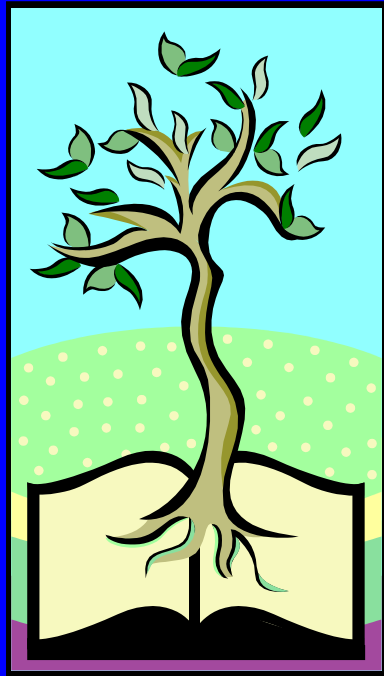


Nutrient budget analysis of the USFS Heppner, Oregon Research Site

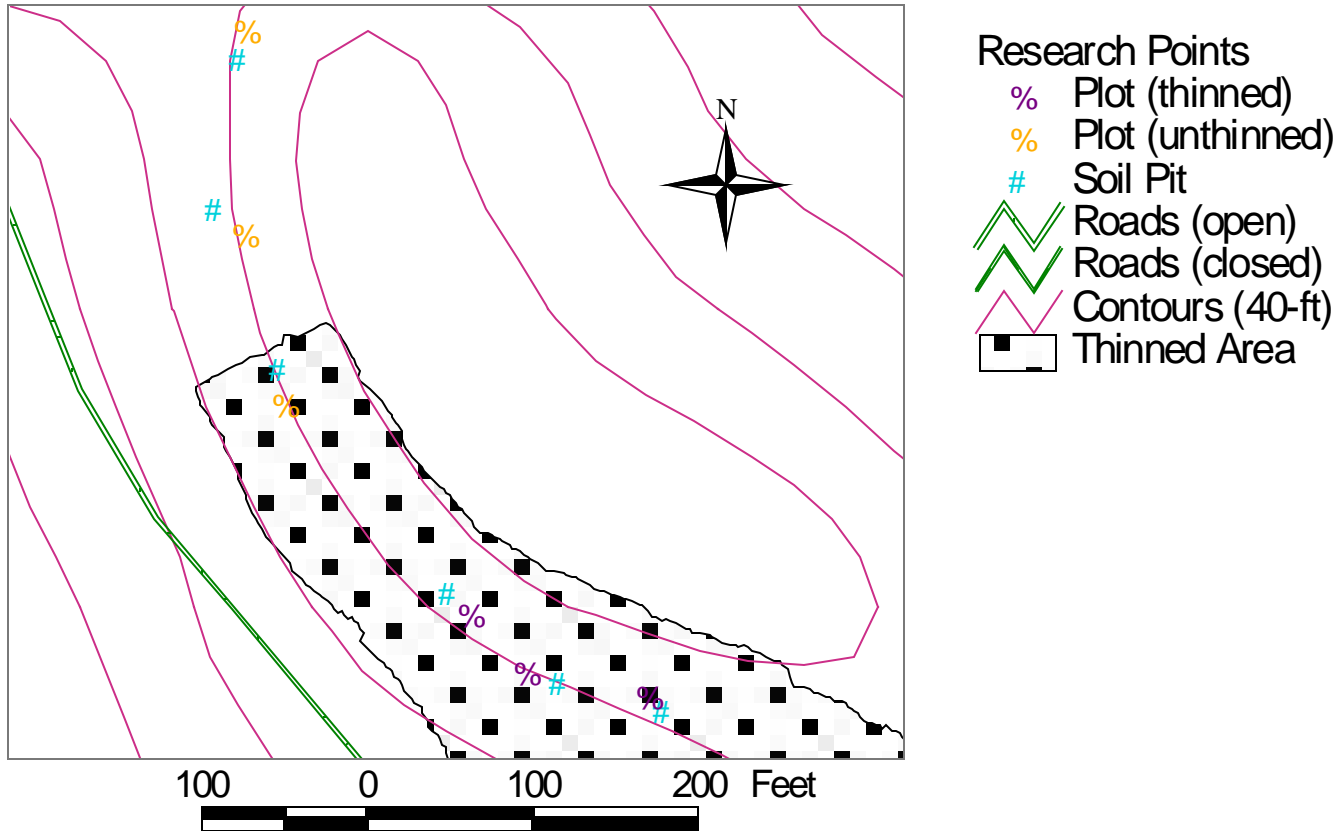


By: Mariann Garrison-Johnston

USFS Heppner Nutrient Study

- Grand fir/ elk sedge habitat type
- Basalt rock type; probably two members of the Picture Gorge basalt flow of CRB
- One half of unit was thinned in spring 1997
- Thinned unit represents ponderosa pine stand maintained through thinning (BA approx 144 ft²/ac)
- Unthinned unit represents ponderosa pine stand with encroachment by grand and Douglas-fir (BA approx 236 ft²/ac)

Heppner Nutrient Study Site



Unthinned Portion of Stand



Thinned Portion of Stand



Activities at Heppner Site

- **Nutrient Model Data Collection**
 - Trees measured in October of 2000 and 2001
 - Destructive sampling of 14 trees in October 2001
 - Clip plots, woody debris surveys, and forest floor sampled
 - Soil and rock samples taken
 - Litter collected periodically for one year
- **Soil Nutrient Availability Testing**
 - Four soil pits with capsules were established on each plot in October of 2000
 - One pit was excavated on each plot in April, June, August and October of 2001 (6, 8, 10 and 12- months)
 - Capsules were processed and analyzed at the U of I

Litter Trap



Destructive Sampling



Soil Pit at 6 Months



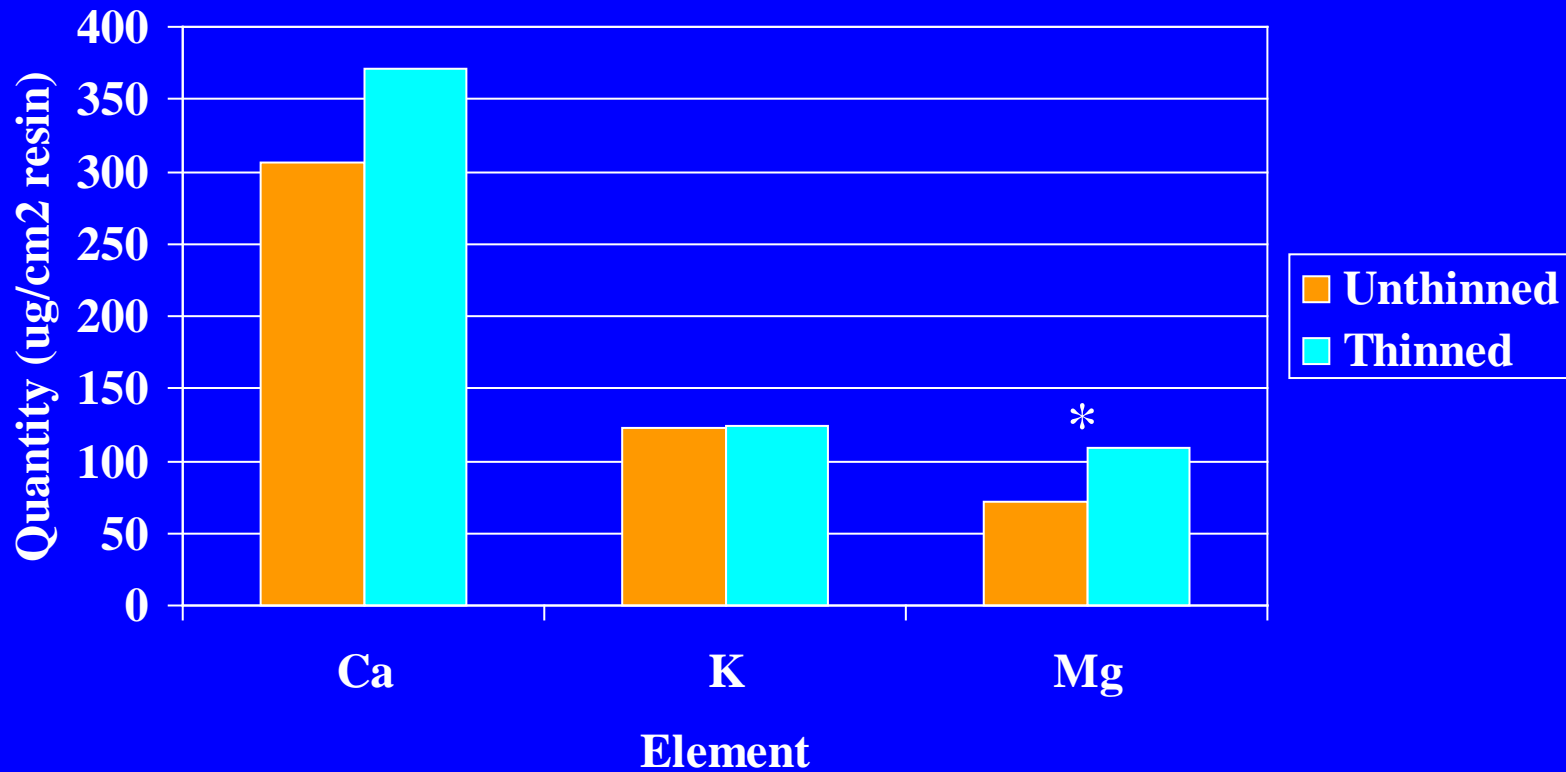
Ion Exchange Resin Capsule Removal



Removal of Resin Capsules

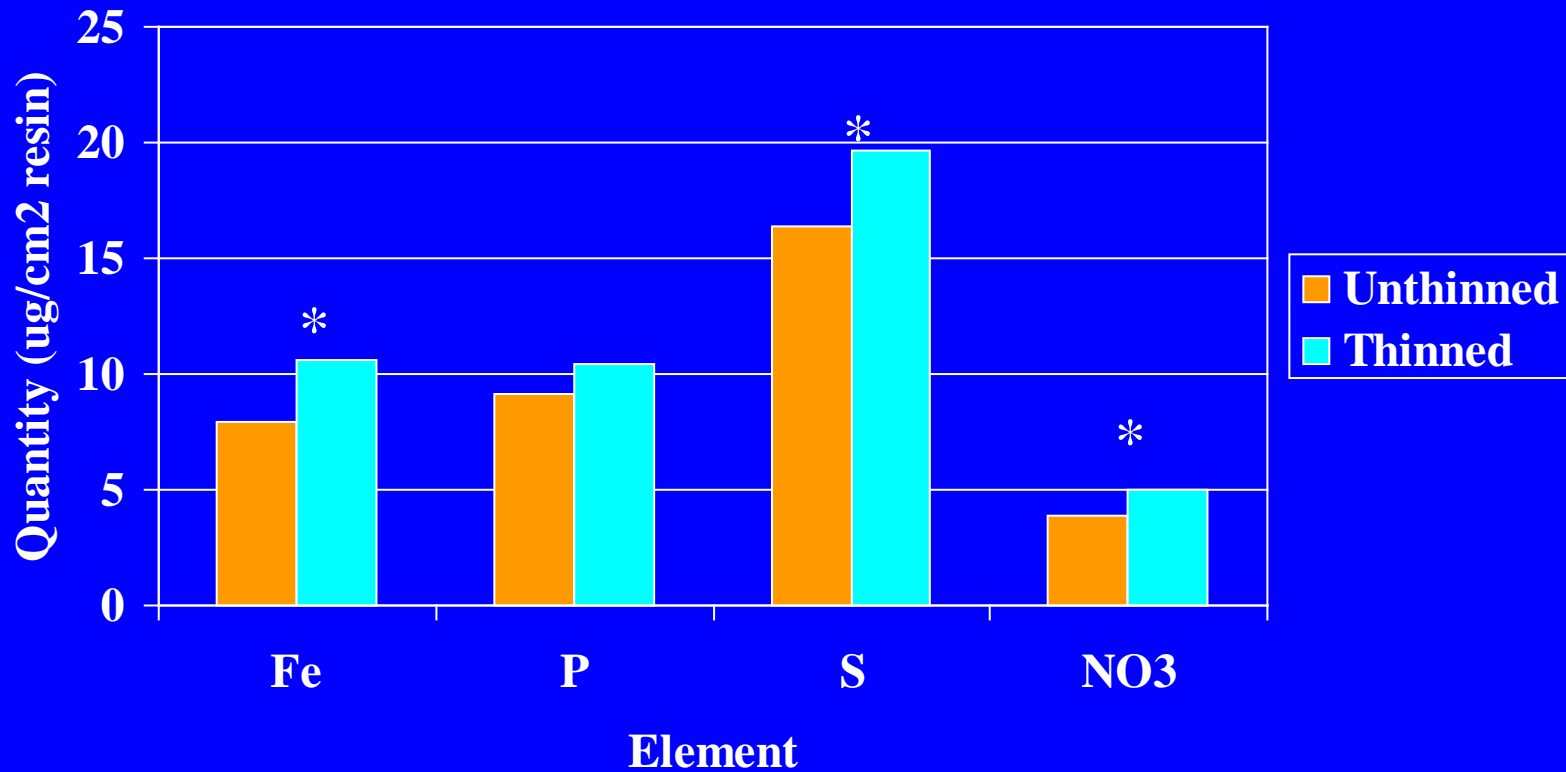


Ion Exchangers: Differences between thinned and unthinned stands: Ca, K and Mg



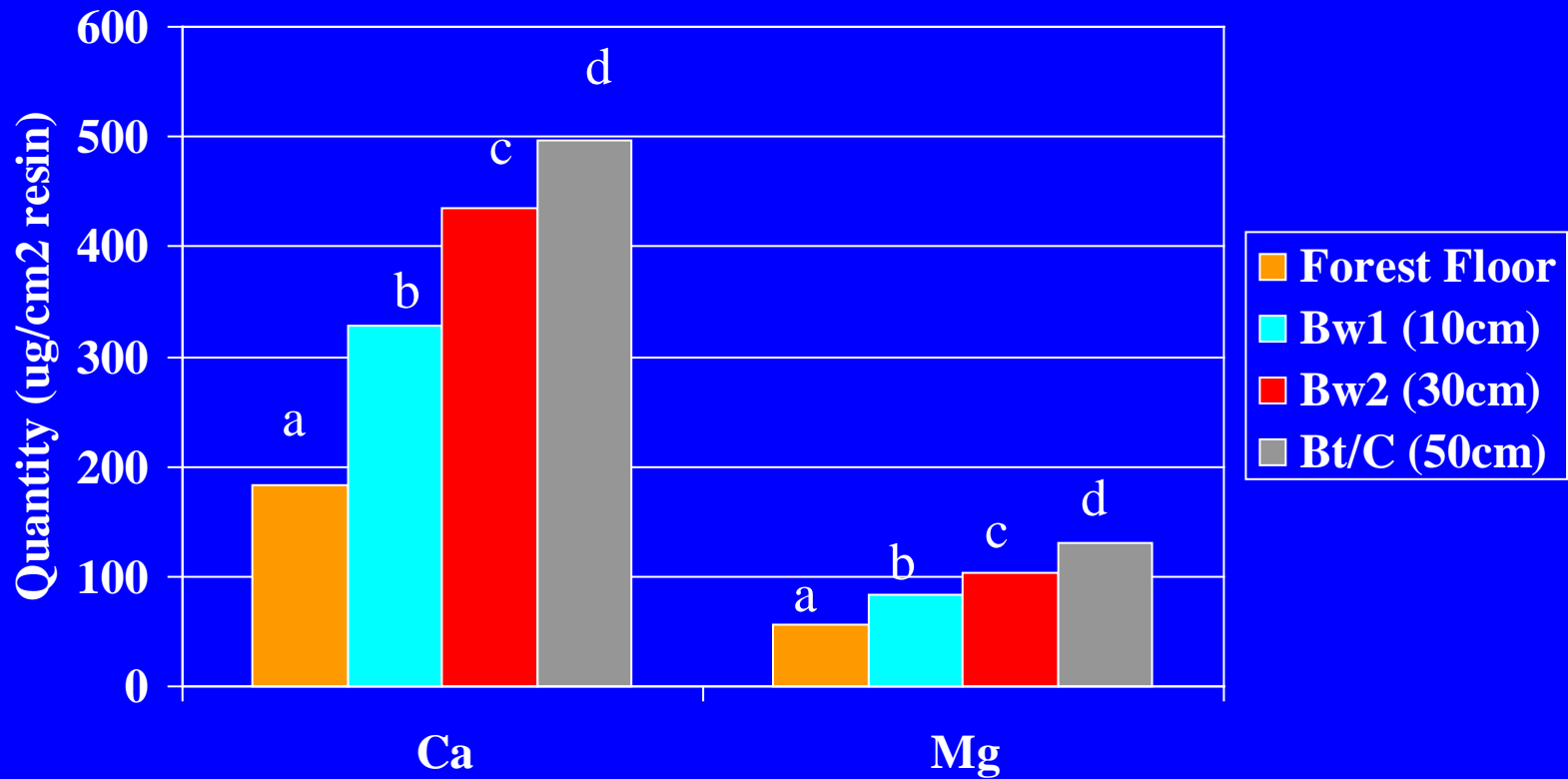
*Significant at $\alpha=0.10$

Ion Exchangers: Differences between thinned and unthinned stands: Fe, P, S and NO₃⁻

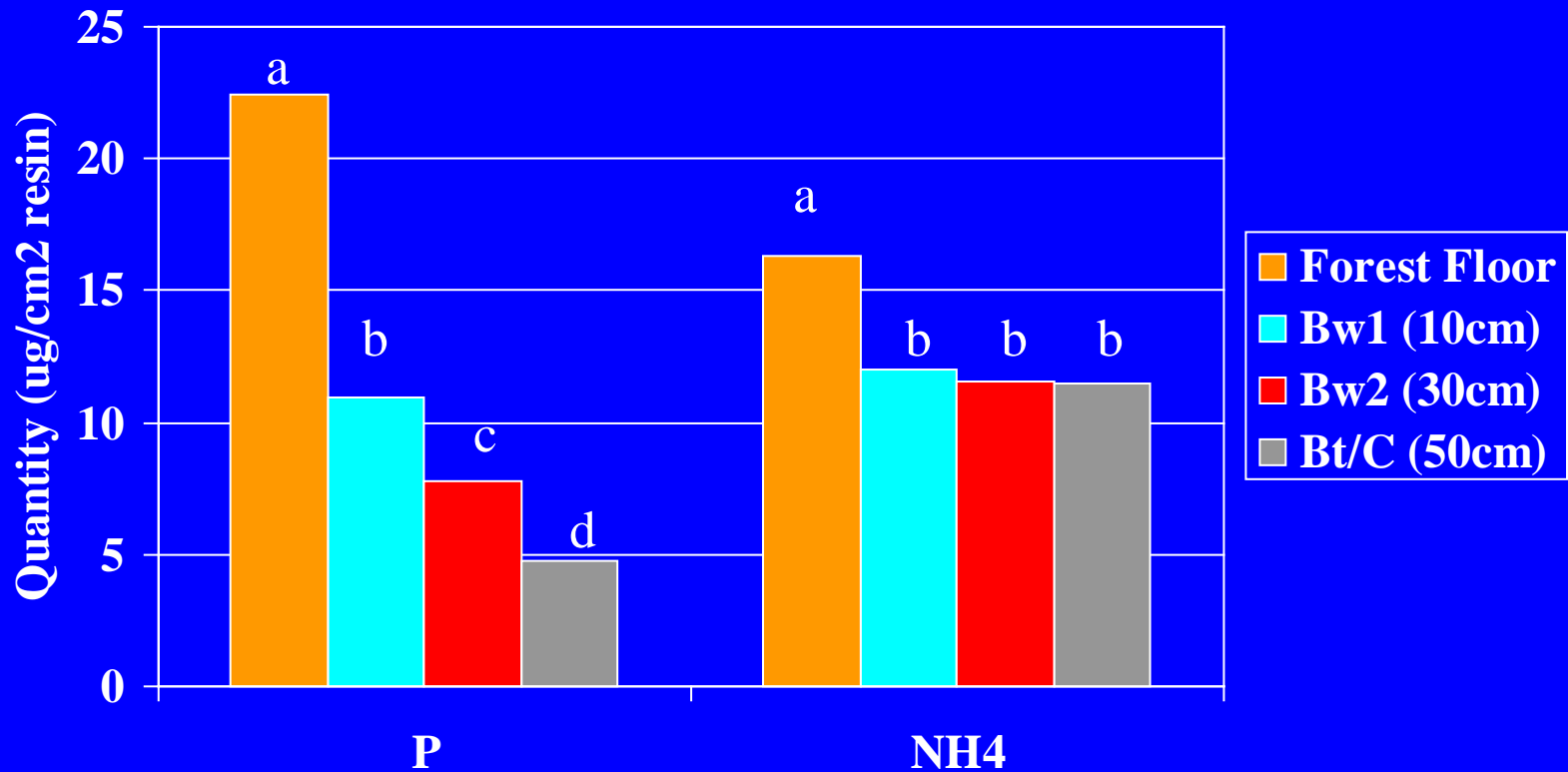


*Significant at $\alpha=0.10$

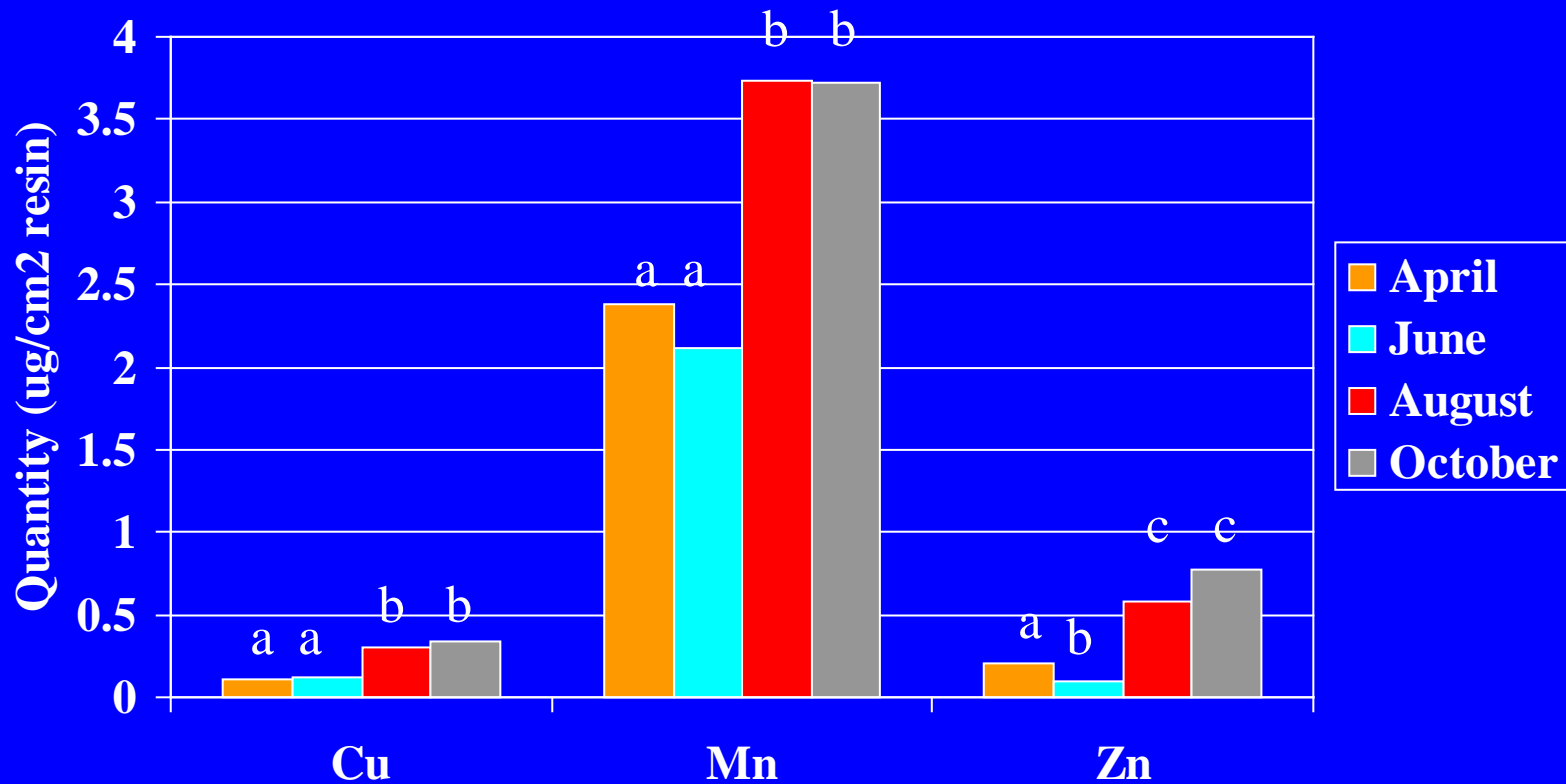
Ion Exchangers: Differences between horizons: Ca and Mg



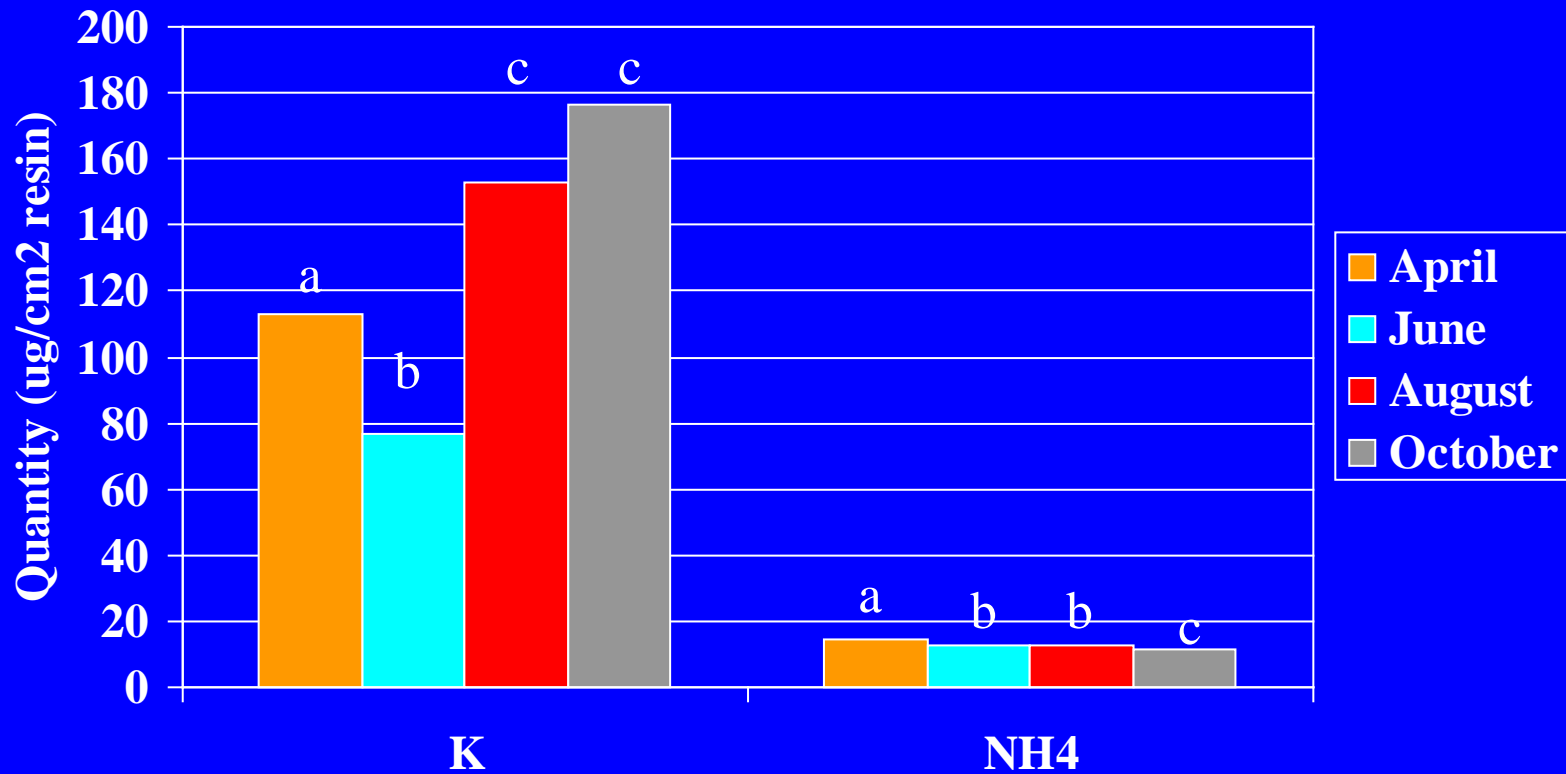
Ion Exchangers: Differences between horizons: P and S



Ion Exchangers: Differences between removal dates: Cu, Mn and Zn



Ion Exchangers: Differences between removal dates: K and NH₄⁺



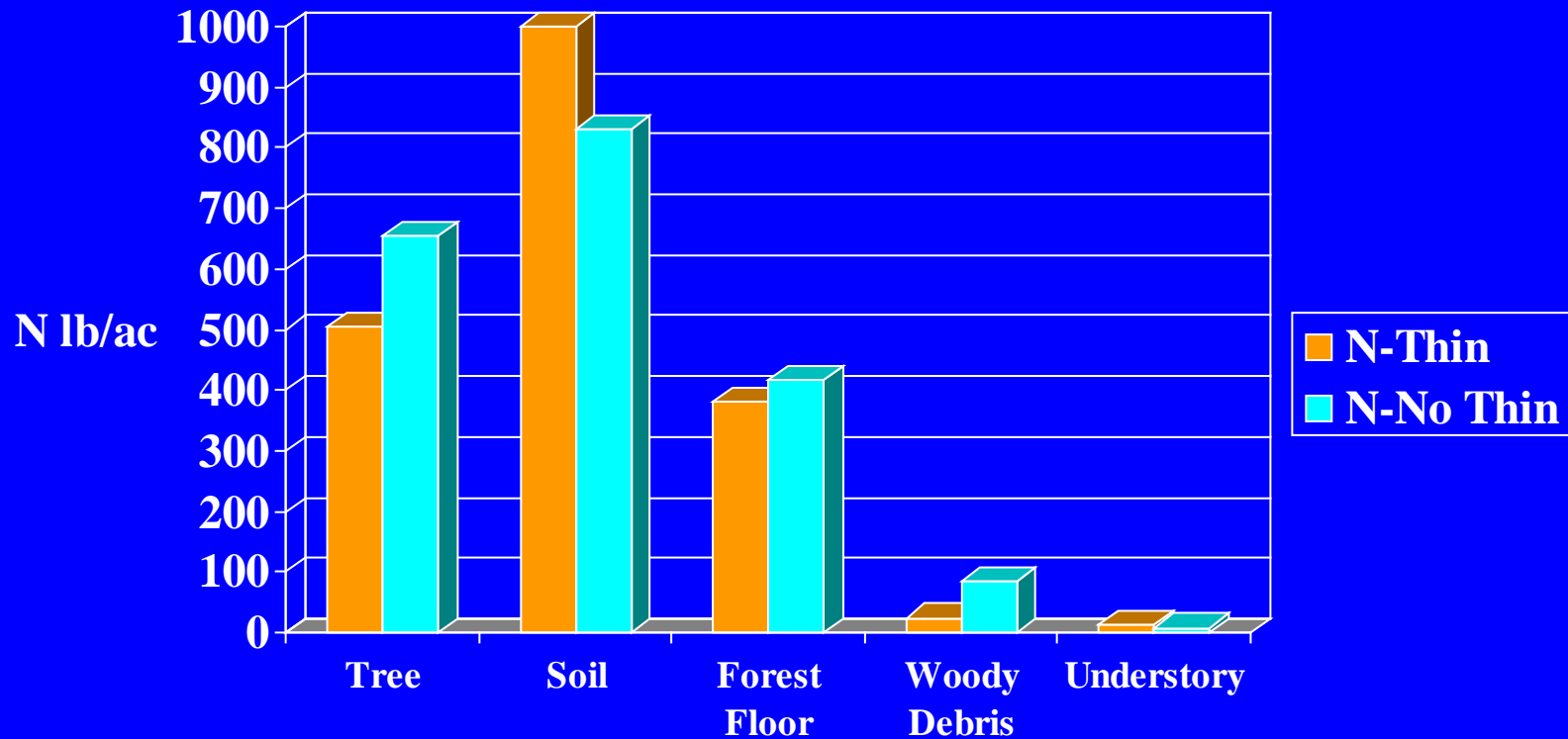
Conclusions Related to Soil Nutrient Availability

- We were able to detect differences in nutrient availability between treatments using ion exchange resins.
 - All elements showed greater soil availability in the thinned stand than in the unthinned stand.
 - These differences were generally not detectable using standard soil chemistry tests.
- We were able to detect differences between soil horizons.
 - Forest floor values were significantly different from mineral soil values for most elements.
 - This probably reflects the difference in nutrient dynamics between organic matter and mineral soil.

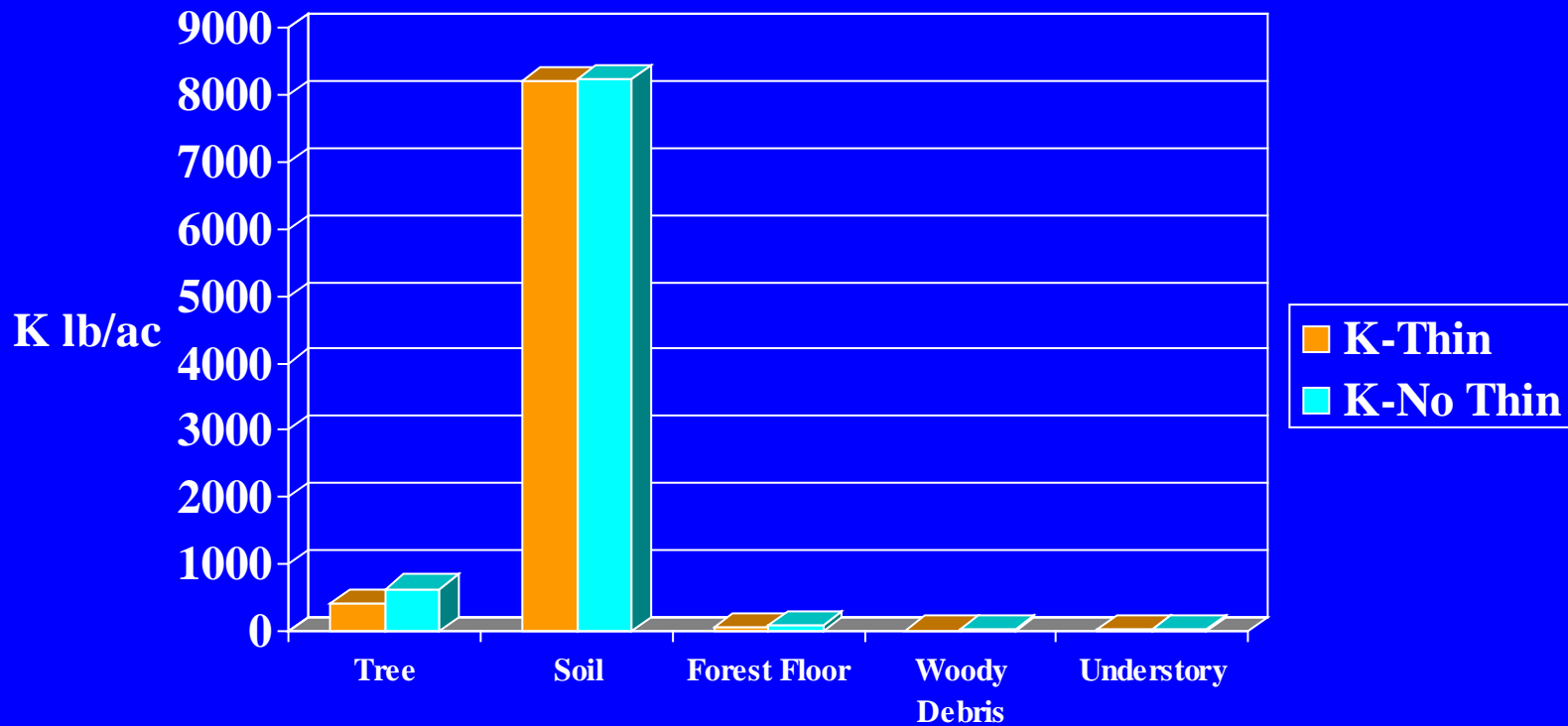
Nutrient accumulation over time

- For most nutrients, most of the accumulation occurred within the first six months, and there was no significant difference between collection dates.
 - Exceptions were K, Mn, Cu, Zn, which showed significantly greater quantities at 12 months than at 6 months.
- Some elements showed lower accumulation in capsules with longer burial times.
 - Generally only occurred at time of peak nutrient demand between April and June
 - May indicate losses from capsules due to soil conditions and nutrient dynamics
 - Certain ions have more affinity to the capsules than other ions, and this especially may help explain the results for NH_4^+
- A fall burial followed by a mid-summer removal would probably effectively detect treatment differences.

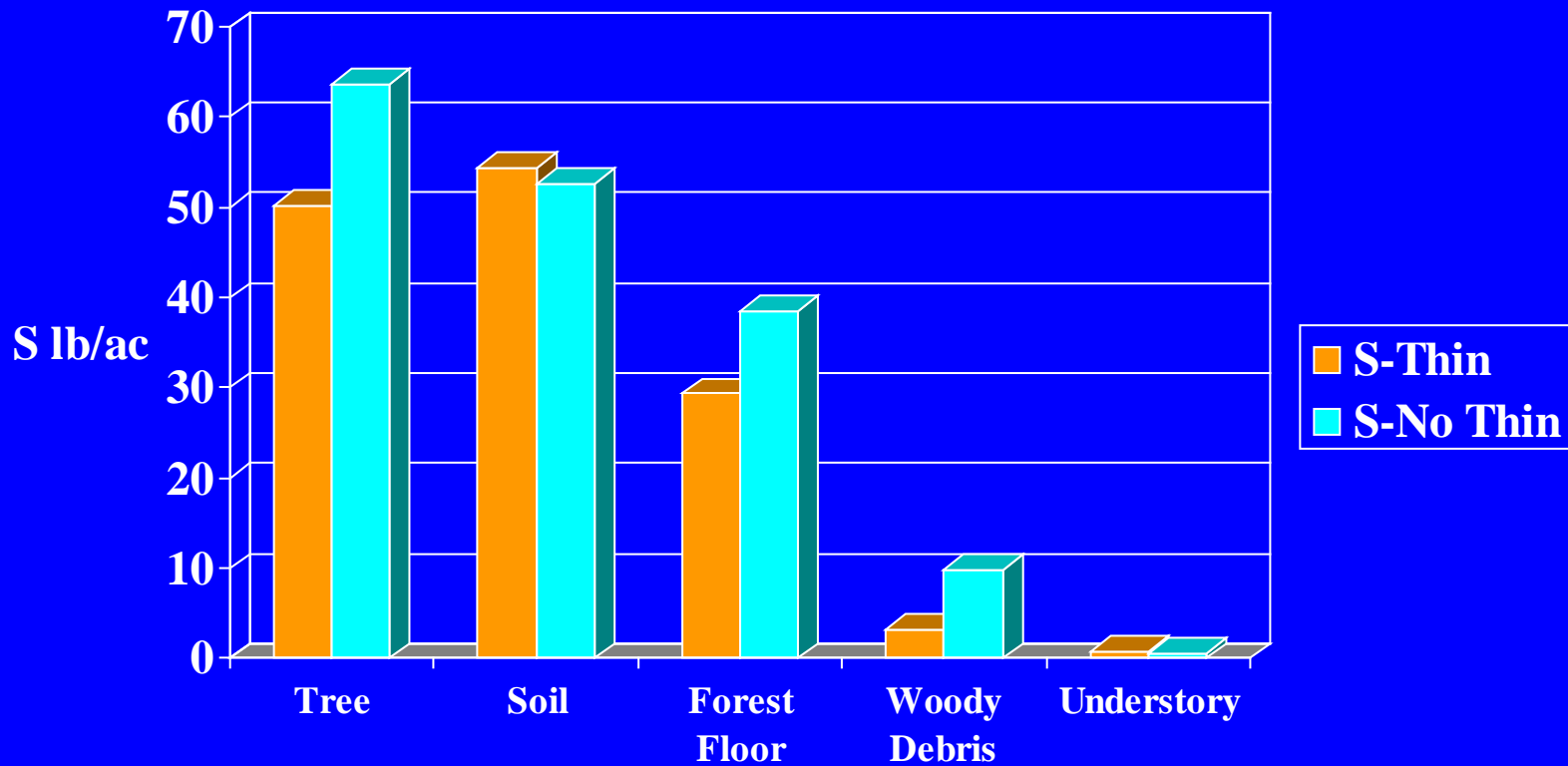
Thinning Effect on Nitrogen Distribution in Forest Ecosystem Components for USFS-Heppner Pine Thinning Study Site



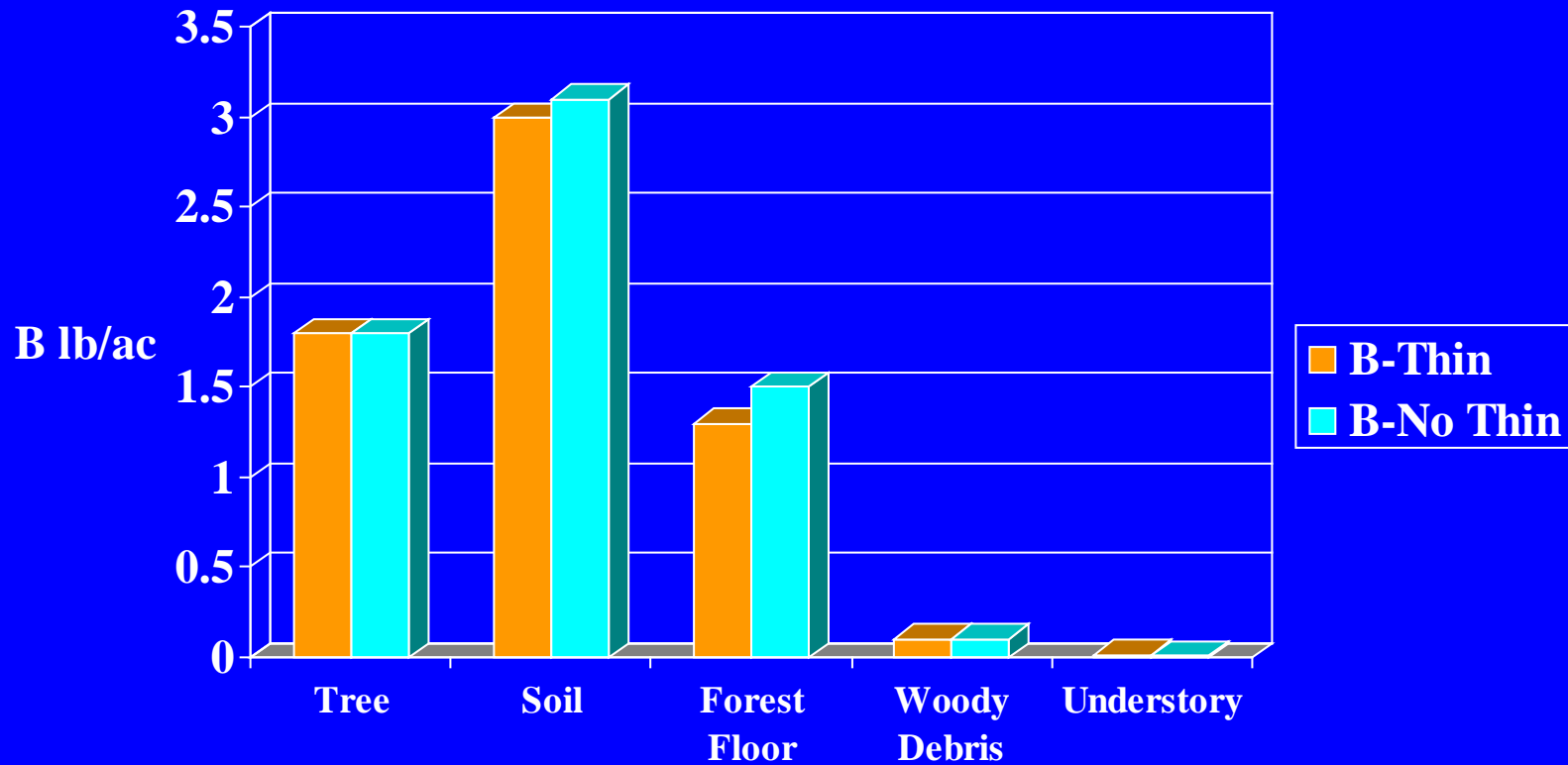
Thinning Effect on Potassium Distribution in Forest Ecosystem Components for USFS-Heppner Pine Thinning Study Site



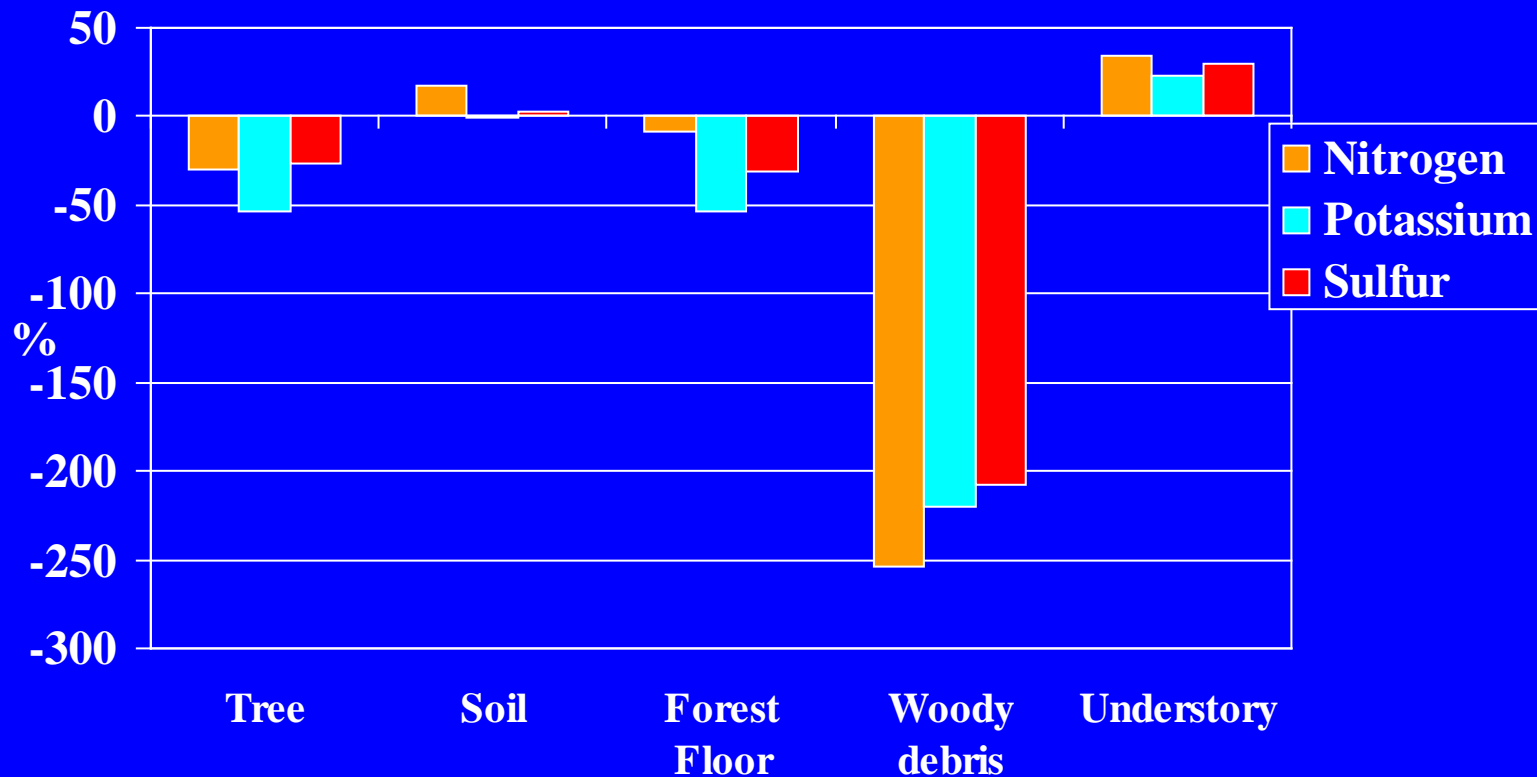
Thinning Effect on Sulfur Distribution in Forest Ecosystem Components for USFS-Heppner Pine Thinning Study Site



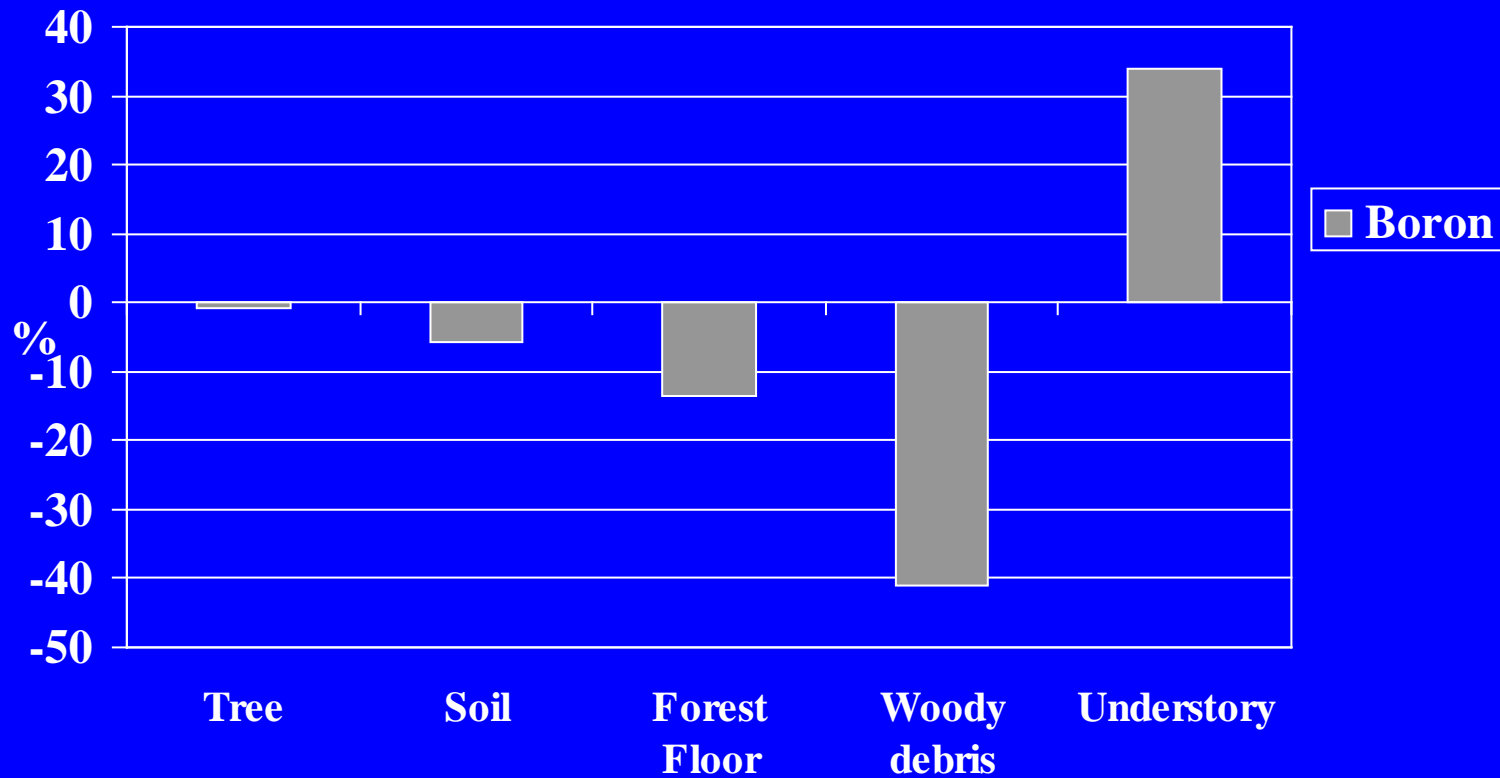
Thinning Effect on Boron Distribution in Forest Ecosystem Components for USFS-Heppner Pine Thinning Study Site



Effect of Thinning on Relative Nutrient Distribution for USFS-Heppner Study Site



Effect of Thinning on Relative Nutrient Distribution for USFS-Heppner Study Site



Summary

- Generally, more nutrients were held in the overstory, forest floor and woody debris in the unthinned stand.
- Standard soil chemistry indicated that for N and S, more nutrients were available in the soils in the thinned portion of the stand.
- Ion exchange resins indicated that more plant-available nutrients were present in the thinned portion of the stand.
- It does appear that allowing grand fir and Douglas-fir to encroach upon traditionally open, ponderosa pine stands significantly changes the nutrient dynamics of the site.