Multi-nutrient Fertilizer Screening Trial Comparison and Review

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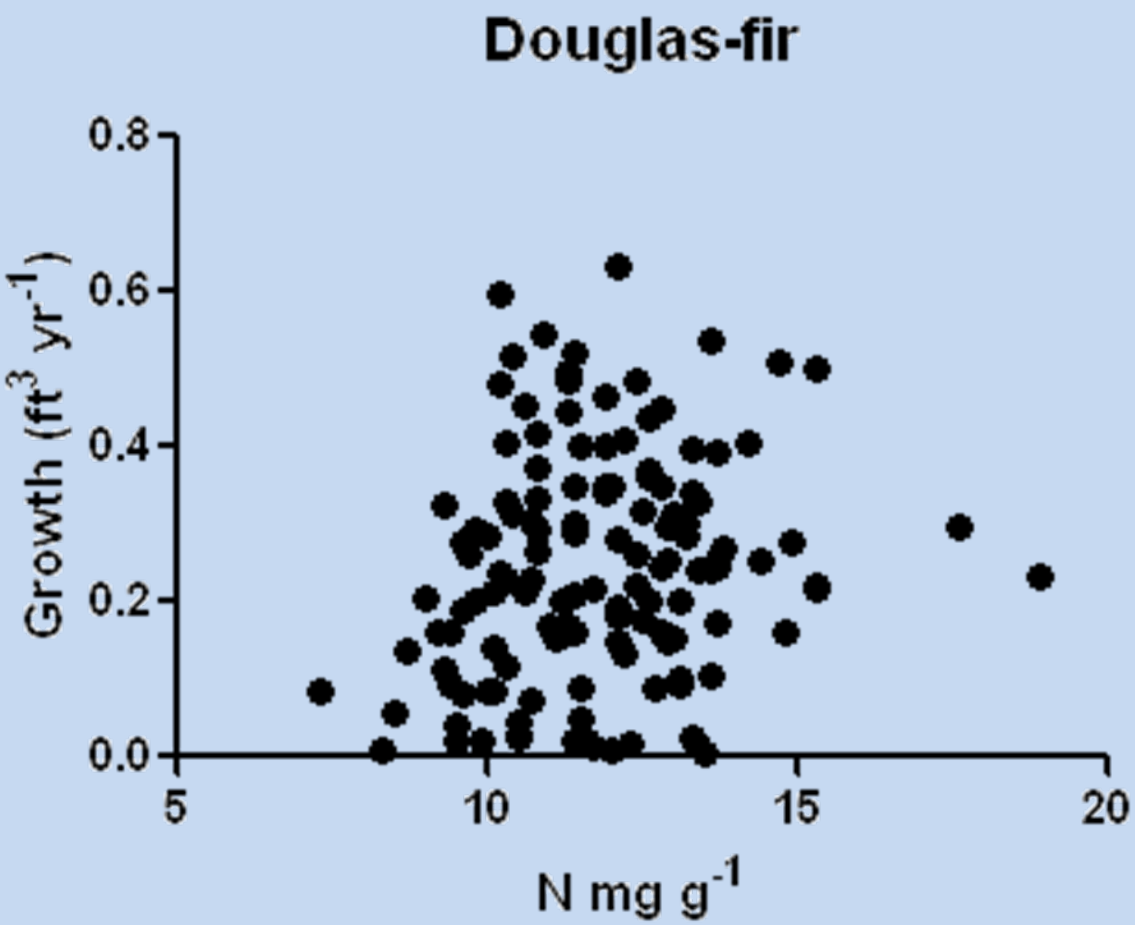
Screening trials define forest site quality, provide knowledge of nutrient availability

Nutrient supply affects management regardless of the objective, …

and management affects nutrient supply

There's no "blood test" for nutrient supply

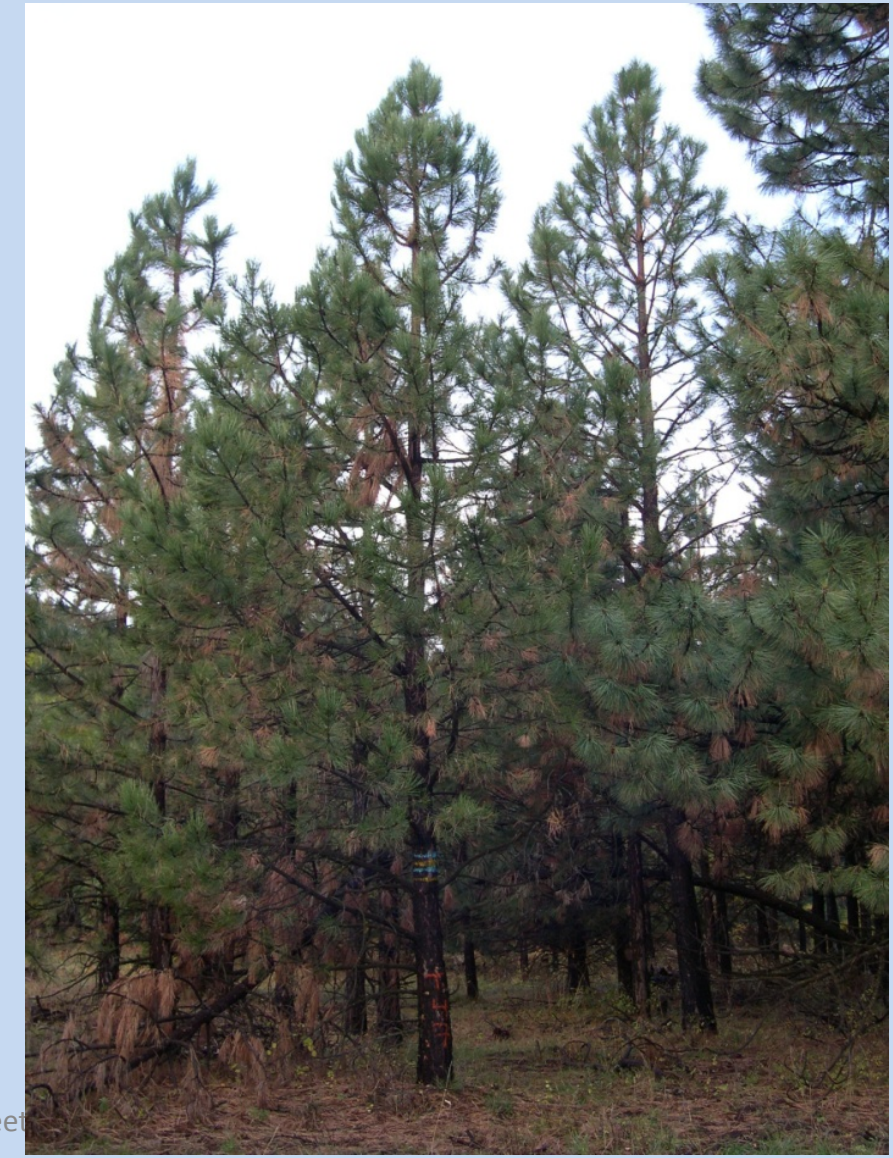


Rely on site-type definitions

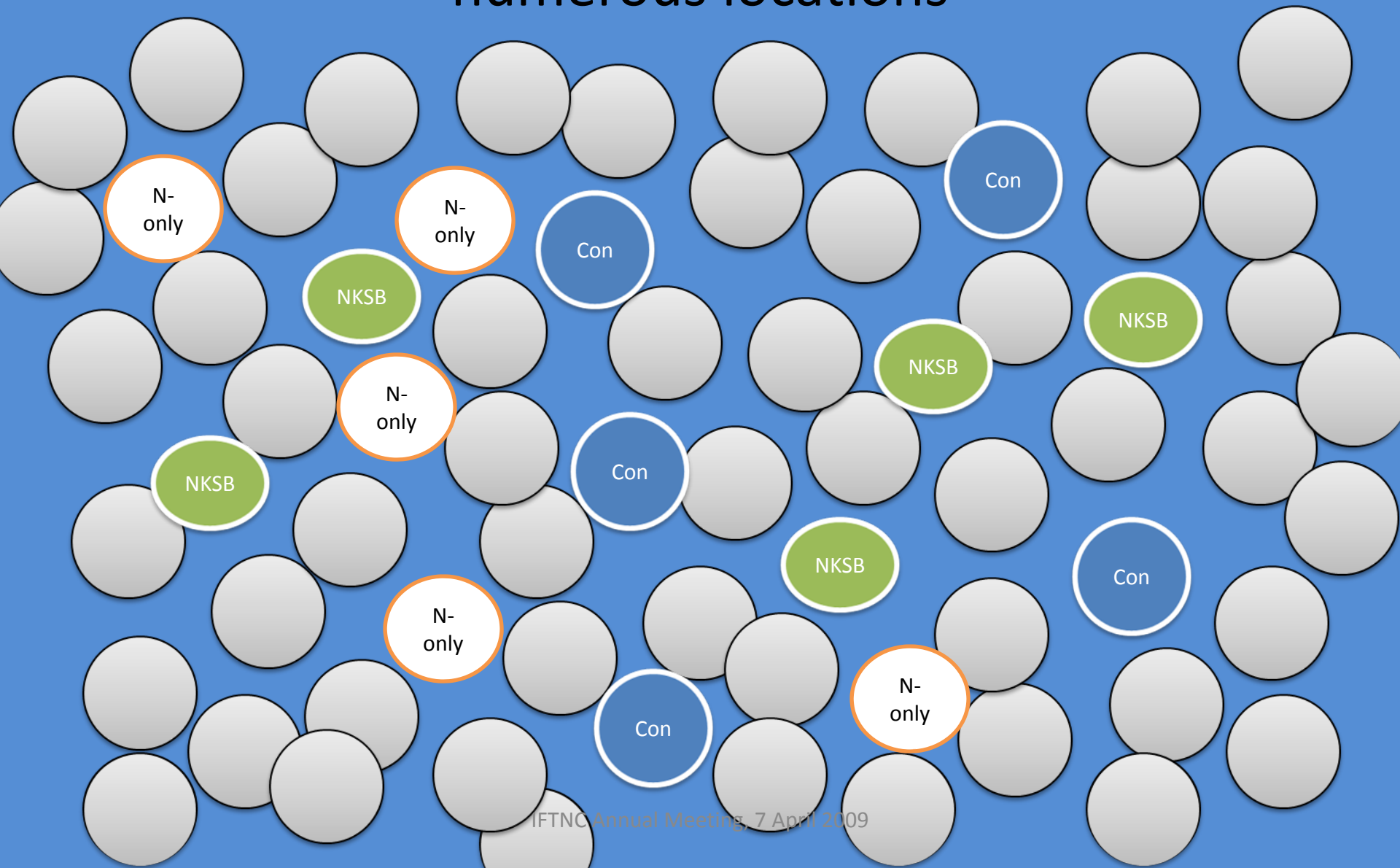
- Site types are a traditional forest management concept
- Soils define site

Screening trials help to define site-types

- Efficient study design
- Deployed at numerous locations
- Site-type definitions for each location
- Reliable productivity information
- Relatively short-term experiments



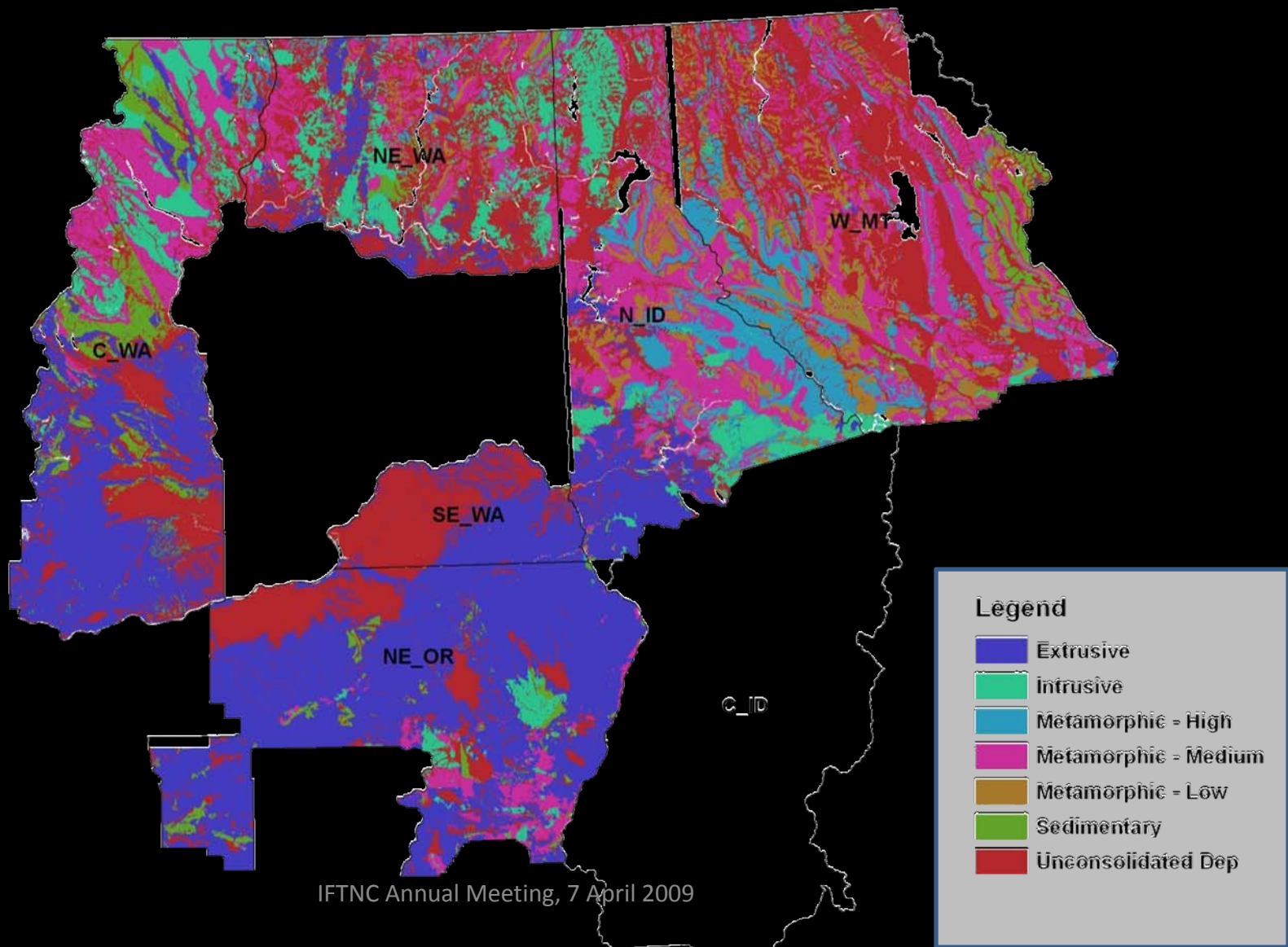
Efficient study design that can be deployed at numerous locations



Response data is assay of site potential, diagnosis of nutrient requirement

- Foliage sampling one year following treatment
- Height and diameter collected after 2 yrs
- Volume growth calculated

Stratifying average response by rock types



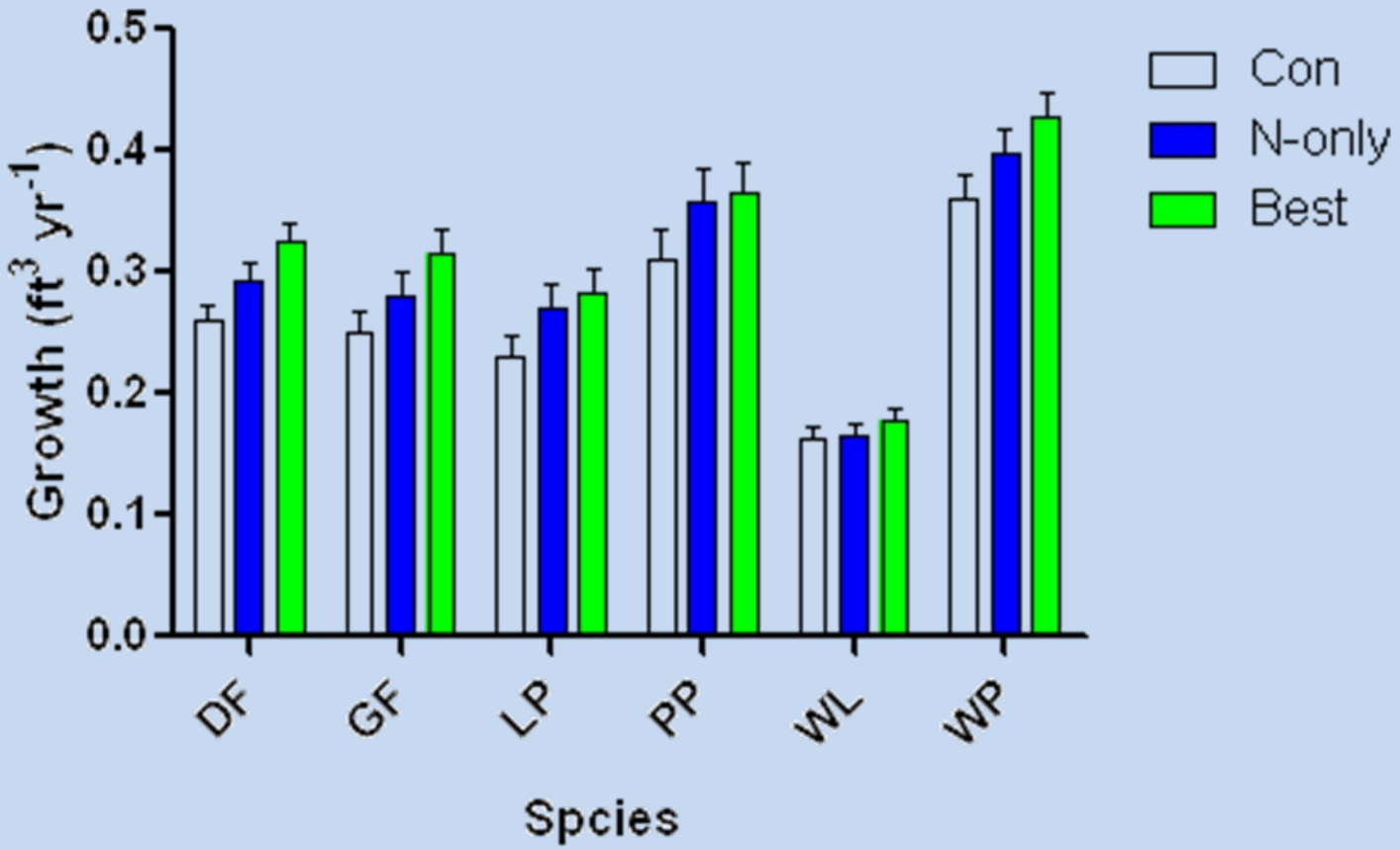
Trials include numerous species

Species	Rock Types	Total # Sites
Douglas-fir	9	40
Ponderosa Pine	6	36
Lodgepole Pine	7	22
Grand Fir	6	16
Larch	5	6
White Pine	2	3

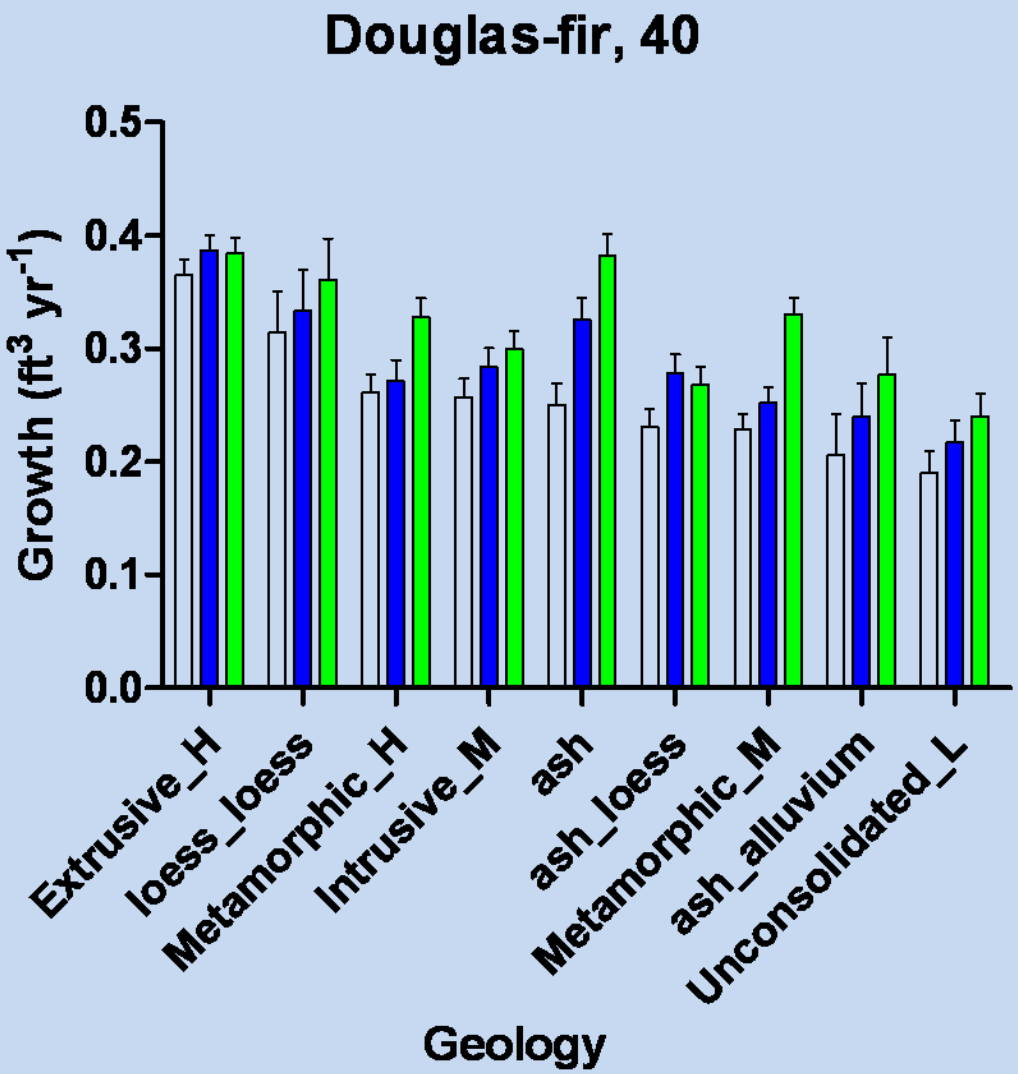
Comparison of Species

- Of these species, few have enough sites to compare among different site types
- Can compare average treatment response within species

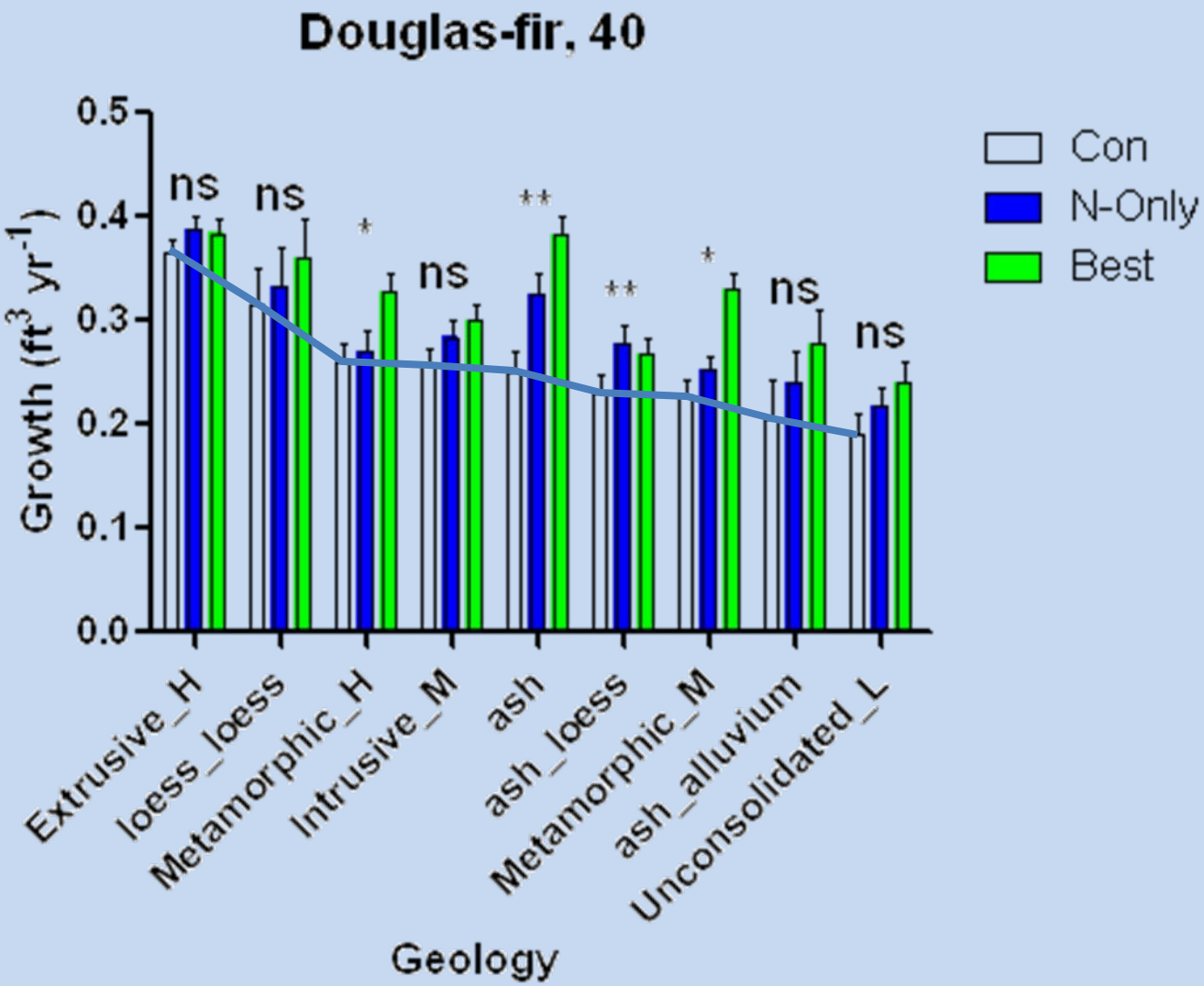
Average response indicates universal nutrient limitation



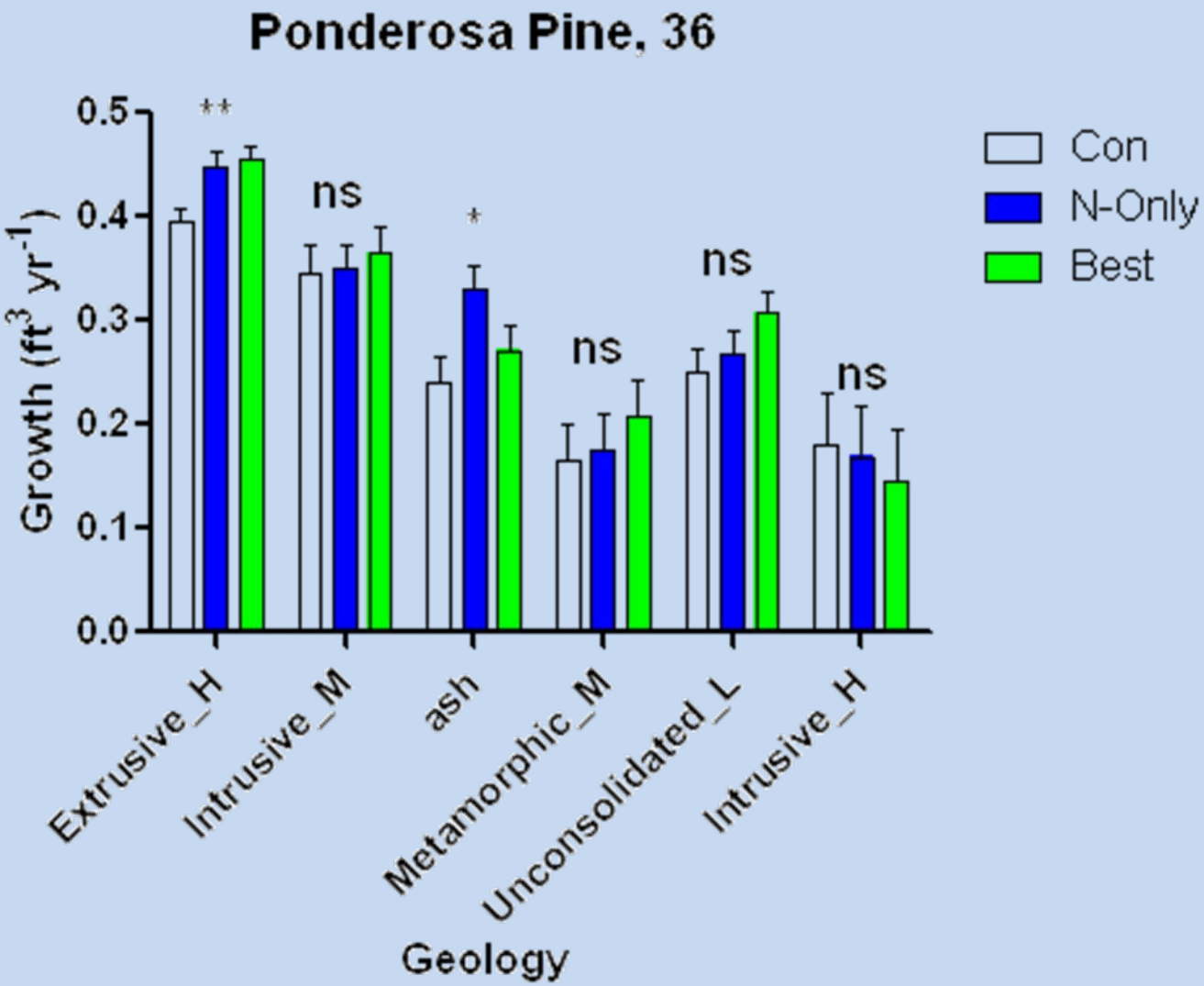
Comparison among rock types


Douglas-fir, 40
Growth (ft3 yr-1)
0.5
0.4
0.3
0.2
0.1
0.0
Extrusive_H
loess_loess
Metamorphic_H
Intrusive_M
ash
ash_loess
Metamorphic_M
ash_alluvium
Unconsolidated_L
Geology

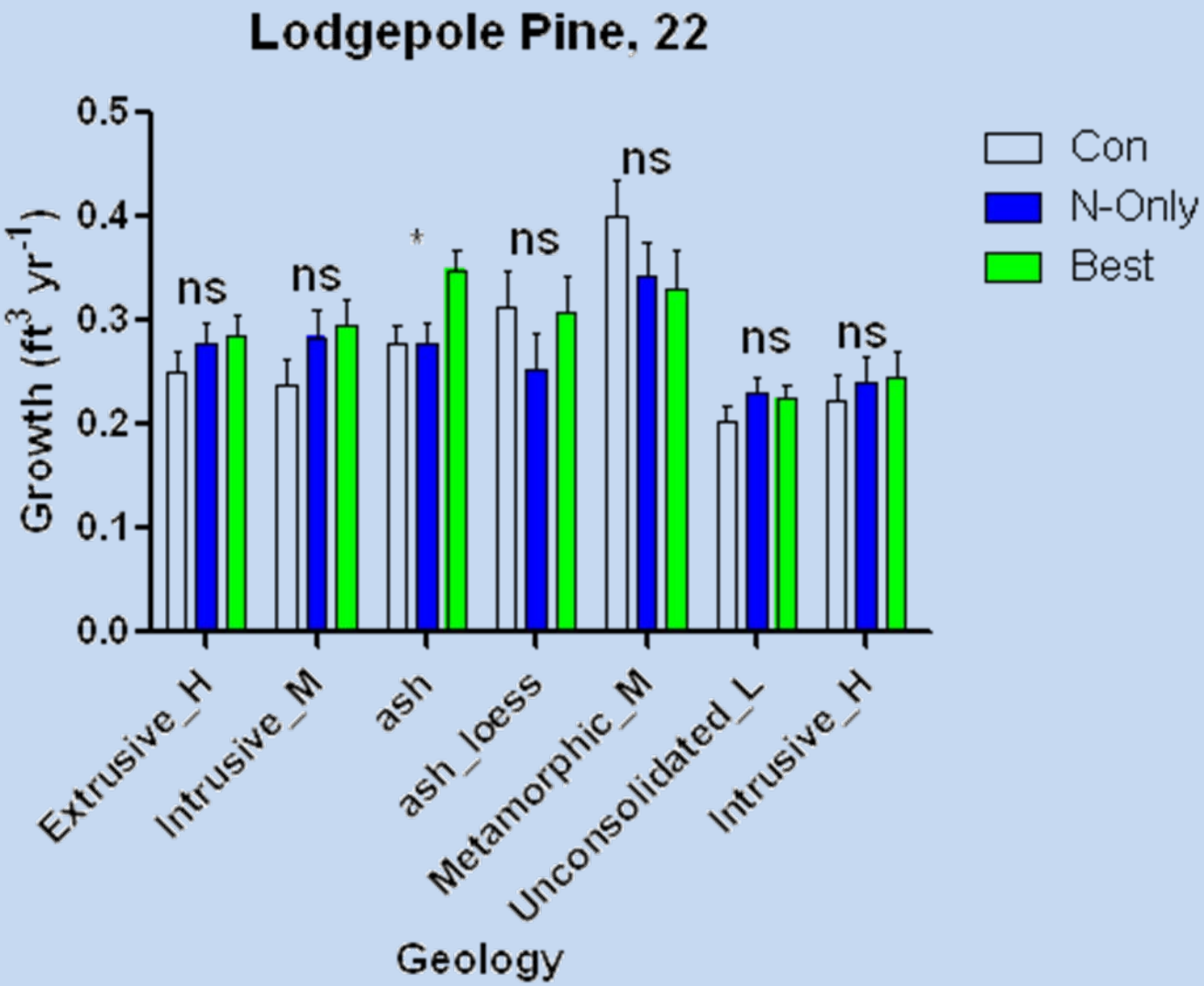
= NKSB



Rock	***
Treatment	***
Rock X Treat	**



Rock	*****
Treatment	*****
Rock X Treat	**ns**



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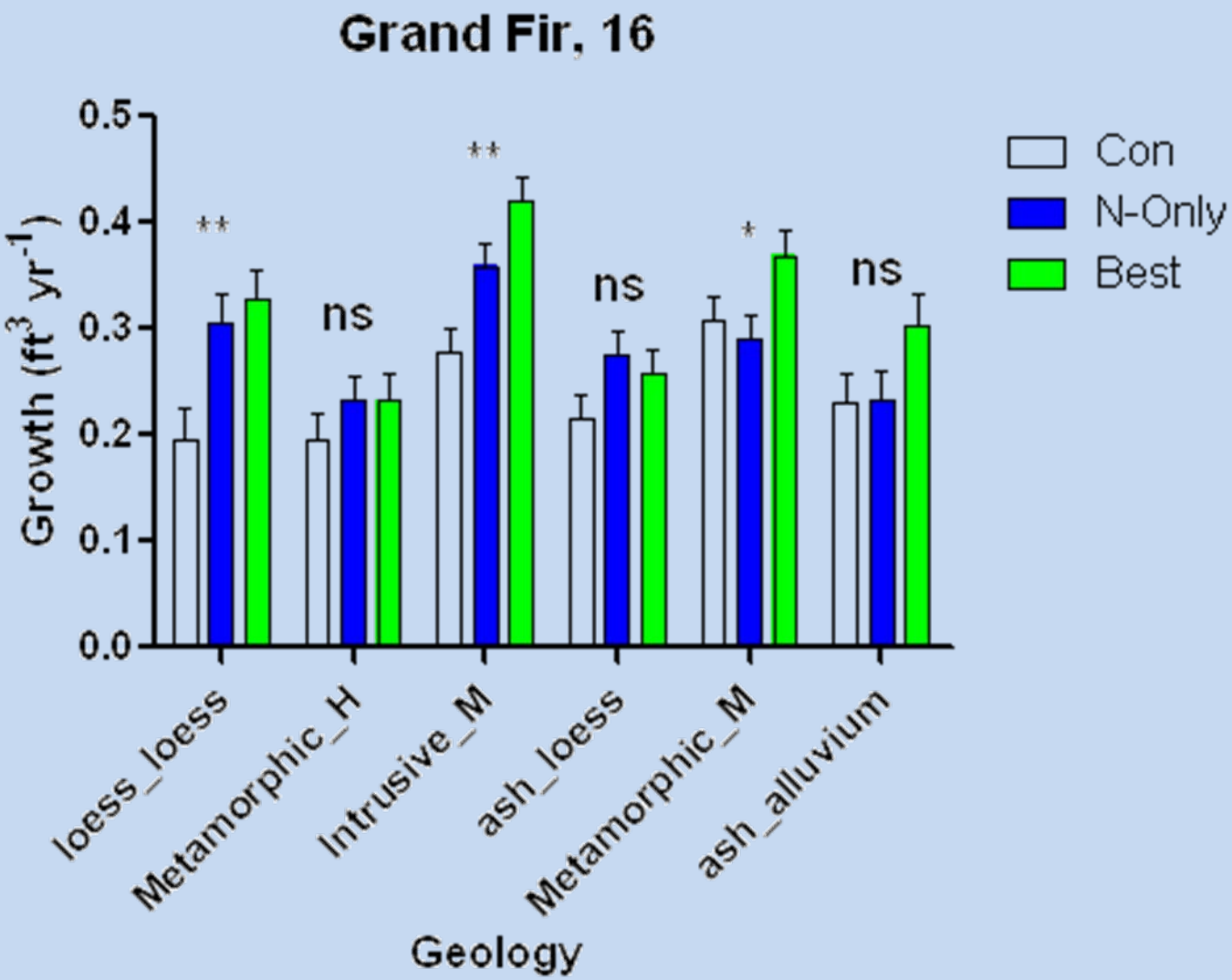
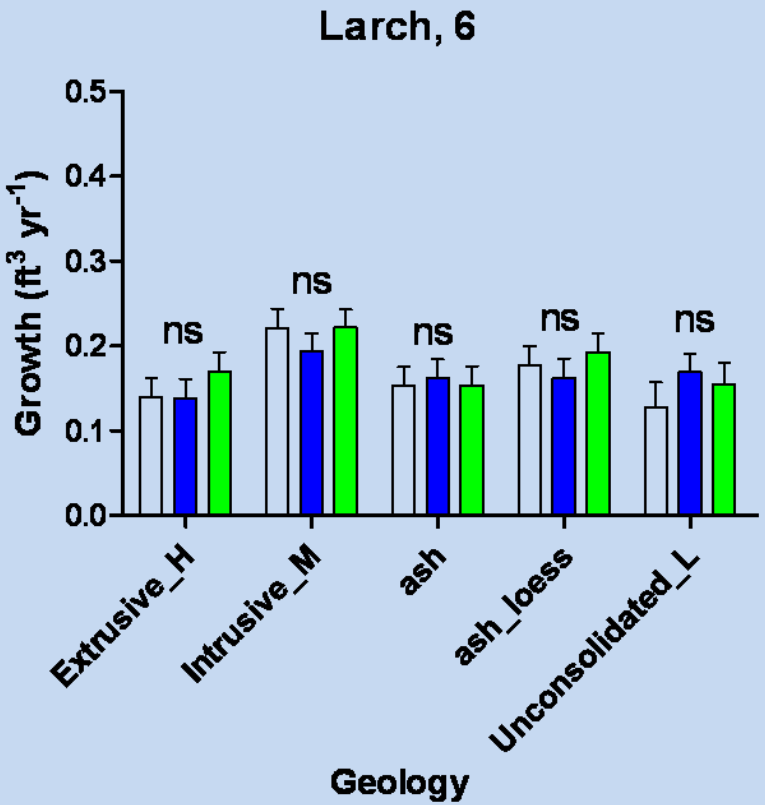
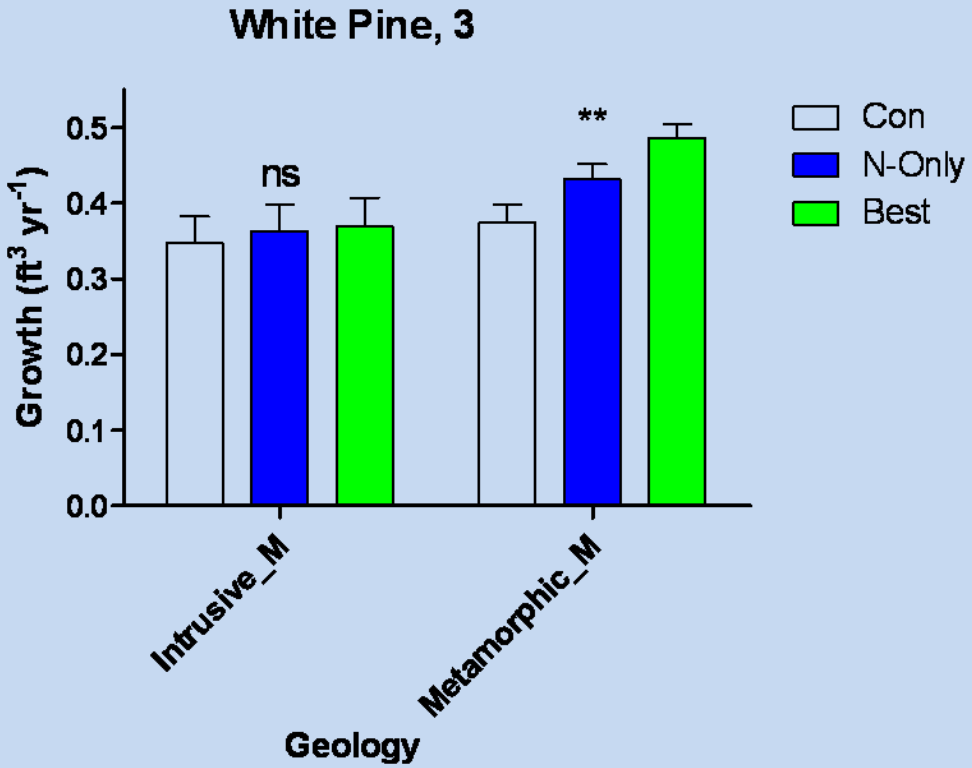


Rock	***
Treatment	***
Rock X Treat	*





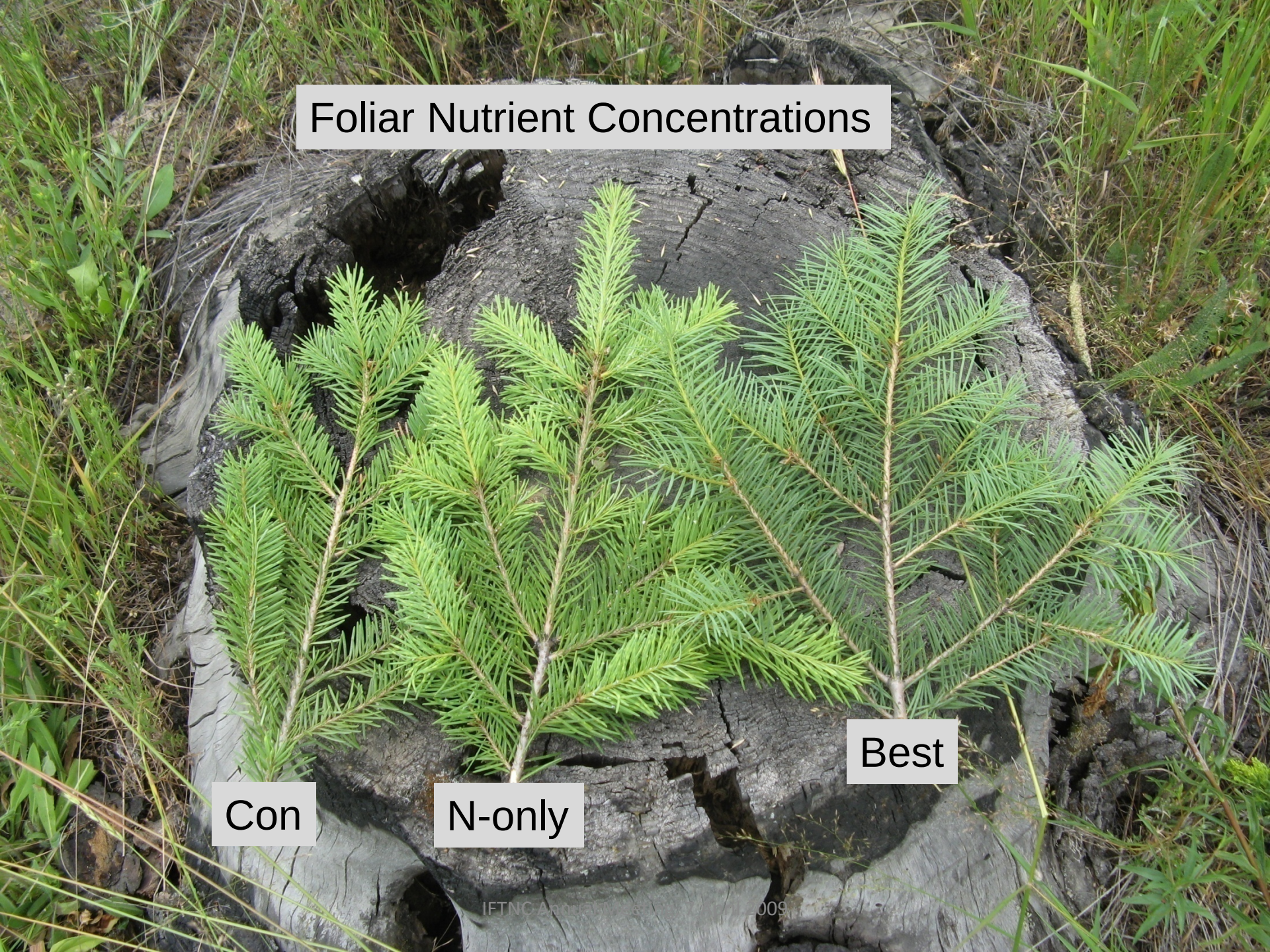
Rock	*****
Treatment	**ns**
Rock X Treat	**ns**

Rock	**
Treatment	**
Rock X Treat	**ns**

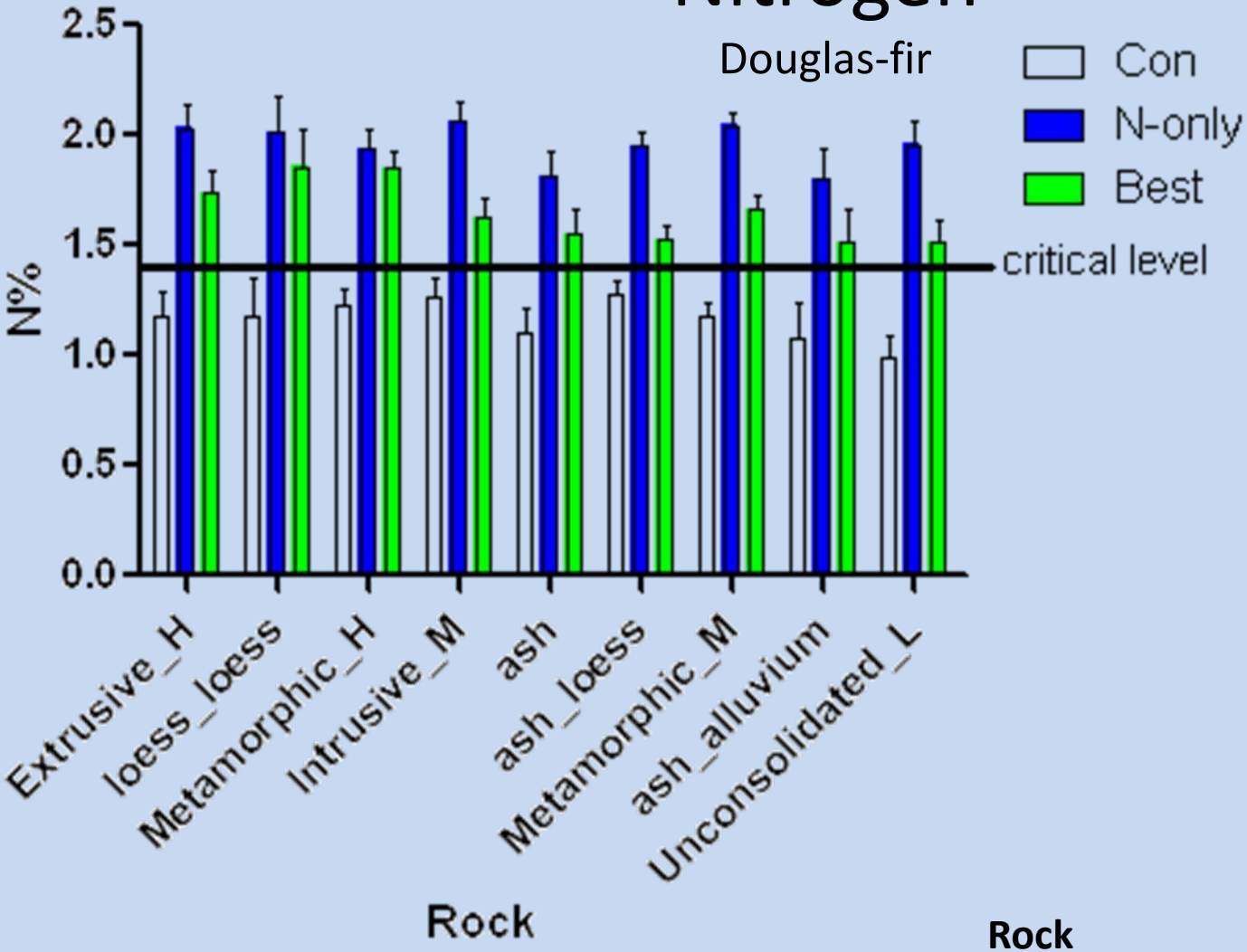
Identification of responsive Rocks

- Metamorphic
- Ash caps
- Unresponsive, relatively productive
  - Intrusive
  - Extrusive
  - Loess

Foliar Nutrient Concentrations



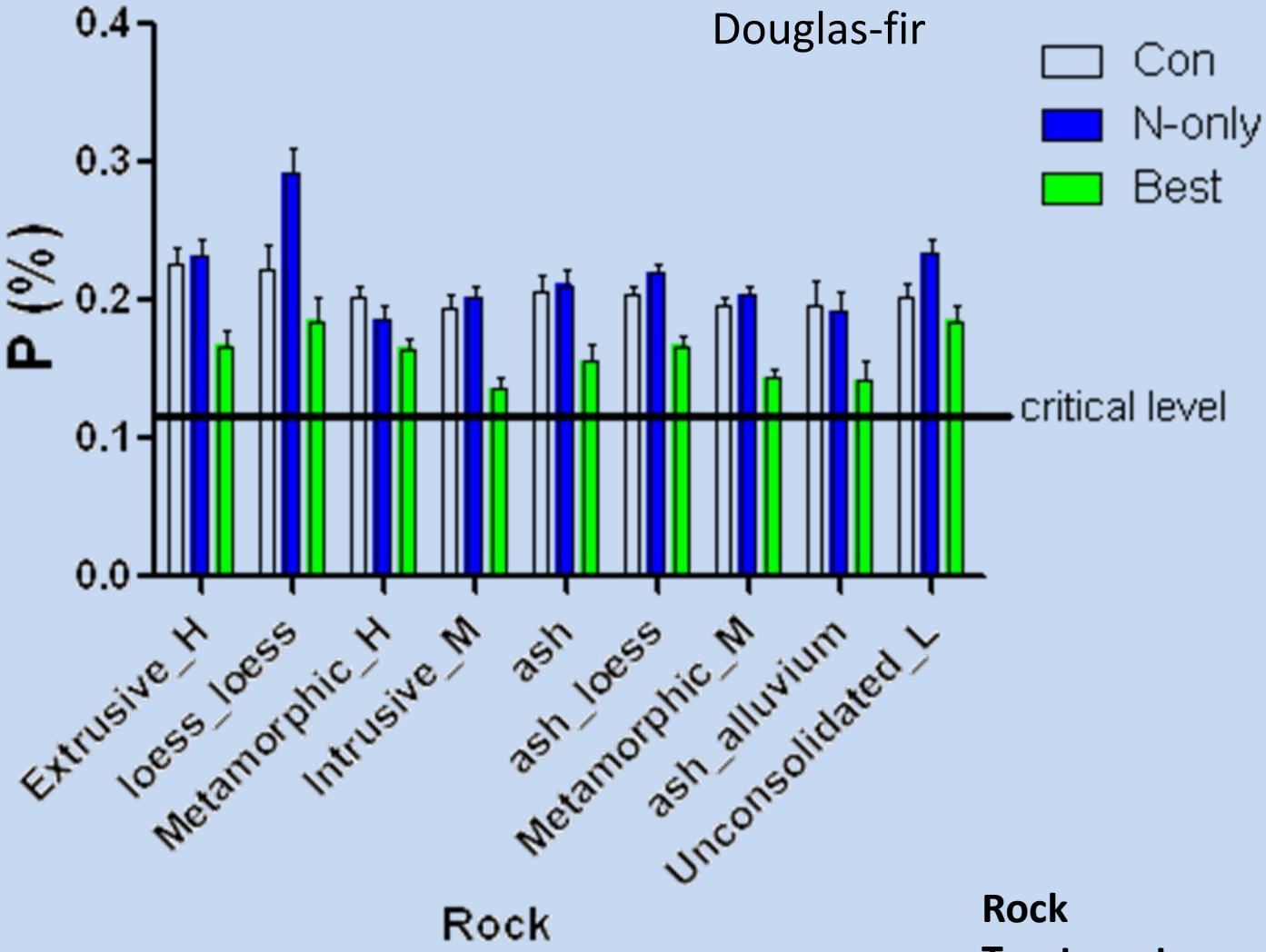
Nitrogen



Rock	*
Treatment	***
Rock X Treat	ns

Phosphorous

Douglas-fir



Rock	***
Treatment	***
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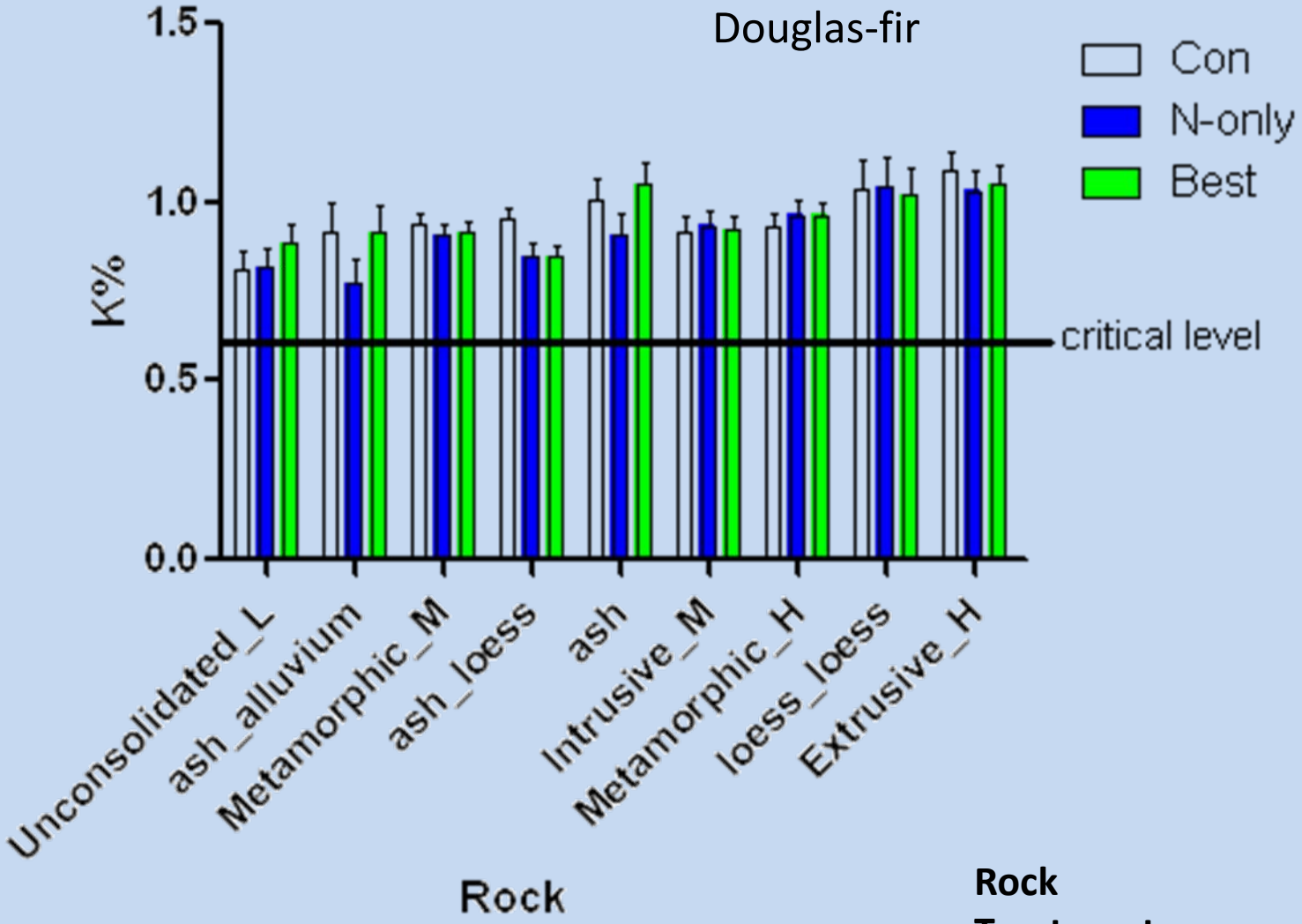
Potassium

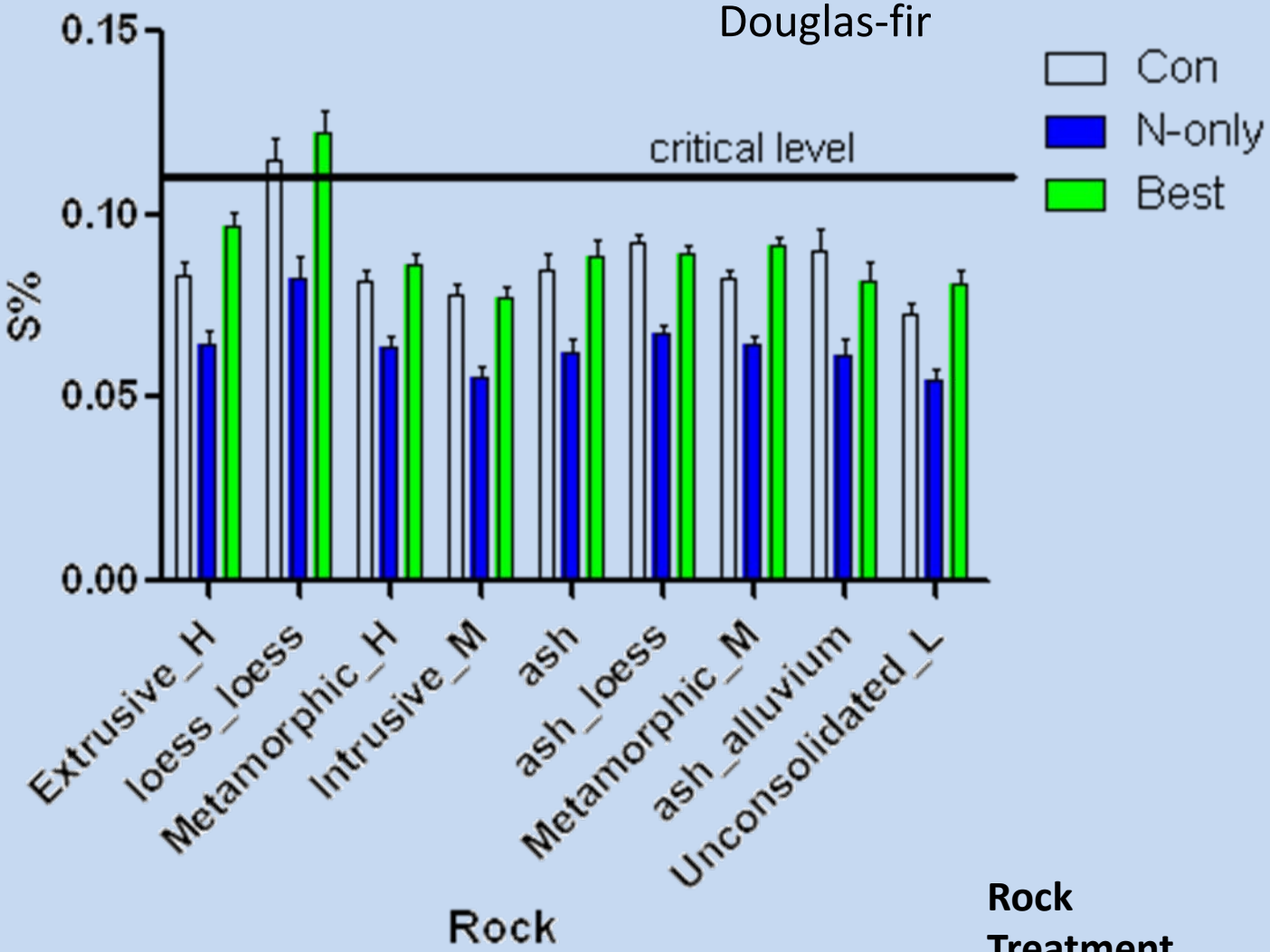
Douglas-fir



Rock	*******
Treatment	**ns**
Rock X Treat	**ns**

Sulfur

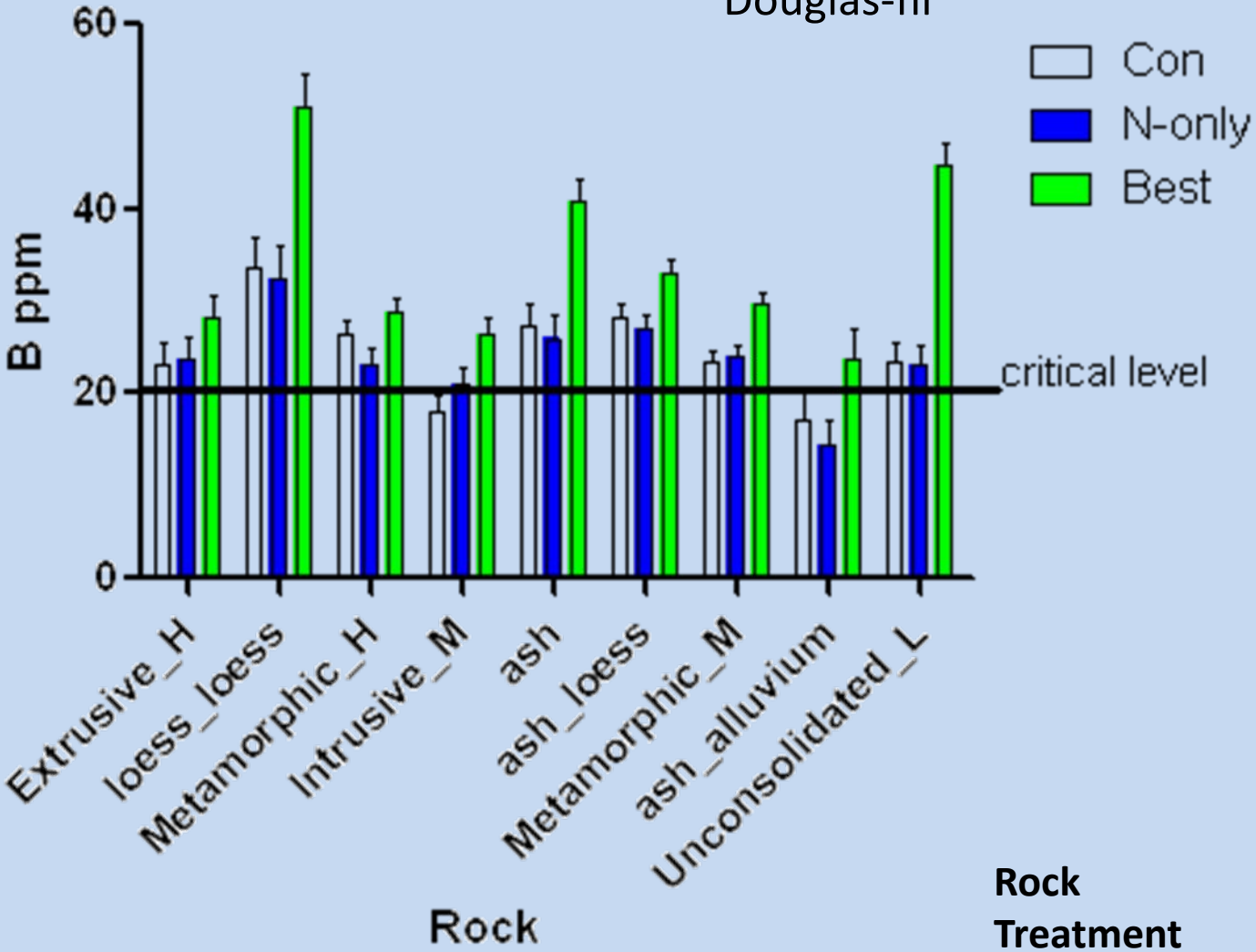
Douglas-fir



Rock	***
Treatment	***
Rock X Treat	**ns**

Boron

Douglas-fir



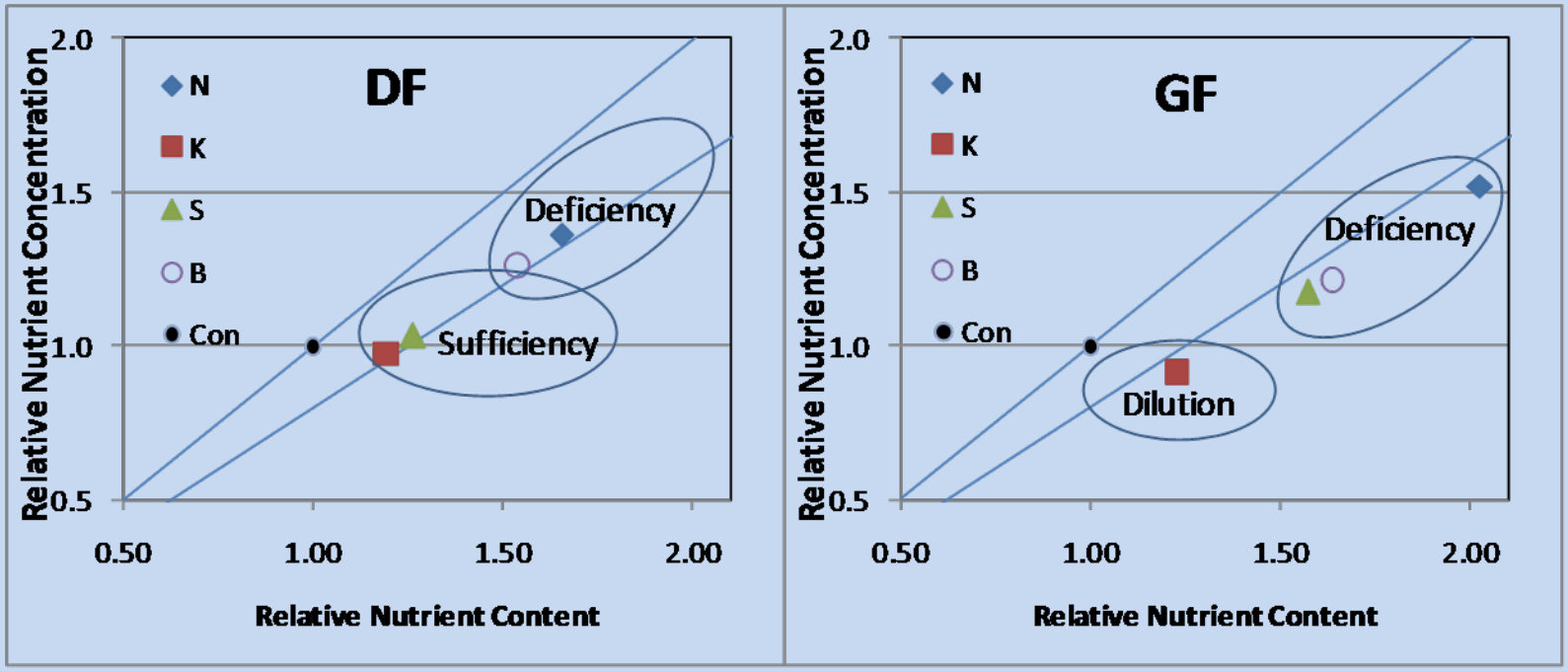
Rock	***
Treatment	***
Rock X Treat	***

Nutrient Ratios

Douglas-fir

Trt	P/N	K/N	S/N	B/N
Control	18.04 A	84.1 A	7.573 A	0.2175 A
N-only	11.71 B	49.29 C	3.502 C	0.126 B
NKSB	10.11 C	59.47 B	5.633 B	0.2116 A
Optimum Ratio:	13	65	8.5	0.2

Vector Analysis



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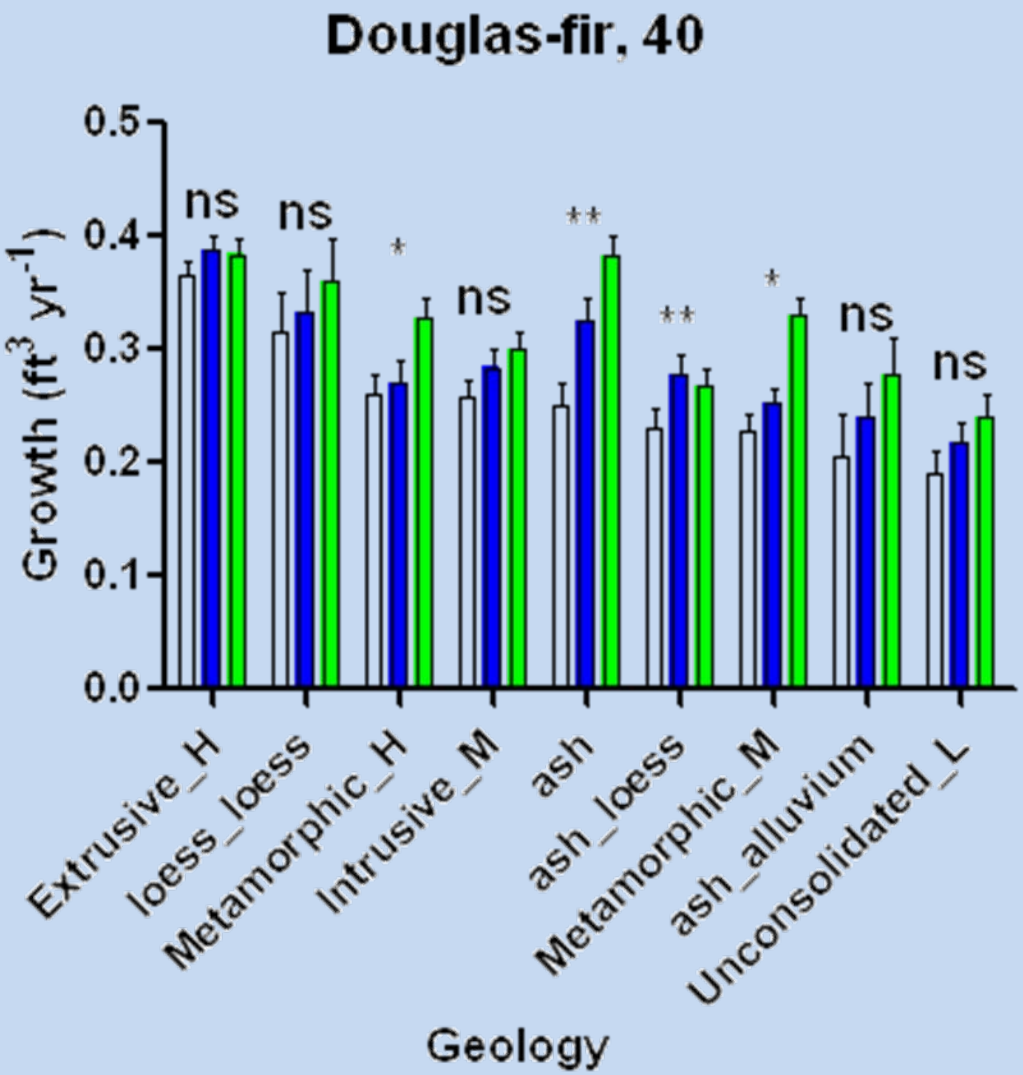

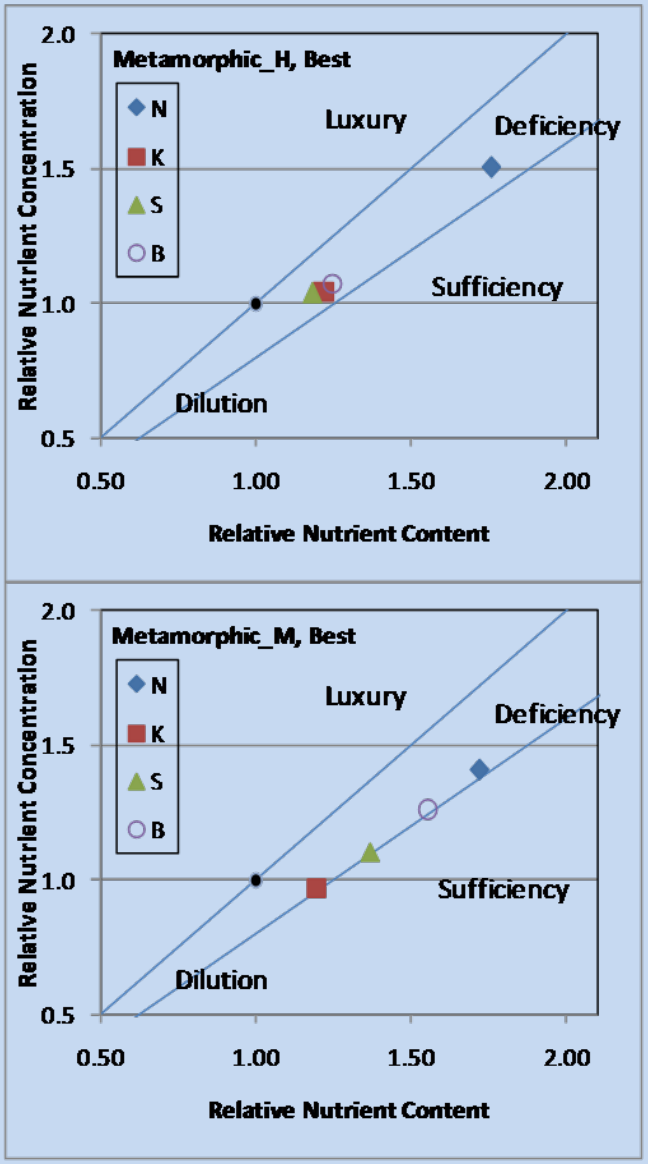

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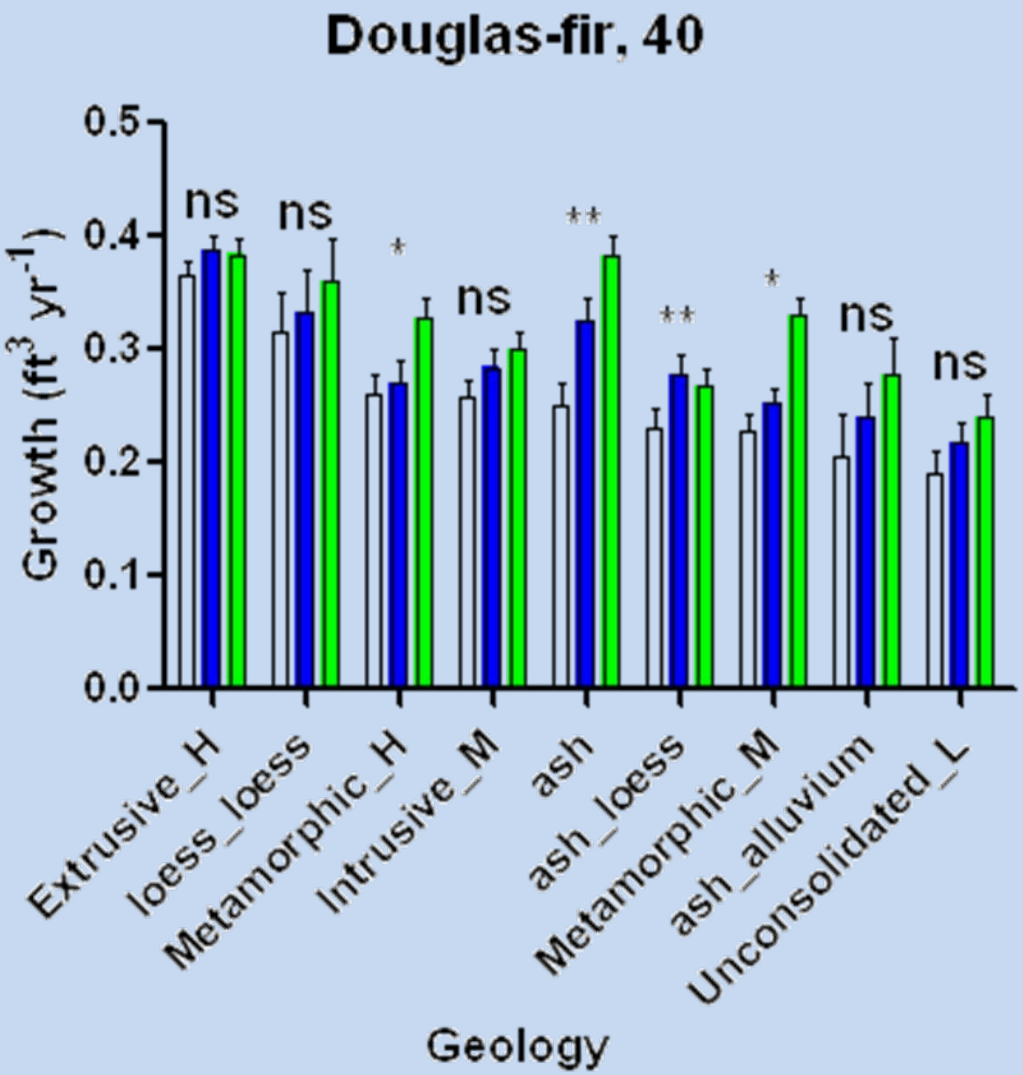

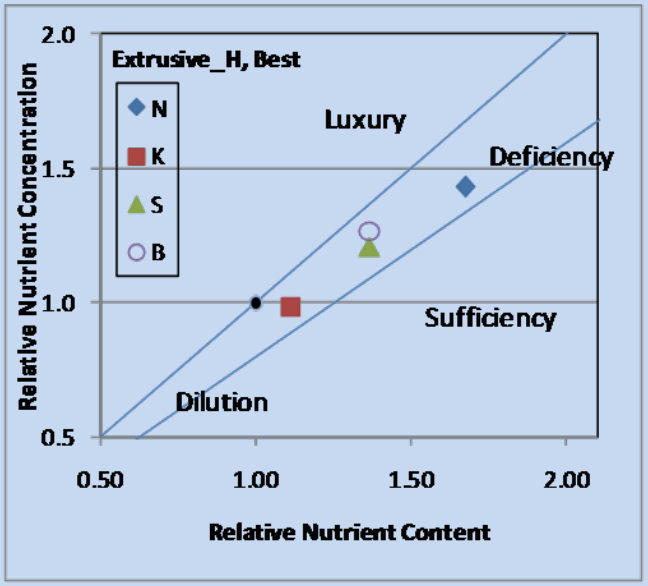

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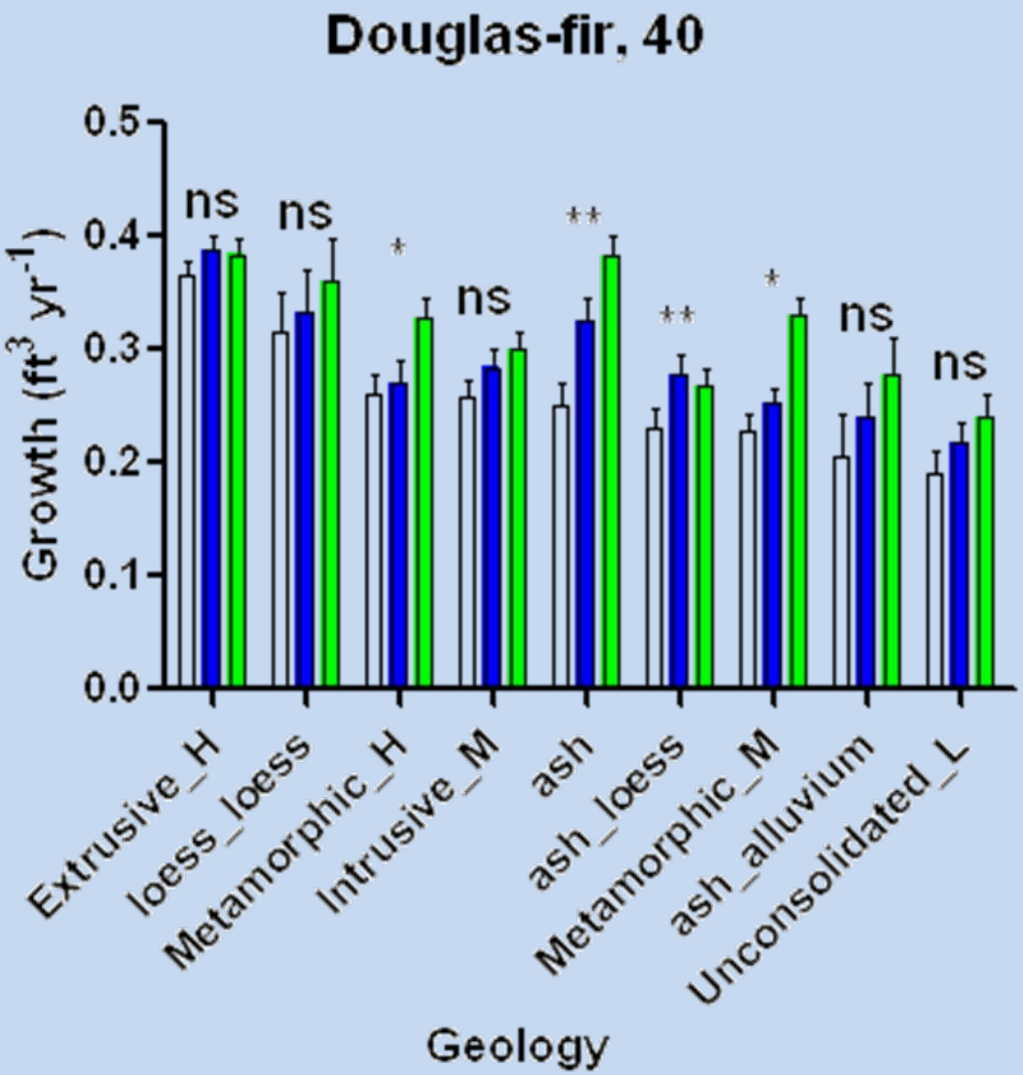

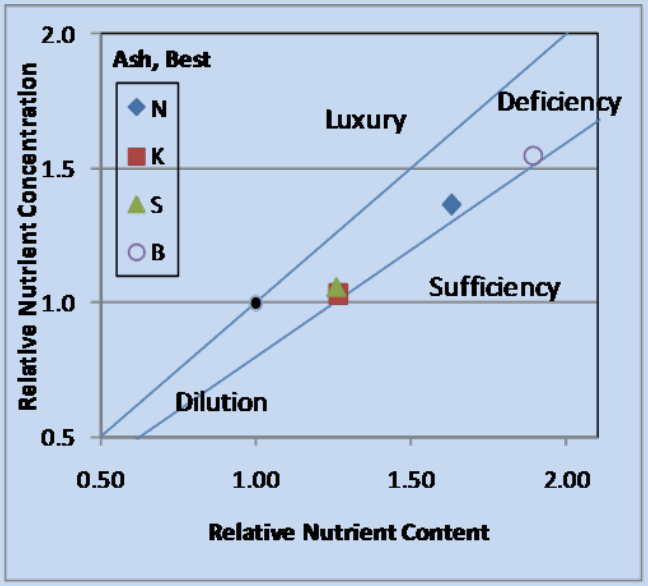

Conclusion

1. Screening trial growth response data describes variation among rock-types
   - Douglas-fir and ponderosa pine are similar
   - Other species are not
2. Overall response shows universal N deficiency
3. Multinutrient deficiency depends on rock type
4. Attributed to S and B, but not K
5. Screening trial bioassay is best approach to define site nutrient availability