

Nutrient Management

PHASE I: Final Retrospective Analysis

PHASE II: 2-YR Results on New Installations


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Nutrition Effects on Future Forest Productivity

 **Goal** - Evaluate the effects of silvicultural practices on forest nutrient status and subsequent forest growth and yield.

 **Objective** – Two phase examination of forest nutrient status and productivity with Phase I being “retrospective” on sites that were previously harvested at various levels of biomass removal and Phase II on new sites to be harvested.



Phase I: Bertha Hill

Final Retrospective Analysis

Treatments



Treatment 1 – Undisturbed

- No mechanical disturbance
- Fire exclusion



Treatment 2 – Undisturbed/Burn

- No mechanical disturbance
- Broadcast burned



Treatment 3 – Scalp

- Dozer slash, litter, surficial soil removal
- Competing vegetation “rooted out”
- Fire exclusion

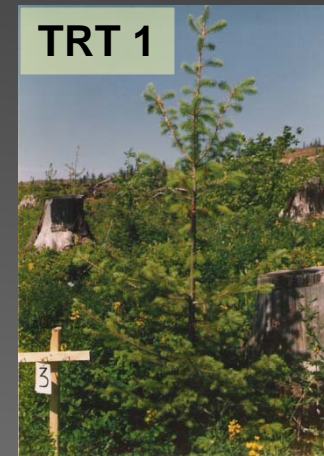


Treatment 4 – Pile/Burn



- Dozer pile & Jackpot burn







Treatment 5 – Skid Trail



2006 Soil-Site Findings

-  Basal area gained 10-15% on burn treatments after 14 and 24 yrs, but showed a significant loss of ~ 35% on scalp and skid trails after 24 yrs.
-  Burn treatments show no overall significant increase in height growth 6, 14, and 24 yrs post-planting. Scalp and skid trail treatments show >40% and >10% decrease in height growth over 6 and 14 yrs, respectively, but showed no treatment effect after 24 yrs.

Questions – 25 yrs later

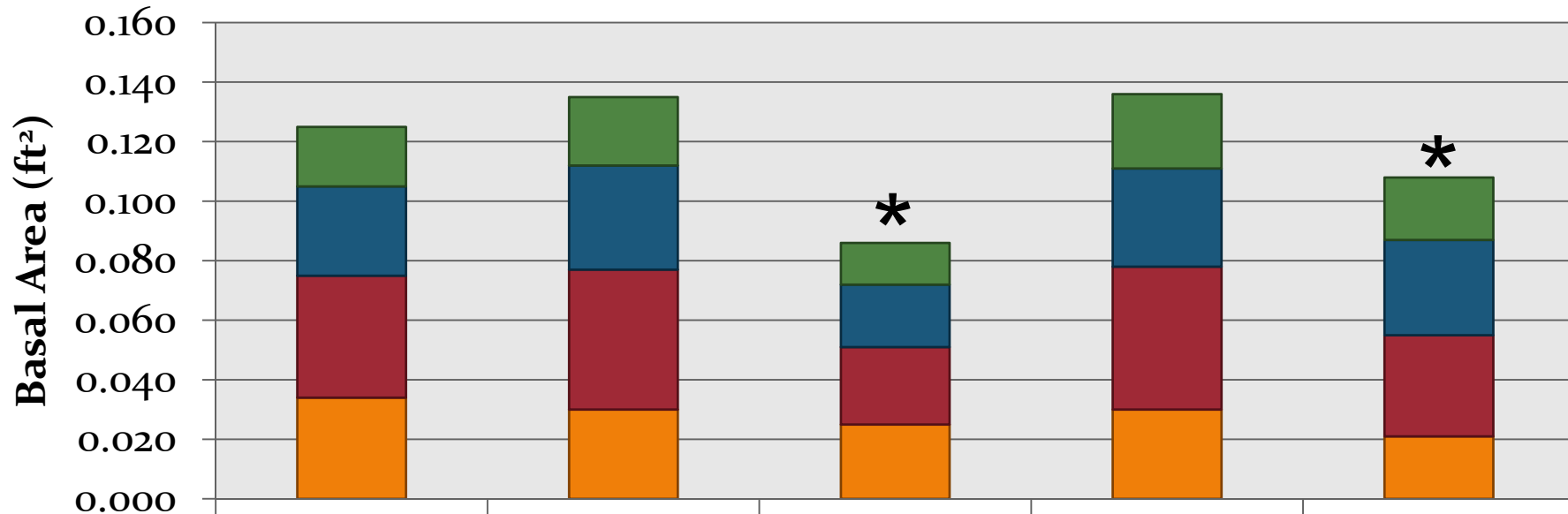
-  When did treatment effect begin?
-  How long did treatment effect persist?
-  Is there still a treatment effect?
-  What is the long-term consequence of site disturbance?



Scalp/Skid Trail Effect

Pile/Burn Effect

Bertha Hill – Basal Area Growth



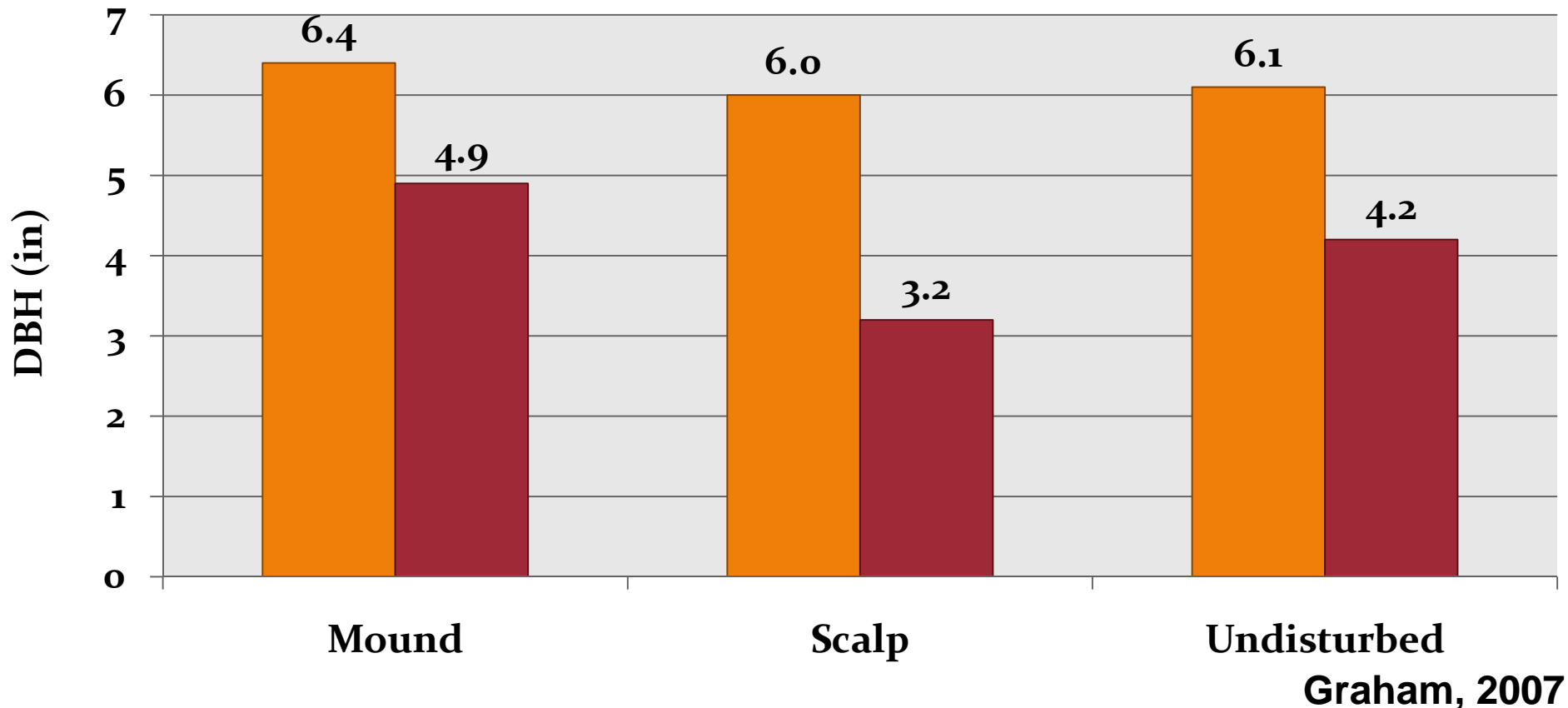
	Undisturbed	Burn/ Undisturbed	Scalp	Pile/Burn	Skid Trail
02-06	0.020	0.023	0.014	0.025	0.021
97-01	0.030	0.035	0.021	0.033	0.032
92-96	0.041	0.047	0.026	0.048	0.034
87-91	0.034	0.030	0.025	0.03	0.021

Diameter

Low Elevation 23-yrs old

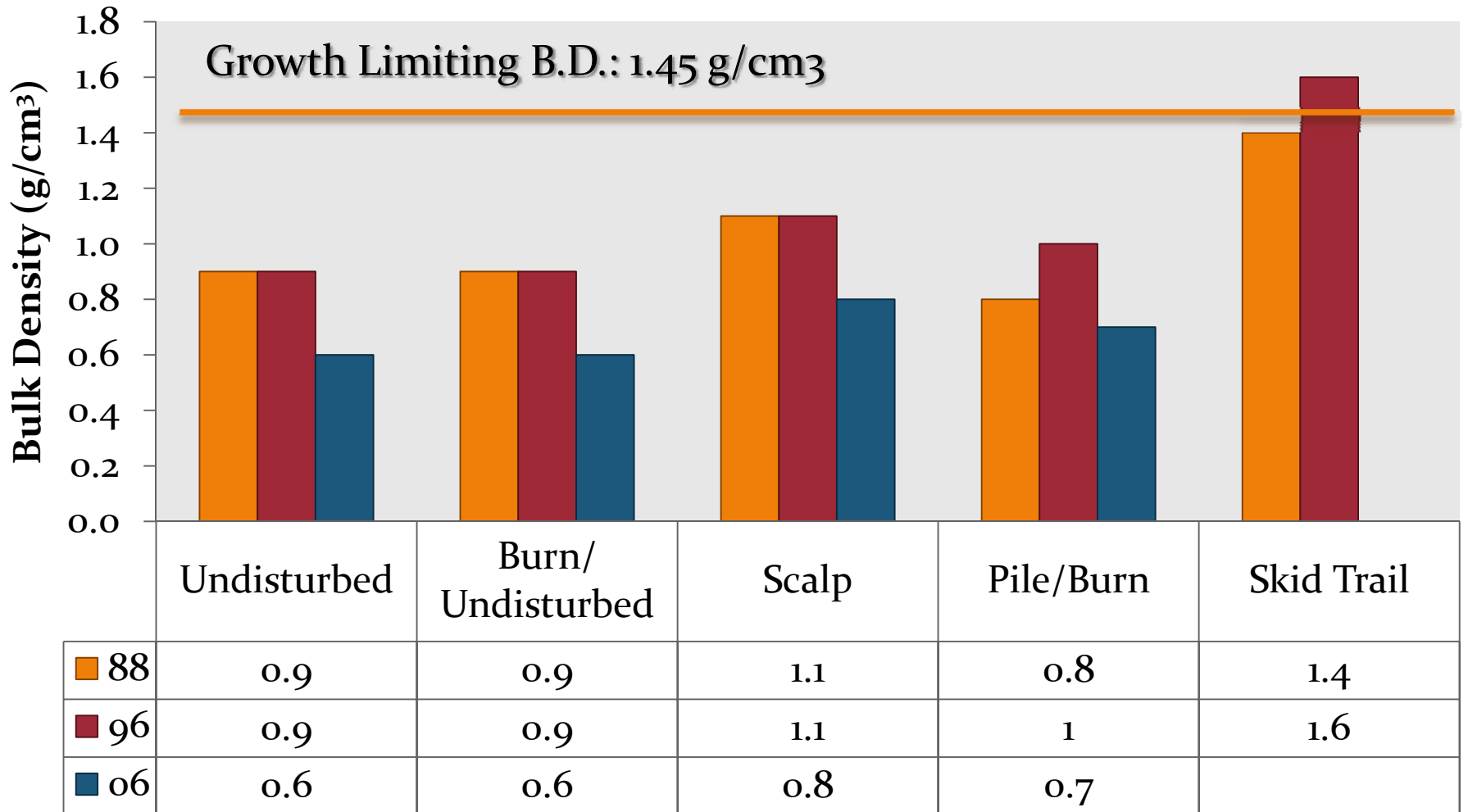


■ W.pine ■ D. fir



Graham, 2007

Bertha Hill – Soil Bulk Density



Site Prep Effect Summary – 25 yrs later



The removal of site nutrient capital – forest floor, topsoil, vegetation – has resulted in a 10 yr (~40%) reduction in basal area on scalped sites



What is the long-term consequence of site disturbance?

- For example, if 20% of the stand was scalped, this will translate to an 8% overall reduction in stand basal area



Changes in soil physical properties (i.e., bulk density) are less of an issue than changes in soil micro-site conditions. Scalped sites are subject to a wider range in soil moisture/temperature fluctuations

Phase I – Retrospective Comments and Conclusions



In general, nutrient levels did not consistently show strong associations with the different silviculture or utilization treatments



Nutrient levels did tend to differ between treatments at the extreme ends (ie. – burn -v- no burn, scraped -v- undisturbed, low utilization -v- high utilization...)







Growth response differences between treatments were expressed early for all study sites, but differences did not always continue over time







All three retrospective studies did show significant growth response treatment differences between the extreme ends (ie. – whole tree -v- bole only, low utilization -v- high utilization, undisturbed -v- scalped) for the first 5-10 years

Phase I – Retrospective Comments and Conclusions

-  Retrospective case studies supplied a wide array of information from different silviculture, harvest, and site prep types
-  Case studies supplied immediate information on nutrient capital and stand growth over time
-  Realize that site variation is dependent on many factors such as rock type, vegetation series or species mix
-  Although there appears to be common trends in the studies, these are case studies and that limits statistical analysis

Phase 2 – New Sites

-  Establishment of long-term experiments coordinated with existing and planned harvest activities
-  Allow replicated statistical design associated with rock and vegetation series
-  Can be used to supply immediate information on nutrient capital in harvested areas
-  Monitor changes in stand growth over time between harvest types



Phase II: UI Exp. For. & Scared Turkey

2-YR Results From New Nutrient Management Installations

Experimental Design



Experimental Forest:

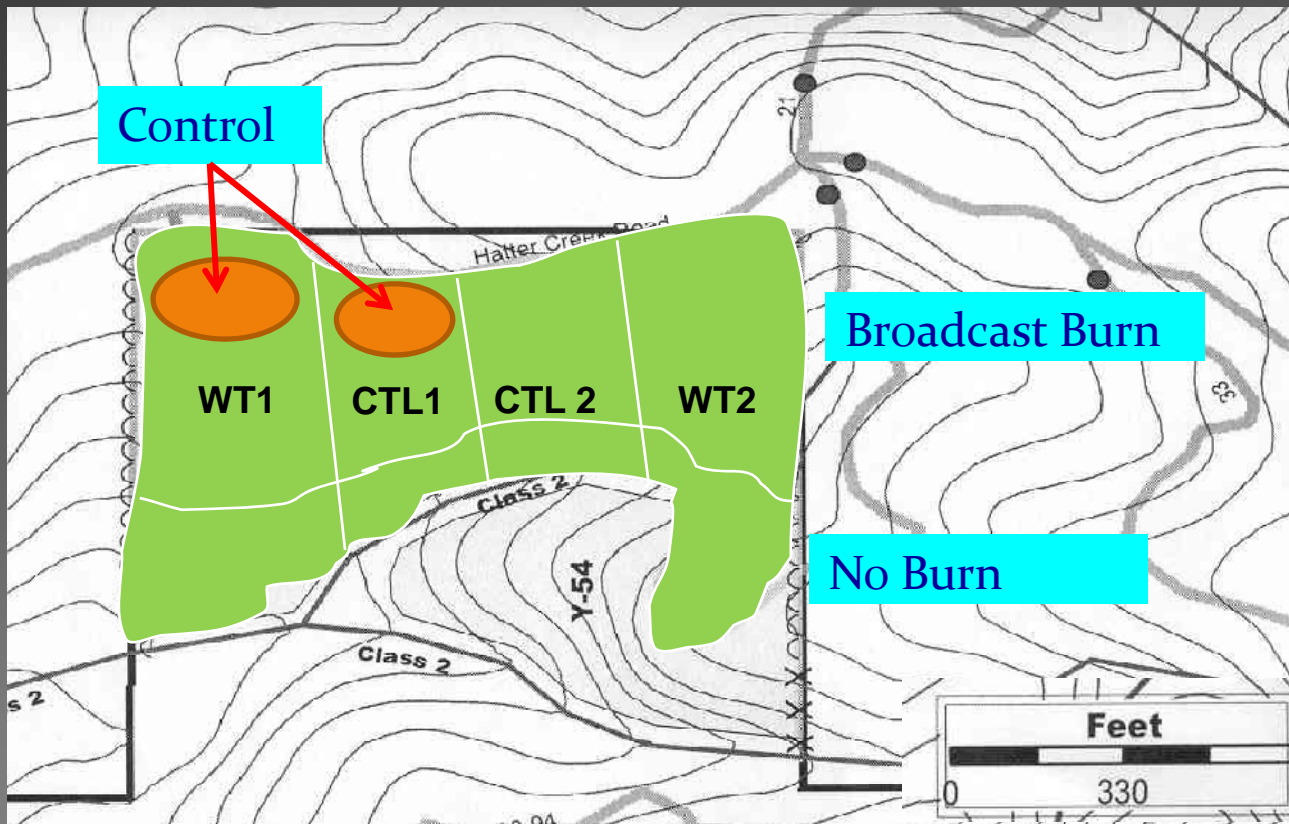
- 3 harvest treatments x 2 blocks x 2 site prep's
 - Control (2)
 - Cut-to-Length – No Burn, Burn (2)
 - Whole Tree – No Burn, Burn (2)



Potlatch – Scared Turkey:

- 3 harvest treatments x 2 blocks x 3 site prep's
 - Control (2)
 - Cut-to-Length – No Burn, Pile, Burn (3)
 - Whole Tree – No Burn, Pile, Burn (3)
 - Site prep treatments delayed one-year

Experiment Forest: Hatter Creek



Two pits installed per treatment

Total pits: 20

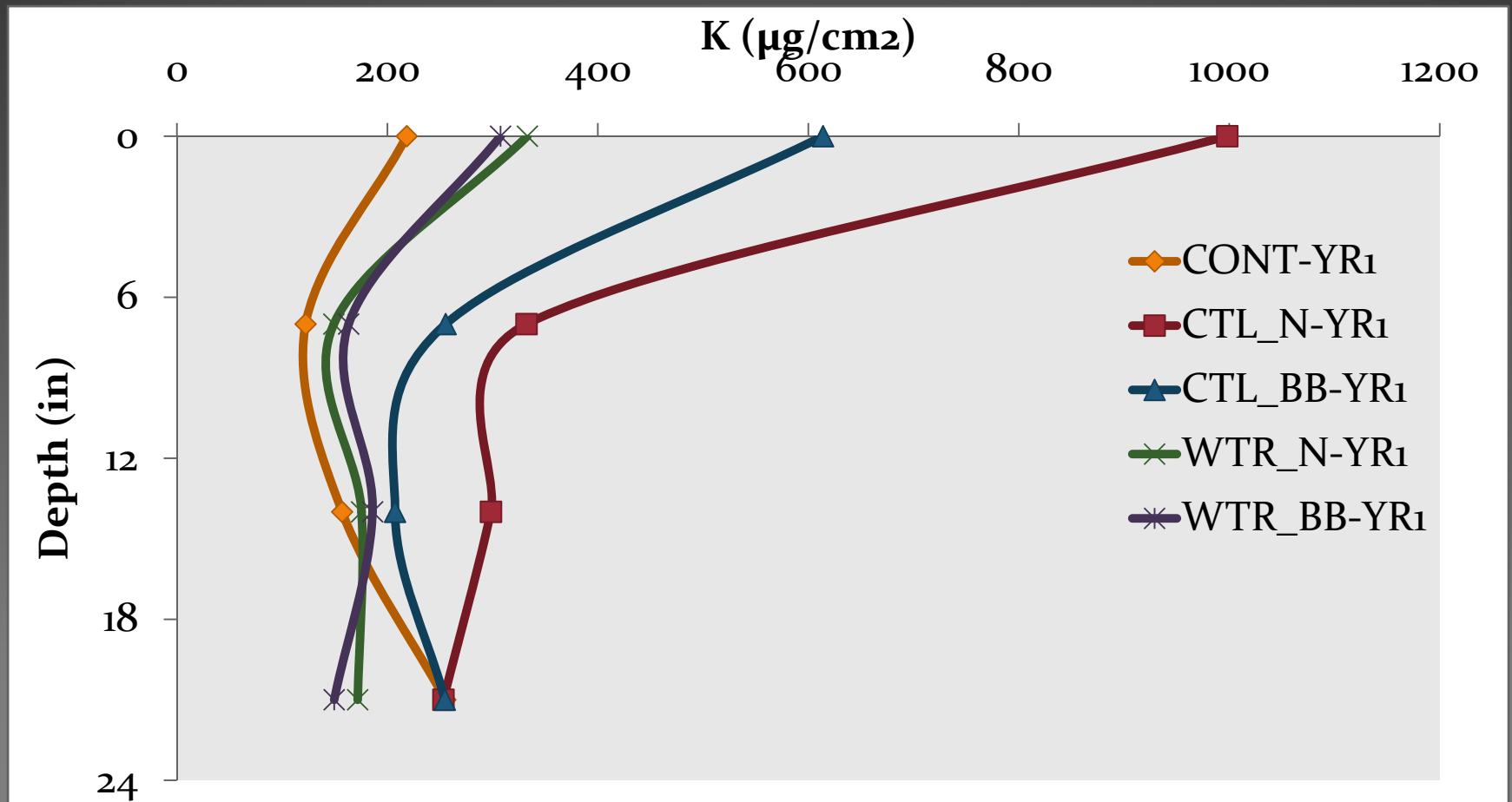
Two resin capsules per horizon per pit

Total capsules: 160

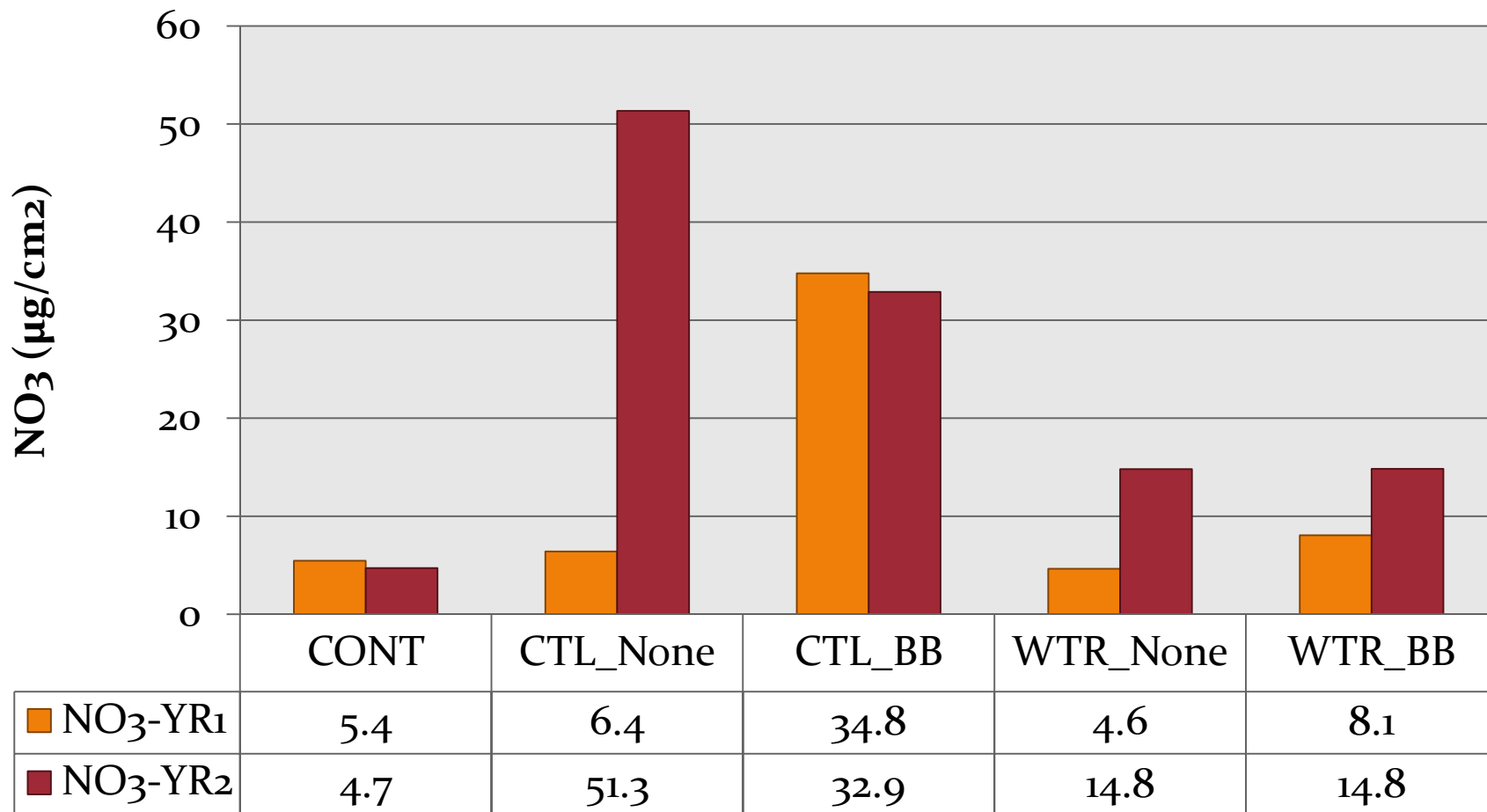


Soil Nutrient Status by Harvest & Site Prep Treatment

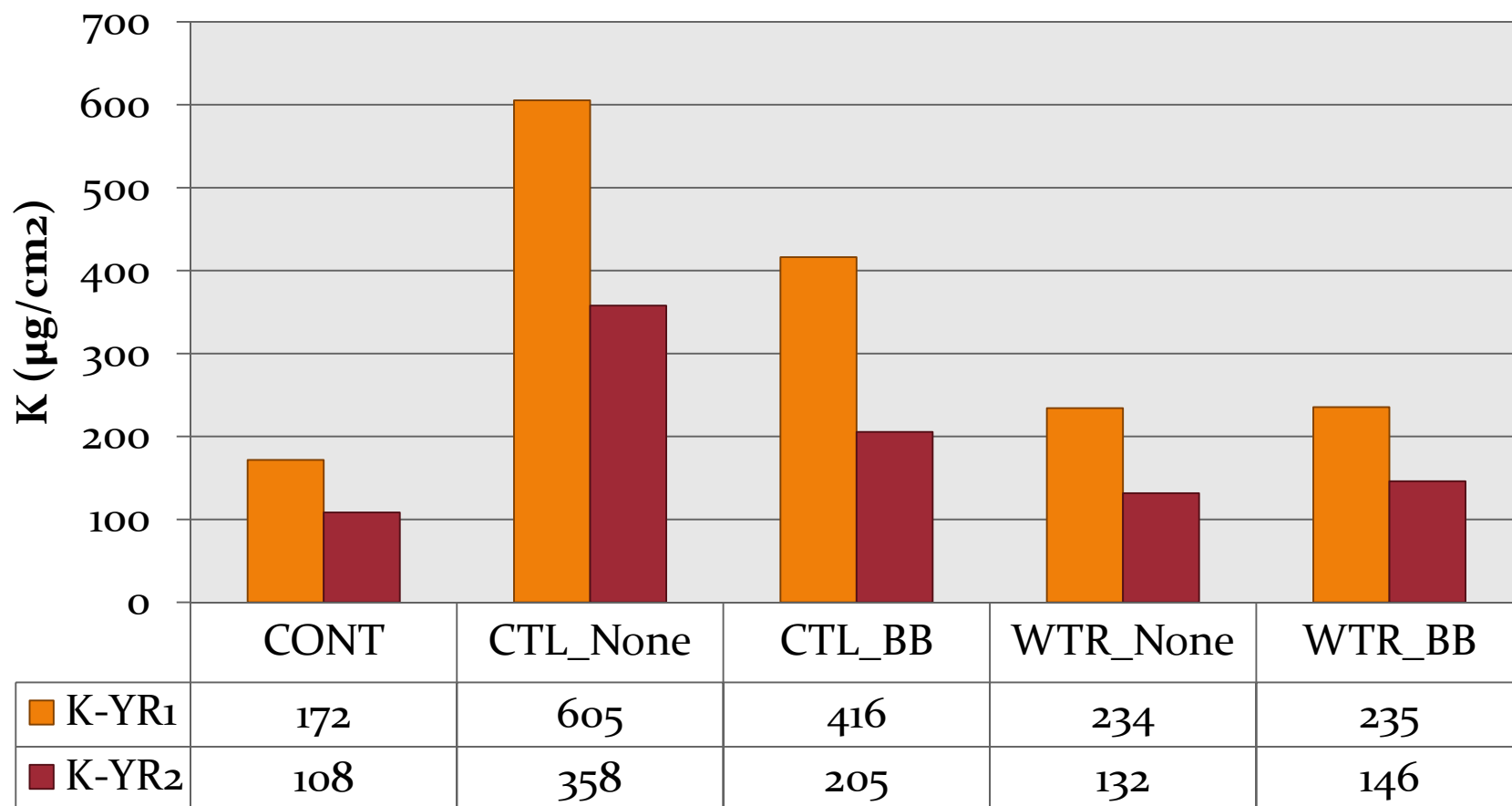
Exp. Forest – K by Depth & Trt



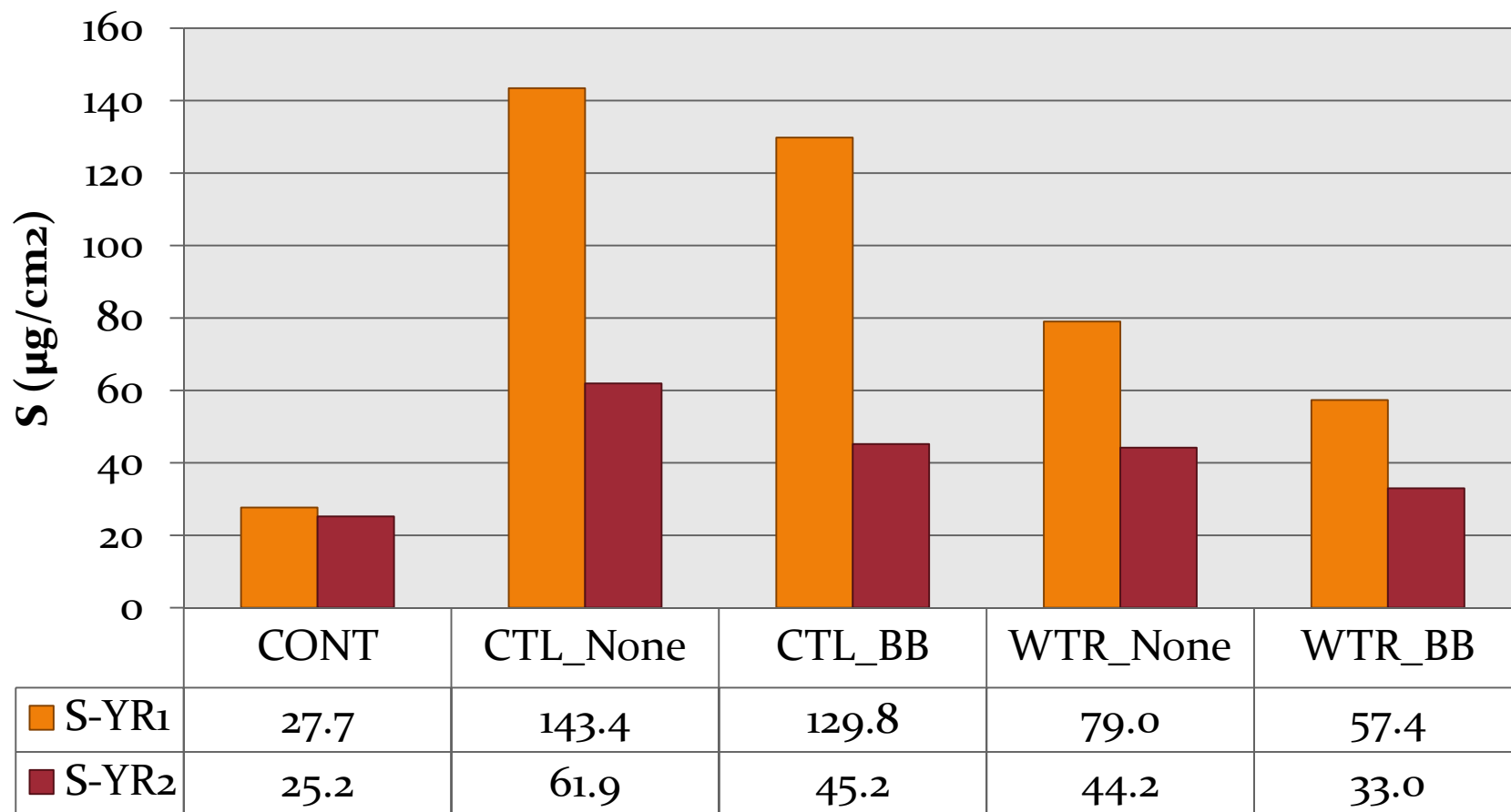
Exp. Forest – NO₃-N



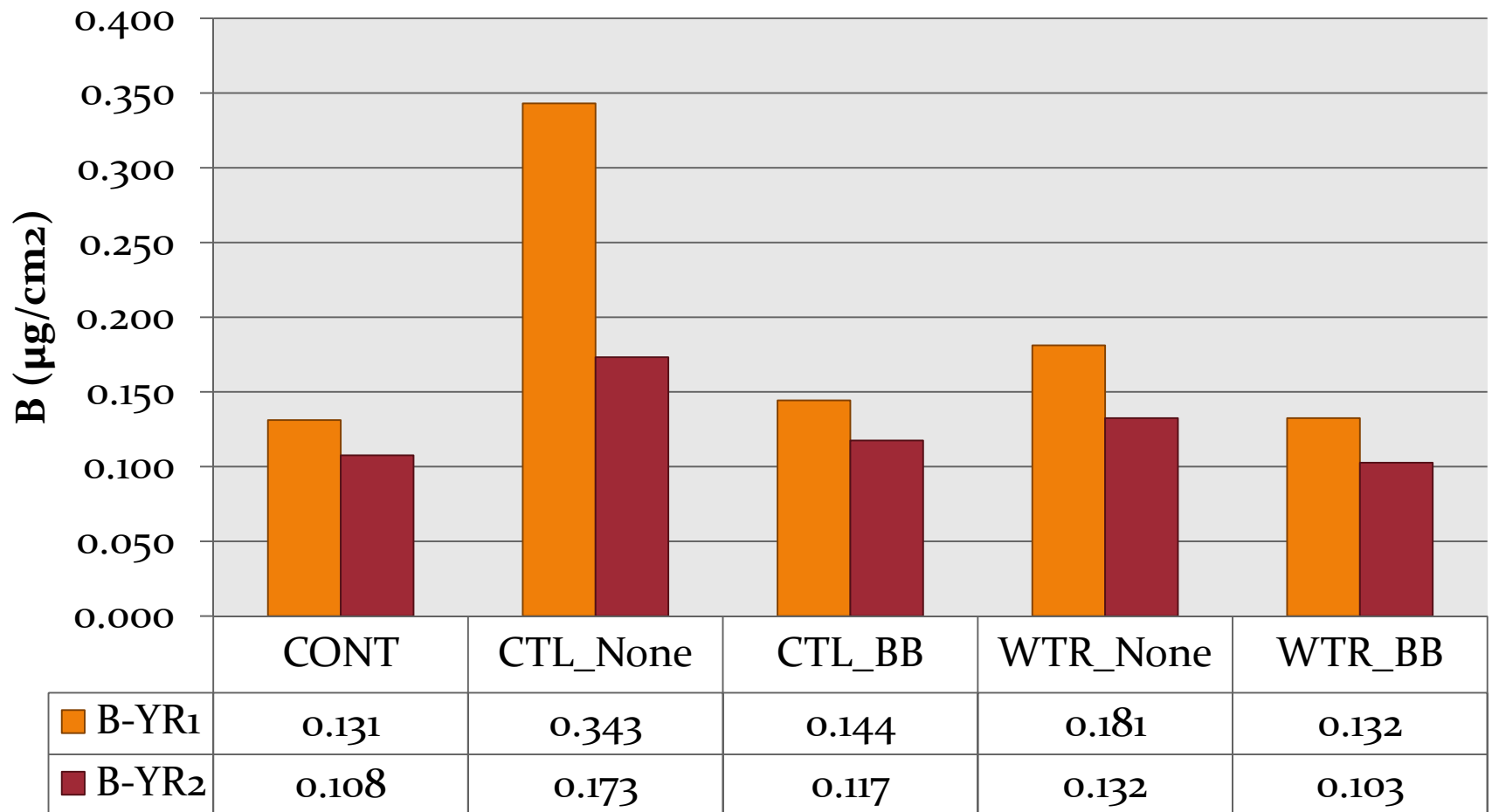
Exp. Forest – K



Exp. Forest – S




Exp. Forest – B



Two-Year Summary – Exp. For.

 Plant available soil nutrients are typically greater in the upper soil profile

 Cut-To-Length/No Site Prep showed higher soil solution nutrient concentrations than CTL/Broadcast Burn

- Without Broadcast Burning, movement of N from slash to soil solution required 2 overwintering periods

 Soil nutrient concentrations were lower following whole tree removal than CTL, and were not affected by broadcast burning

Future Work



Establish long-term growth plots – Spring 2008



Foliar Nutrient Status

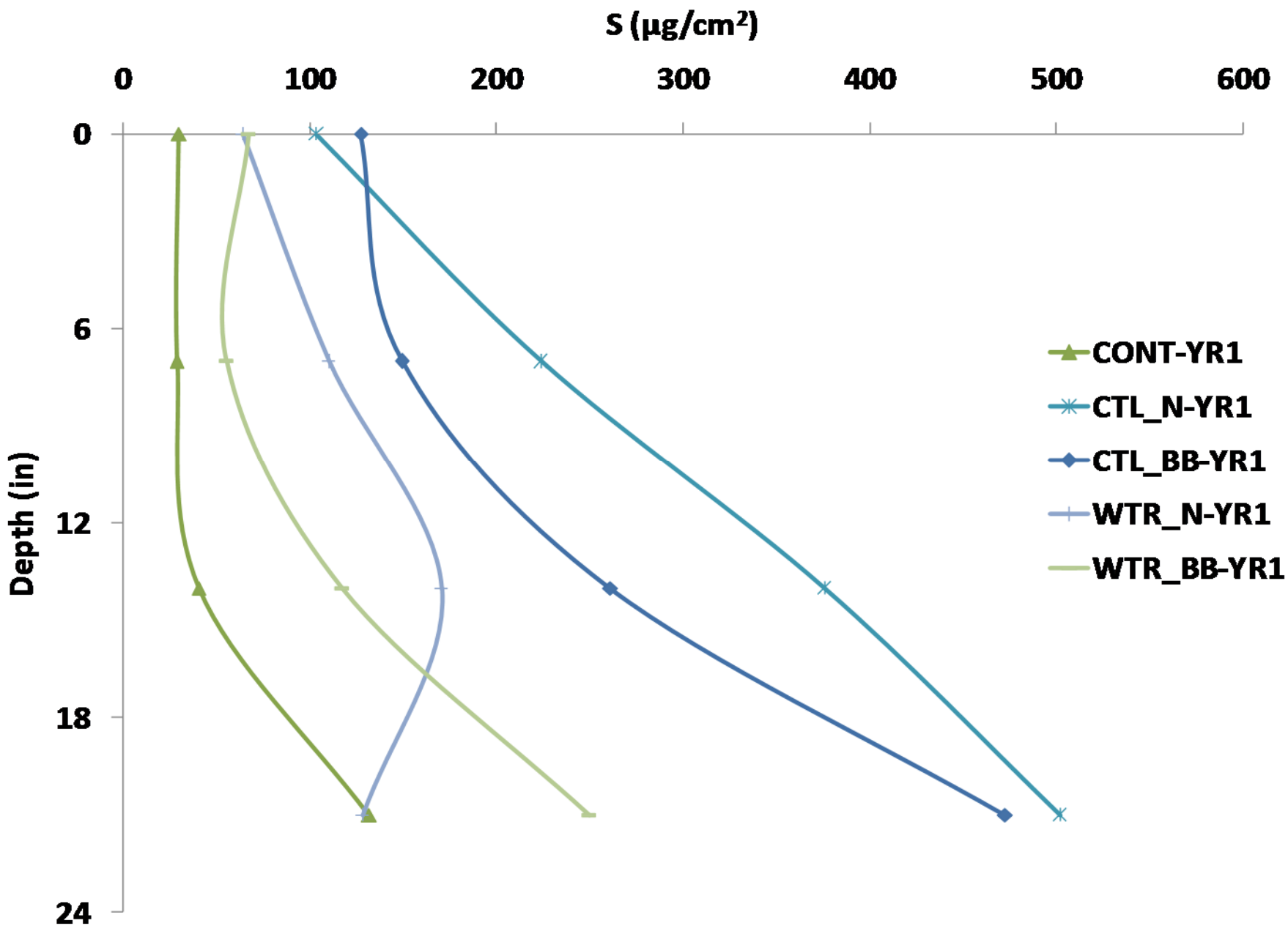
- Of Residual Trees at Experimental Forest – Fall 2008
- Of Seedlings at Both after two years – Fall 2008



Continue monitoring soil nutrient status – Fall 2009 & Fall 2014

Acknowledgements

- Potlatch Corp.
 - Dan Miller
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Critical Soil Temperatures

Nutrient, Physical, & Vegetation Impacts

