth response was significantly high following the third multi-nutrient (medasediment v granite) treatment application.
- The B only treatment tended to show low or antagonistic response for both species.

SUMMARY

- Ponderosa pine tended to respond better than Douglas-fir, especially when B was in the fertilizer mix.