

The Long-Term Effects of Prescribed Fire and Harvesting Techniques on Forest Floor Soil Biogeochemistry in a Mixed Conifer Forest in the Eastern Sierra Nevada



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Introduction/Objective

Prescribed fire is a useful and common tool used in management practices in order to eliminate thick fuel load buildup that could otherwise cause a harmful wildfire. The objective of this study is to quantify the lasting effects of prescribed fire and harvesting techniques on O-horizon and soil nutrients approximately 9 years after a burn occurred in the Eastern Sierra Nevada Mountains. The study site is comprised of a prescribed fire following various harvest and understory removal treatments, including: whole-tree thinning, bole only thinning, and no harvest. Data was collected before, immediately after, and 9 years after the prescribed burn. All soils and organic layer samples were analyzed for nutrients. Resin lysimeters were instrumented in order to assess soil leaching. O-horizon and mineral soil Nitrogen and Phosphorus will be emphasized. These results will add to the data base on long-term effects of harvesting and prescribed fire on carbon and nutrient status of Sierran forest ecosystems.



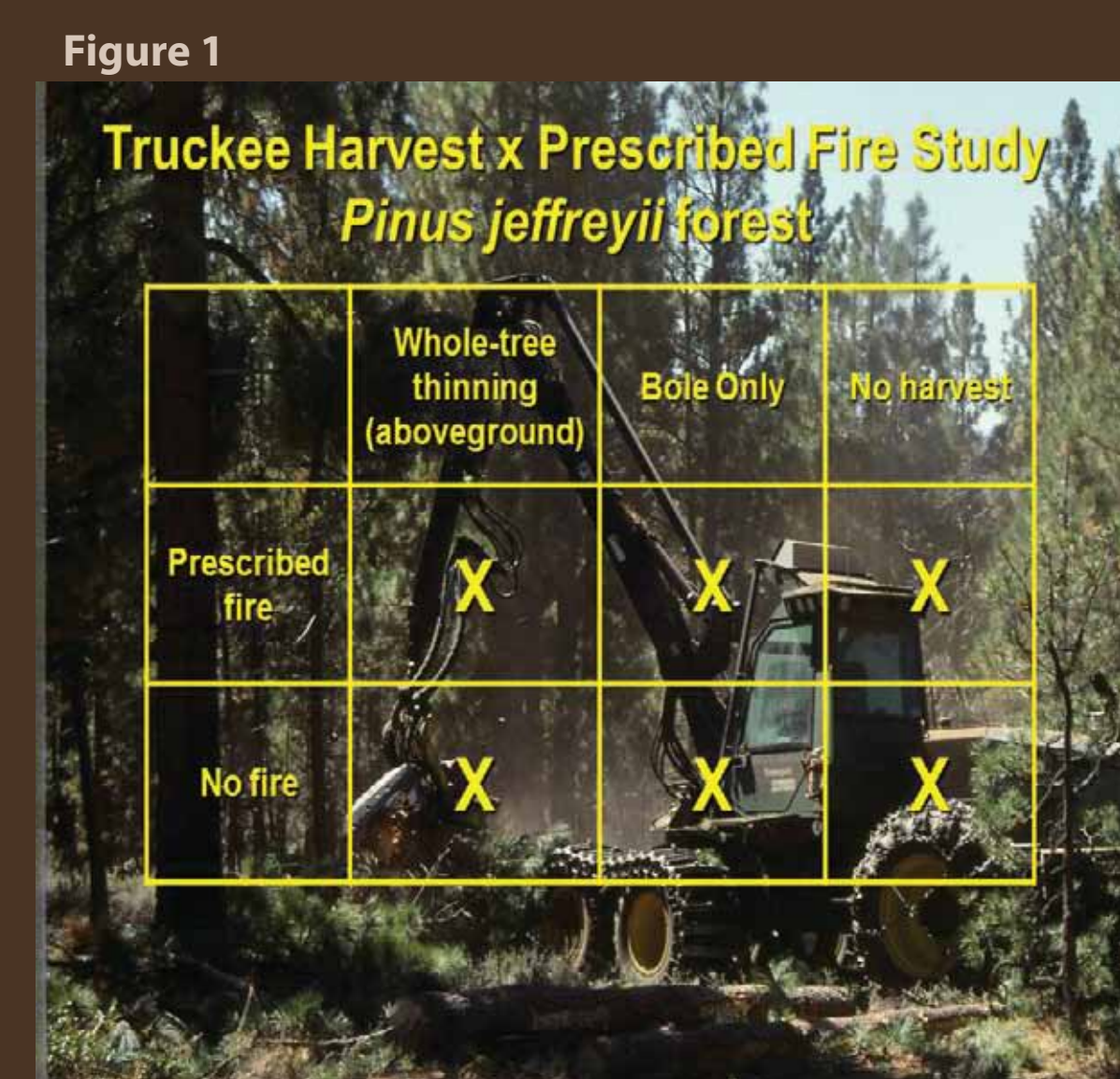
Site Description



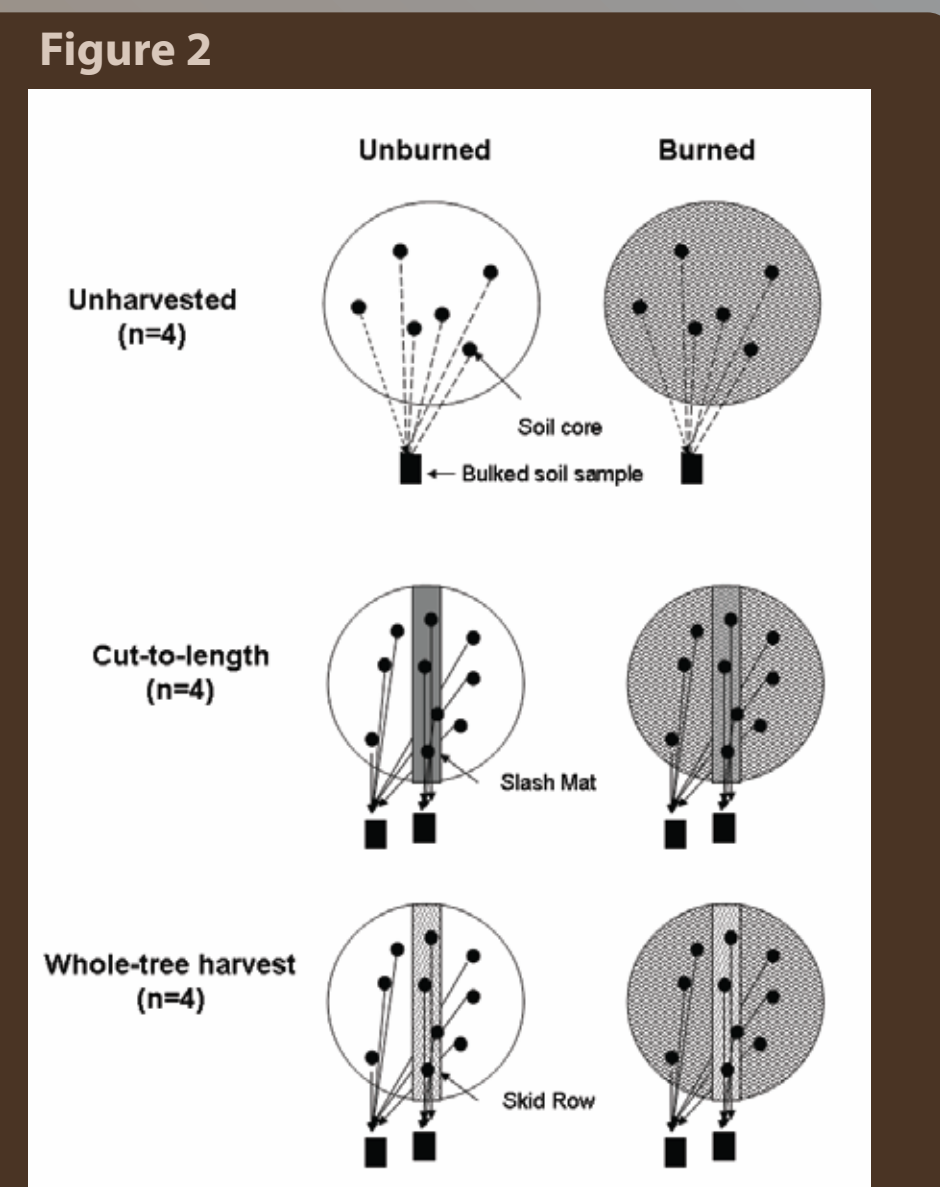
Located approximately 32 km north of Truckee, California, in the Tahoe National Forest in the Sierra Nevada. The elevation is 1767 m above sea level and receives an average of 94 cm annual precipitation, approximately half of which occurs as snow. Over story vegetation is dominated by *Pinus jeffreyi* with a few scattered *Abies concolor*. Soils are of the Kyburz series, fine-loamy, mixed, frigid Ultic Haploxeralfs derived from volcanic andesite.



Experimental Design



The harvest treatments at this site include whole tree, bole only, and no harvest. Bole only residues were left on site in slash mats. Each harvest treatment occurred in approximately a 5 ha block. Ten replicate, circular plots 0.04 ha in size, were established in each harvest treatment, five of which were burned in 2002. See figure 1 for plot schematics and figure 2 for sampling schematics.



Mineral Soil

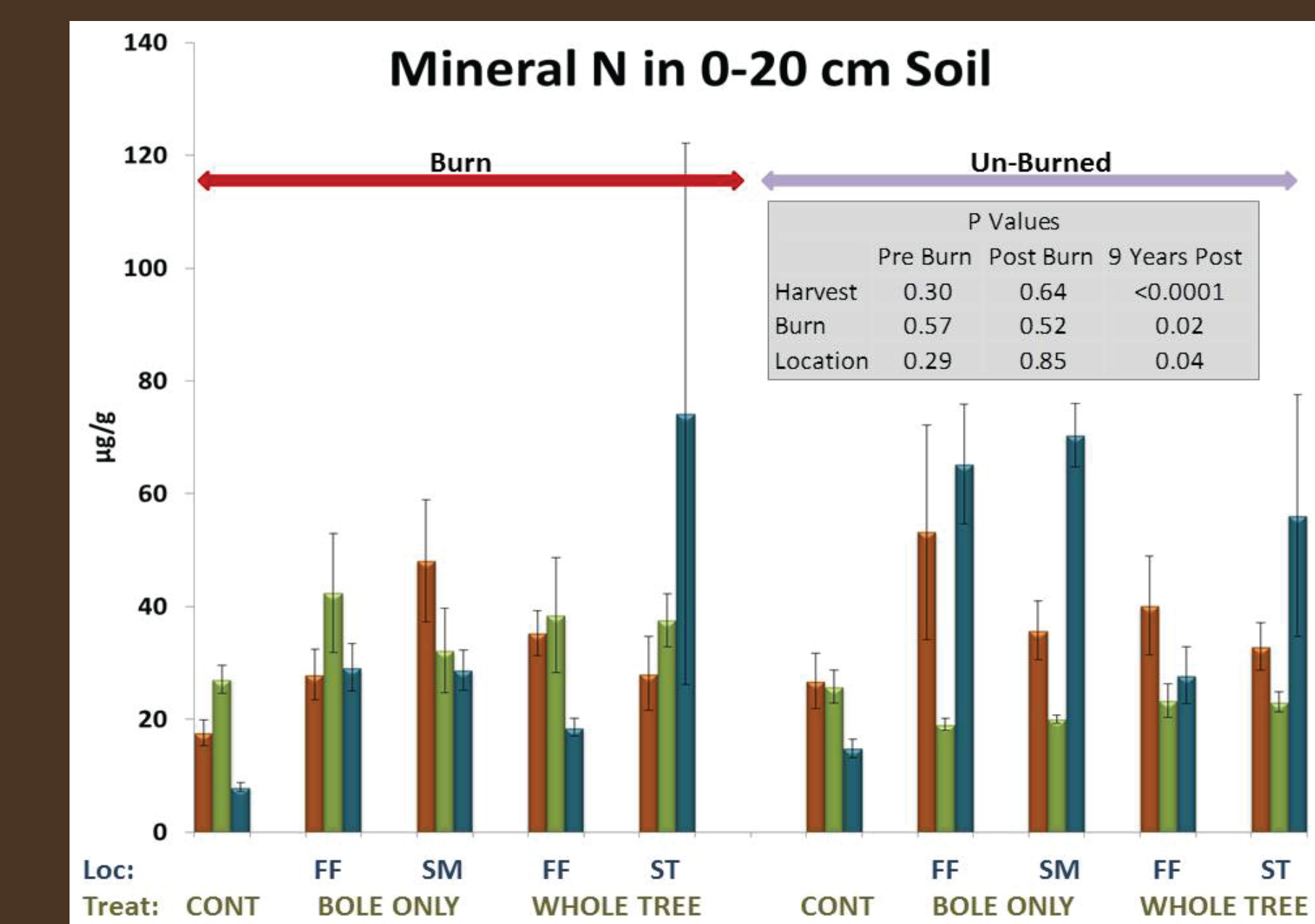


Figure 7: Lower in burned plots 9 years later. Initial increase in labile N since burn has ceased (except in whole-tree). No effects on large slash mat in unburned plots.

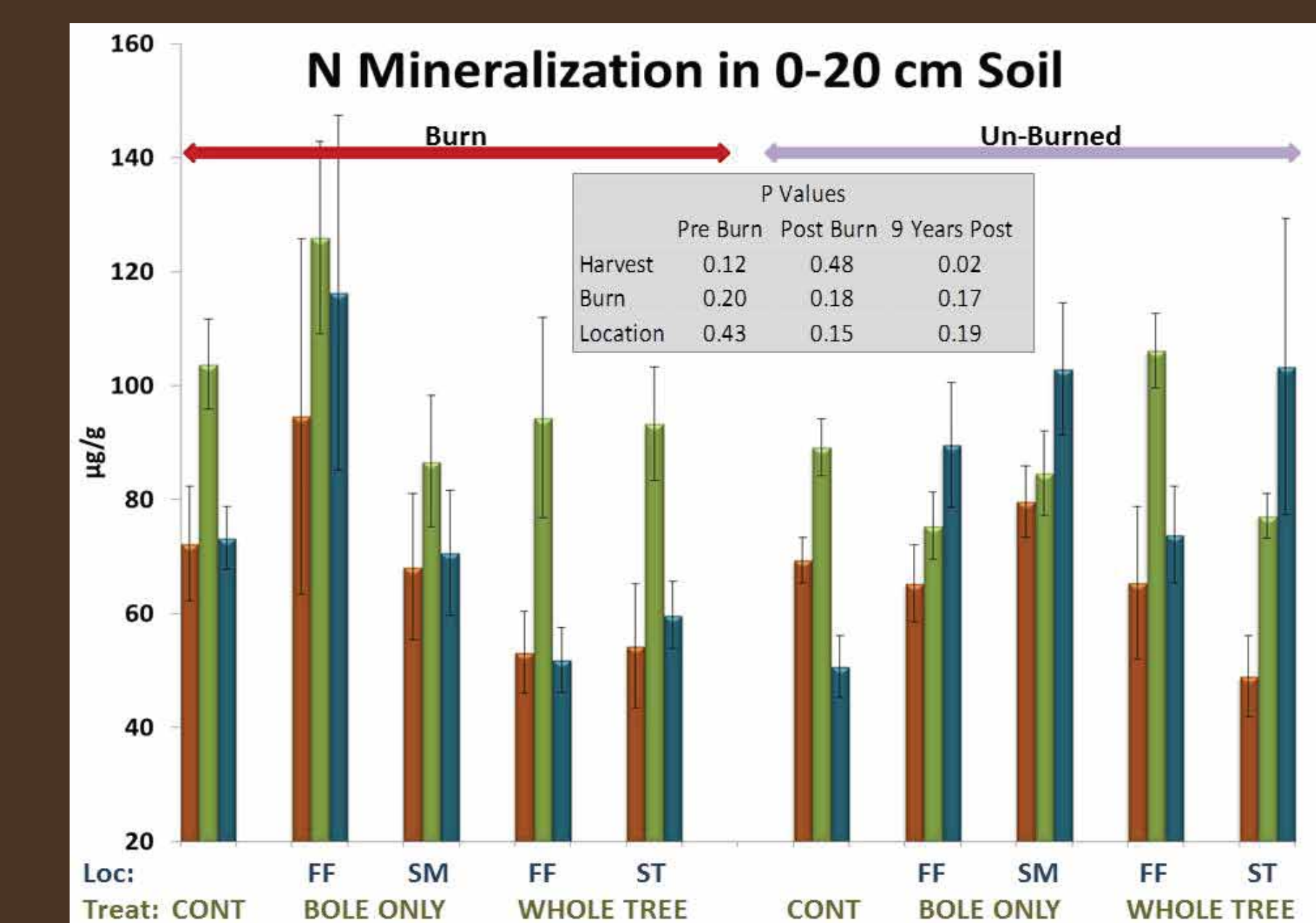


Figure 8: Harvesting effects are significant but lacking a pattern in whole-tree.

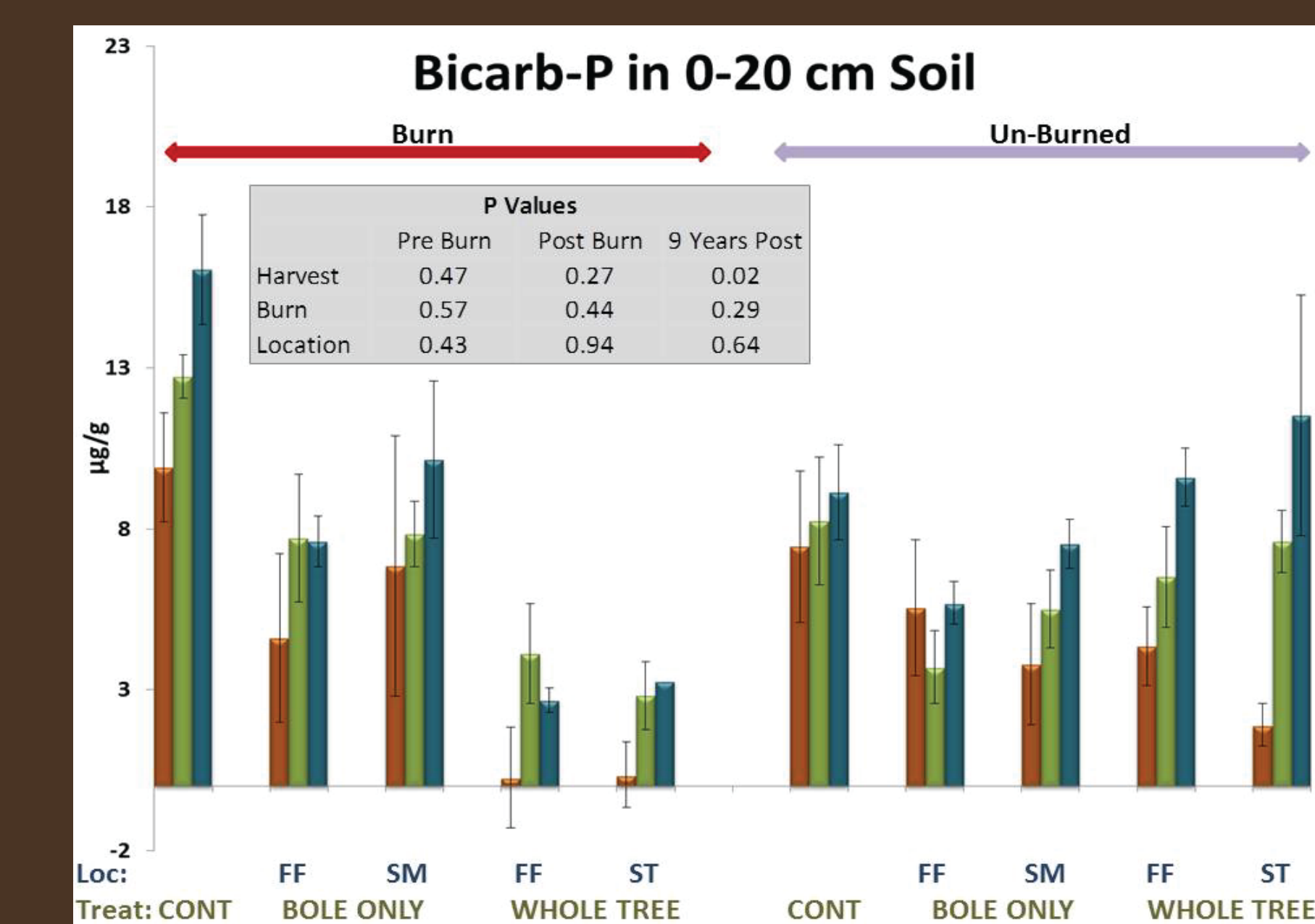


Figure 9: Increase in slash mat and control regardless of burn. Overall increase in unburned plots.

O-Horizon

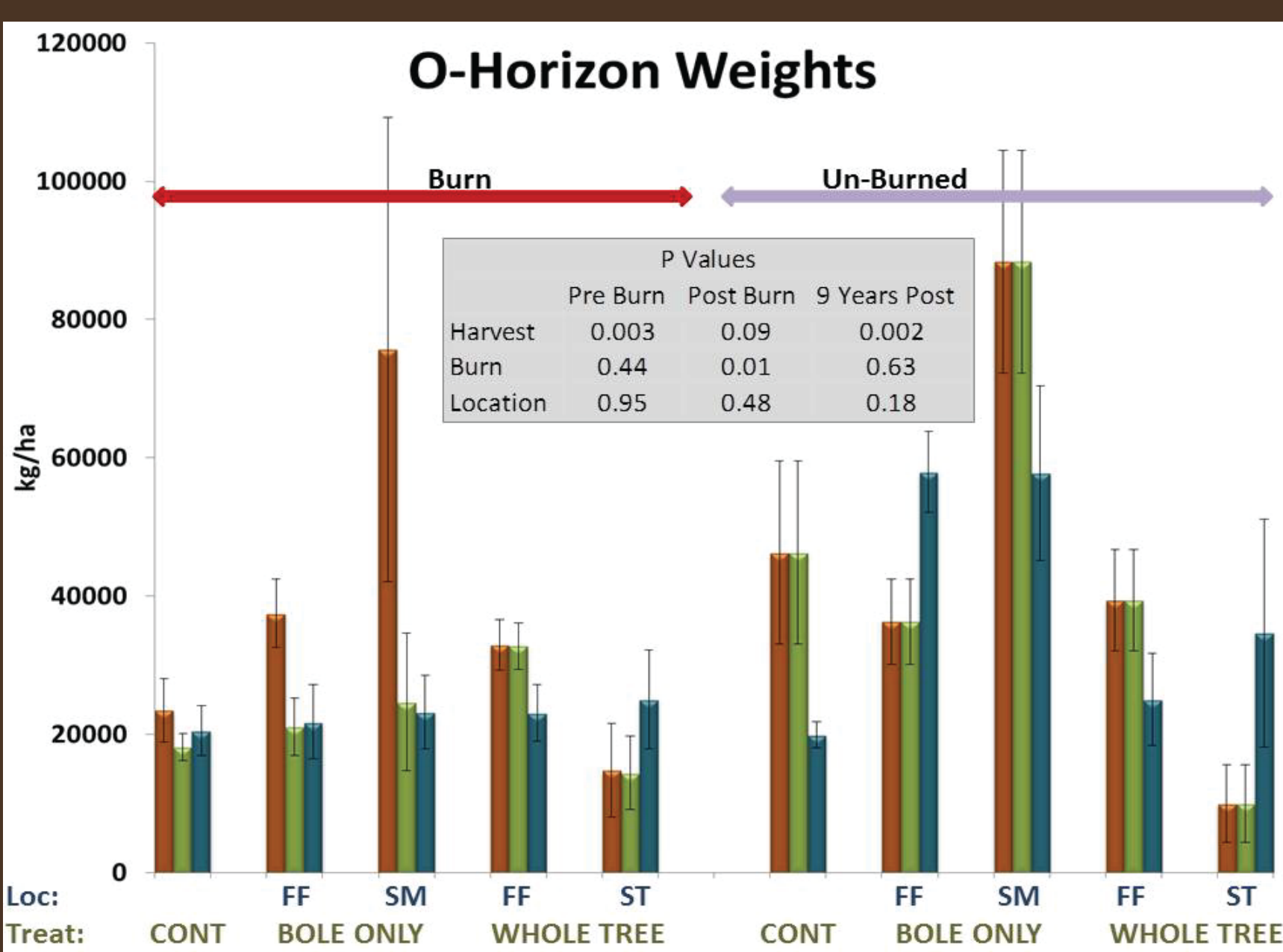


Figure 3: Losses occurred after burning have not been replenished. Forest floor accumulation in skid trails. Loss in unburned control plots for an unknown reason.

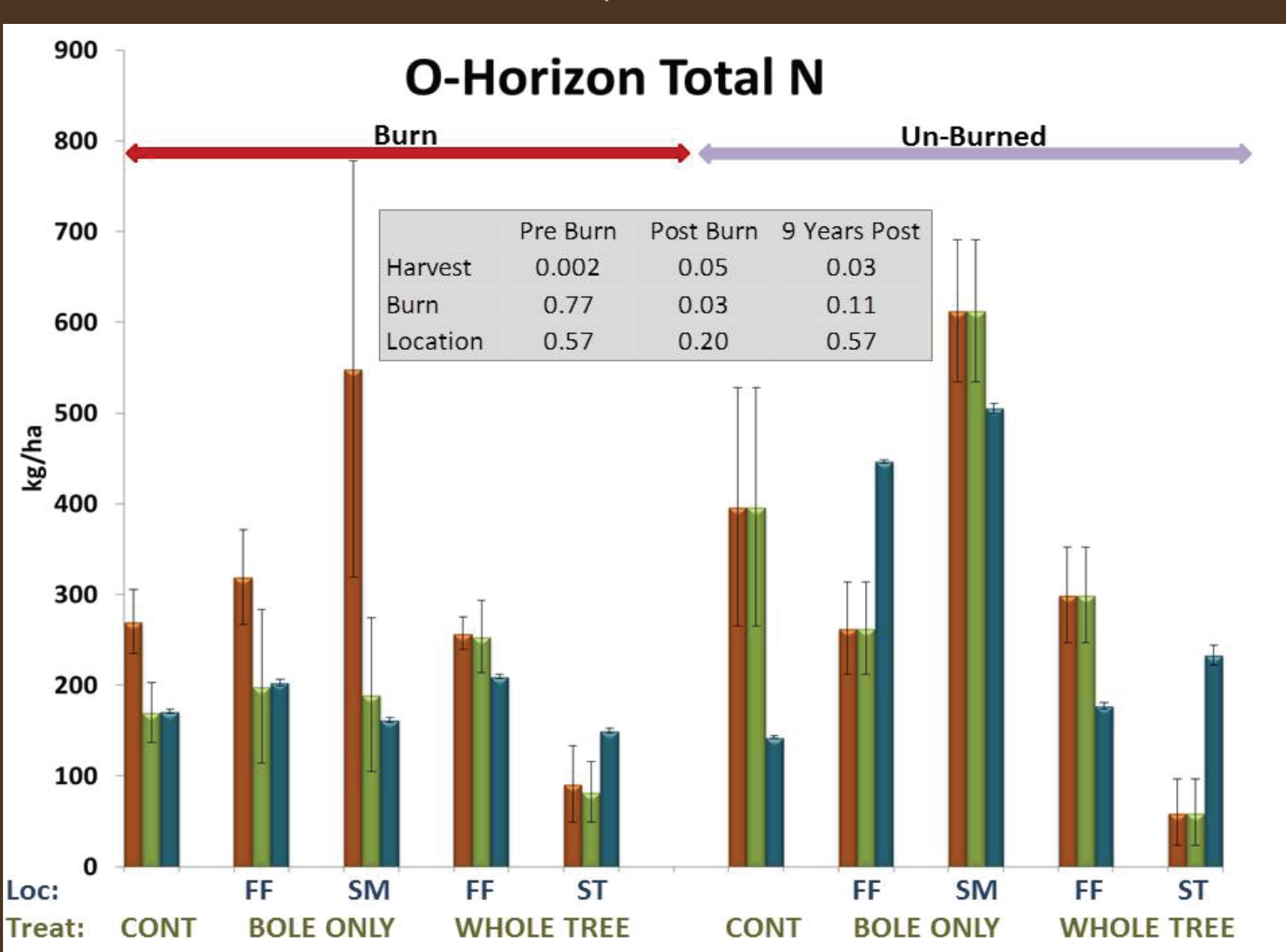


Figure 5: Initial losses of N via volatilization has not yet been replenished to pre-burn levels. Losing more weight in bole-only slash mat than N decrease.

Conclusions



Acknowledgements:

We would like to thank the following people for their assistance: Tye Morgan with ARS and Jacob Phillips, Julie Ruiz, Jessie Smith, Samantha Evanson, Kelli Belmont, and Chris Simmons from UNR. We would also like to recognize our research funding which was provided by the Nevada Agriculture Experiment Station.

- Decreased overall fuel load most successfully with harvest and burn
- O-horizon mass changes did not affect underlying mineral N or N mineralization
- Forest floor accumulation in skid trails and forest floor loss in slash mats
- Soil leaching is not affected by treatment or burning
- Burning and harvesting (in conjunction or separate) appears not to have any negative effects on O-horizon or soil N and P
- Although total N is not restored in forest floor, this has not reduced soil available N
- Continue with harvesting and prescribed burning

Statistical Analysis

Analysis of variance computations were performed by the use of linear models analysis of variance with the software DATA-Desk v. 6.3. The variables included harvest (bole only, whole-tree, and no harvest), location (forest floor or skid/slash mat), and burn (burn or no burn).

*Note: Forest floor weight and nutrient content were not resampled immediately post burn in the unburned plots because it was assumed that changes were negligible in such a short time. Values are assumed to be the same for the purpose of statistical analysis.

Legend

- Pre Burn
- Immediate Post Burn
- 9 Years Post Burn

- FF=forest floor
- SM= slash mat
- ST= skidtrail

*Note: Error bars represent the standard error



Soil Leaching

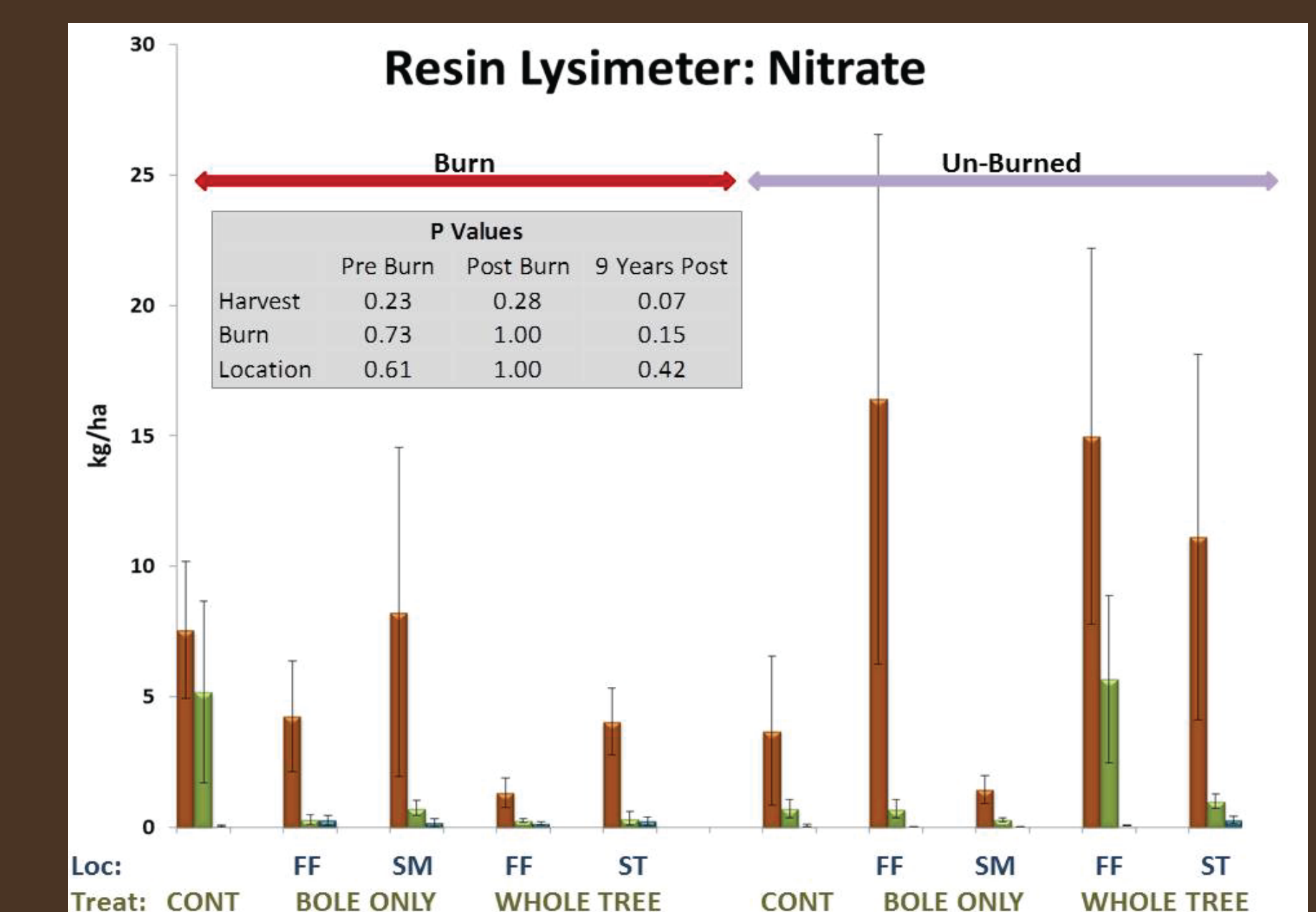


Figure 10: Inter-annual variation is greater than treatment effects except in the 9 years post harvest plots.

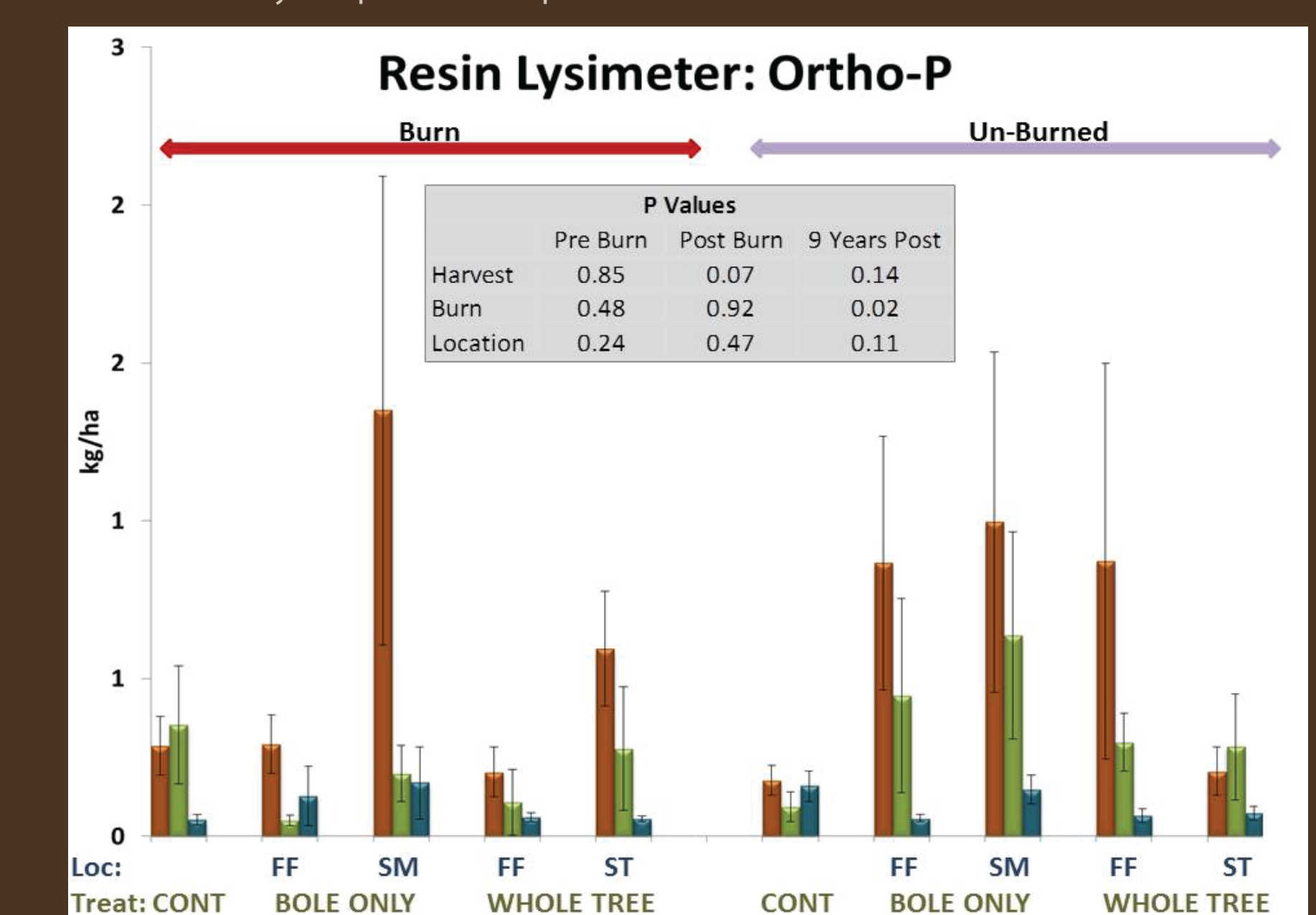


Figure 11: No real leaching effect. Overall decrease.