

Background

- Shrubs are replacing grasses in dryland ecosystems, altering the quantity and quality of plant litter inputs.
- Plant litter is one of the major sources of carbon (C) and nitrogen (N) inputs to the soil.
- Differences in C and N inputs from grass and shrub litter may influence SOC and STN, which may also be positively related.
- This study evaluated how 10 years of litter manipulation, including litter removal (0x), control (Ctrl), and litter addition (2x), influenced SOC and STN while quantifying C and N inputs from grass and shrub litter

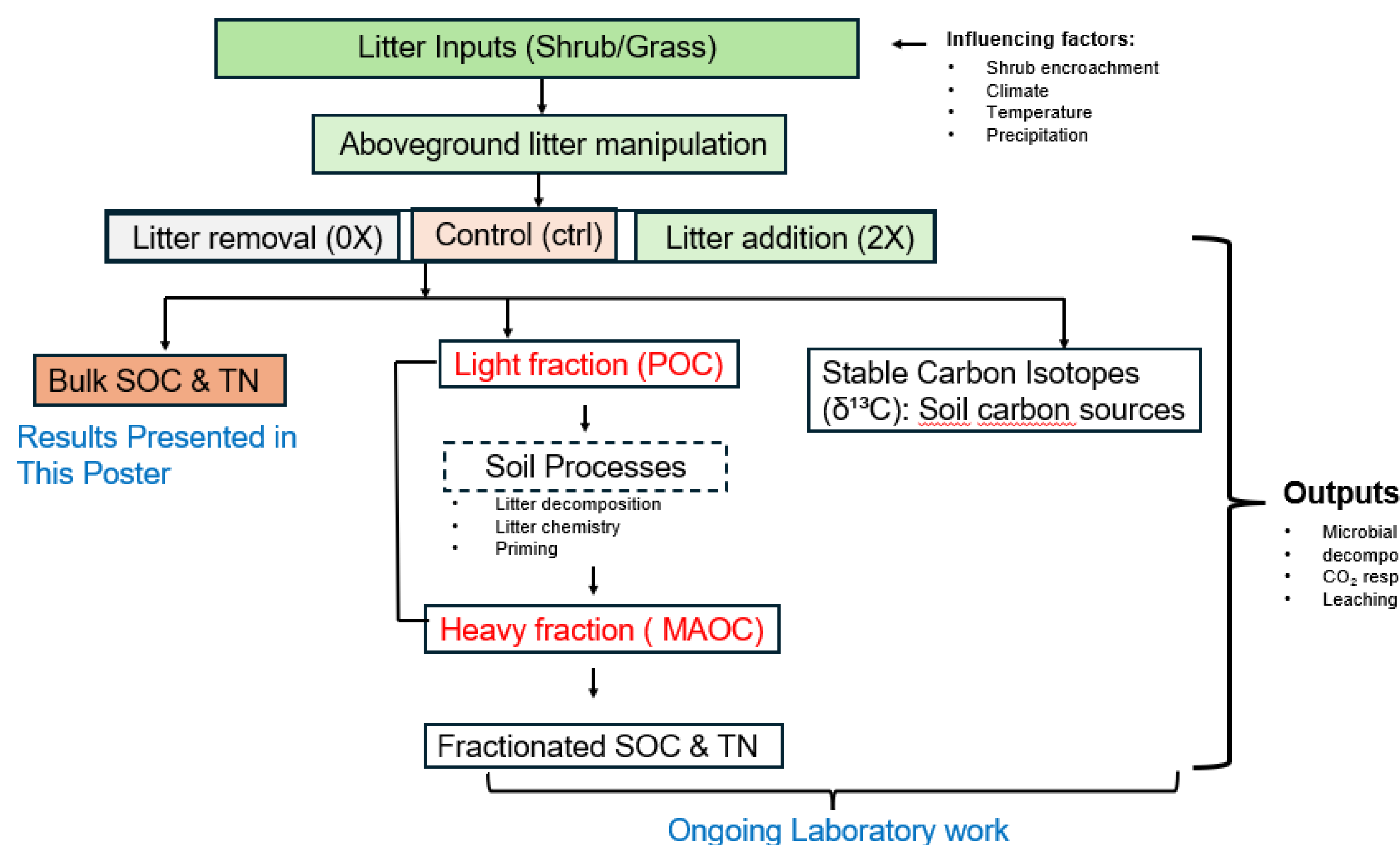


Figure 1. Graphical abstract illustrating the effects of 10 years of litter input manipulation on SOC and STN. Bulk SOC and STN results are presented in this poster, while other laboratory work is ongoing

Research Questions

- How do 10 y of litter manipulation influence SOC and STN in a shrub-encroached dryland?**
We hypothesize that aboveground litter addition will increase SOC and STN by increasing C and N inputs, whereas litter removal will decrease SOC and STN. We also expect shrub plots to have greater SOC and STN than grass plots because mesquite (*Prosopis velutina*) produces woody litter and fixes nitrogen.



D-DIRT Litter manipulation

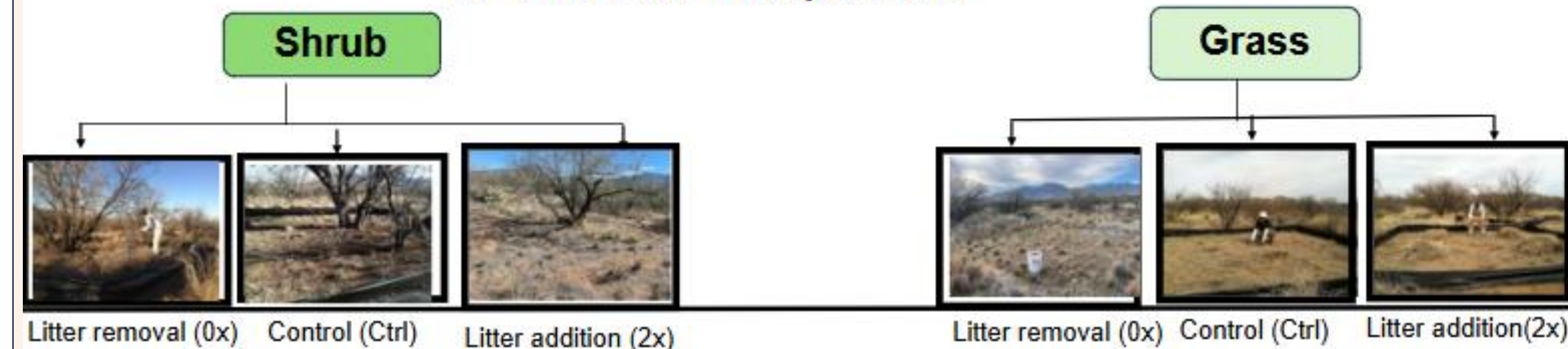


Figure 2. D-DIRT experimental plot design, 5 m x 5 m plot size.

Methods

- We manipulated litter every year in grass and shrub plots at the Santa Rita Experimental Range by removing litter from 0x plots, adding it to 2x plots, and leaving Ctrl plots unchanged
- We collected litter samples every year and soil samples in 2013 and 2023 to measure changes over 10 years
- We measured C and N in litter samples to quantify litter inputs and measured SOC and STN in soil samples

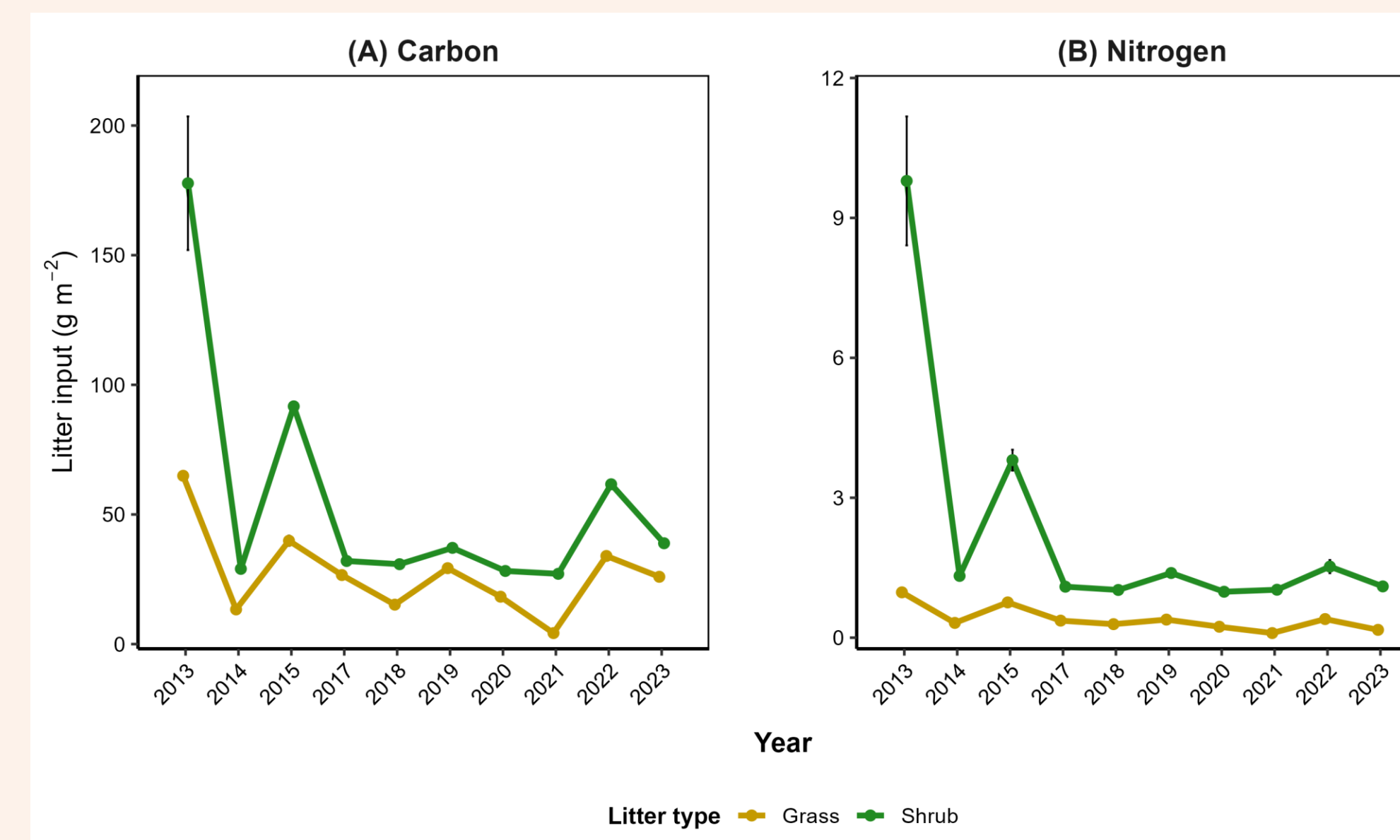


Figure 3. Annual C and N inputs from grass and shrub litter from 2013 to 2023. Points represent means, and error bars represent $\pm$ SE. The 2013 values represent total litter inputs collected during the initial litter manipulation, whereas the 2014–2023 values represent annual litter inputs.

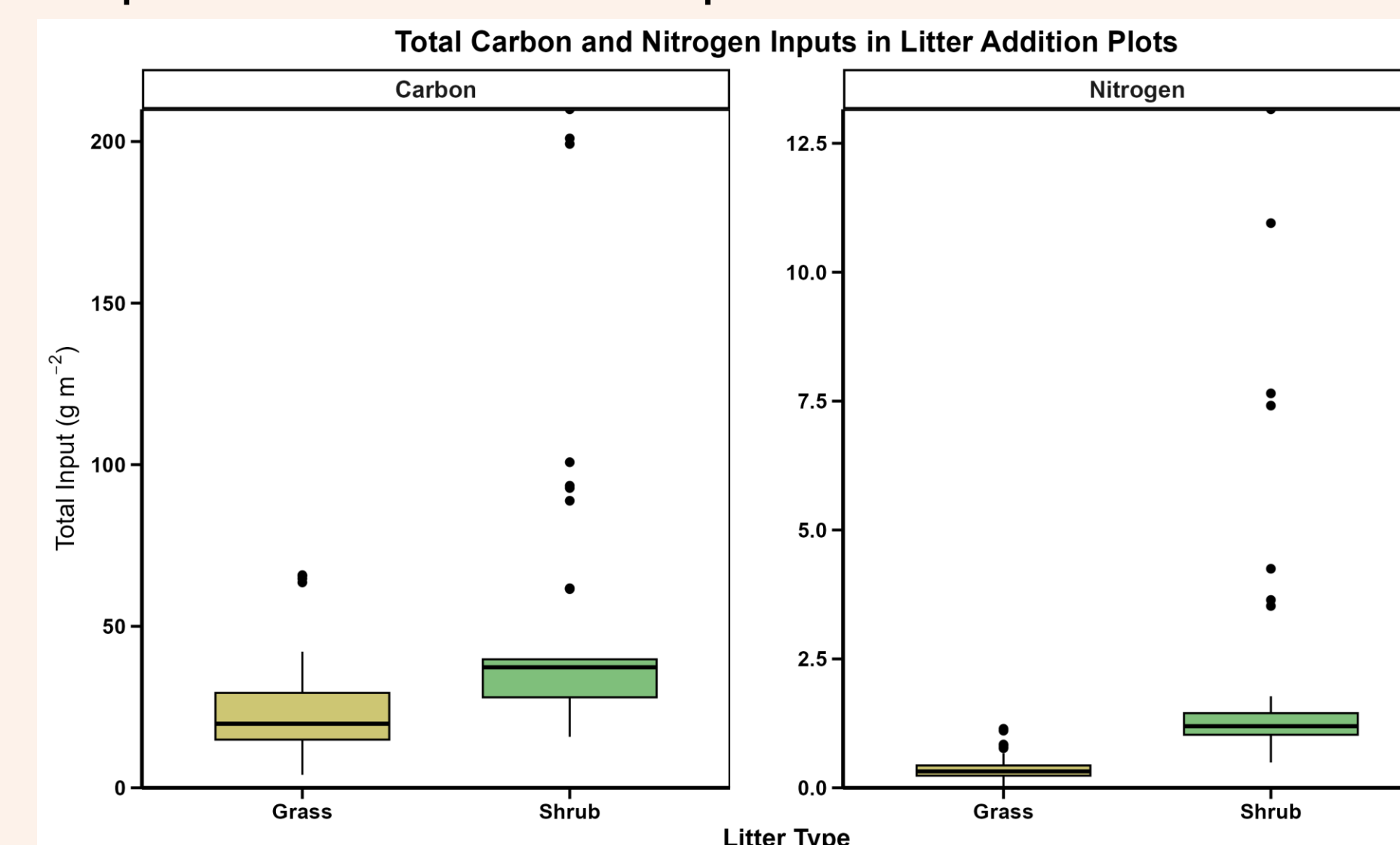


Figure 4. Total C and N inputs from grass and shrub litter added to the 2x litter addition treatment over the 10-year study period. Bars represent the inputs added through grass and shrub litter to the 2x litter addition plots

Results

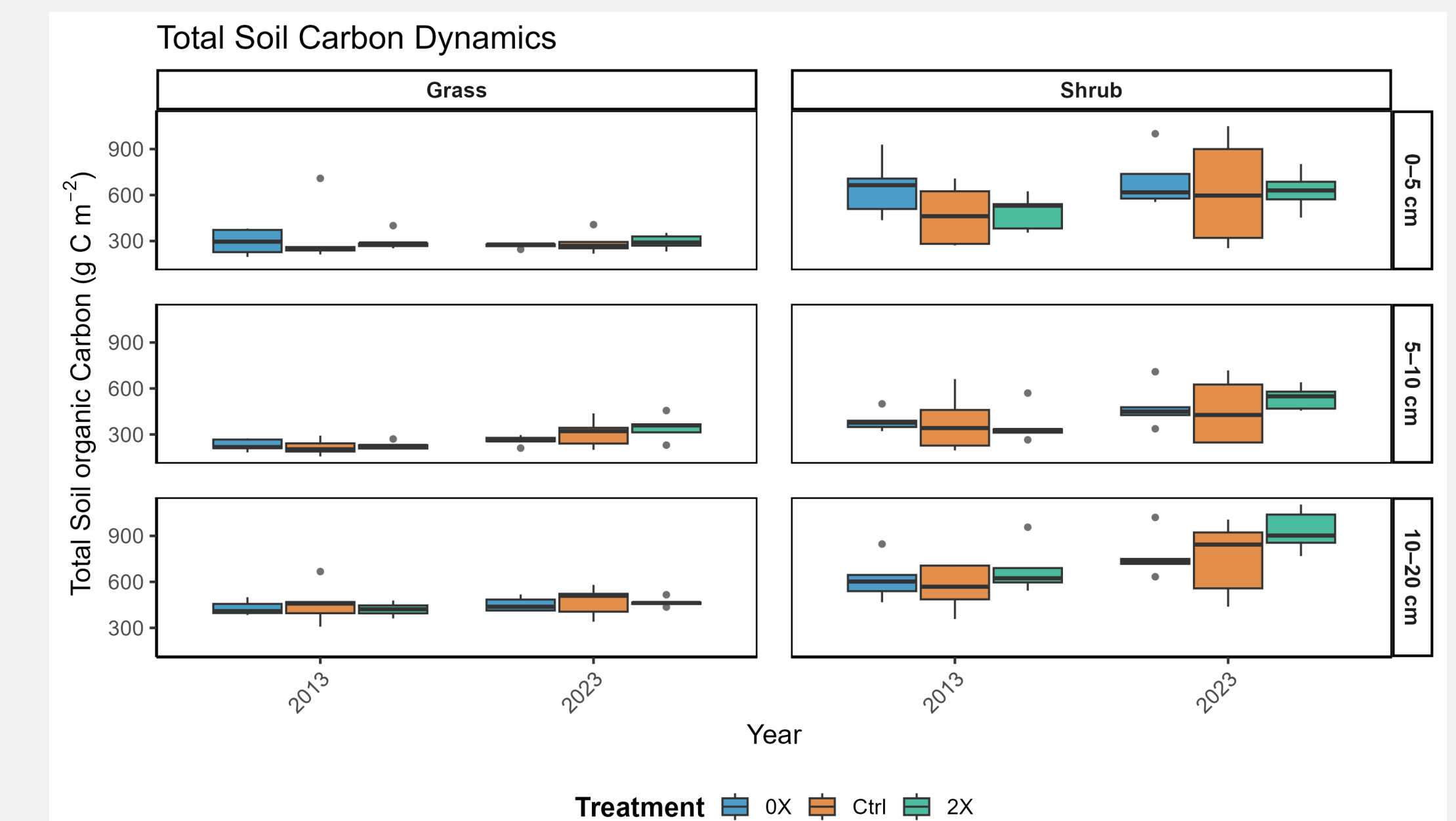


Figure 5. SOC in grass and shrub plots under litter treatments in 2013 and 2023. Boxplots show the median, interquartile range, and outliers. Shrub plots had significantly greater SOC than grass plots, whereas litter treatment and year had no significant effects.

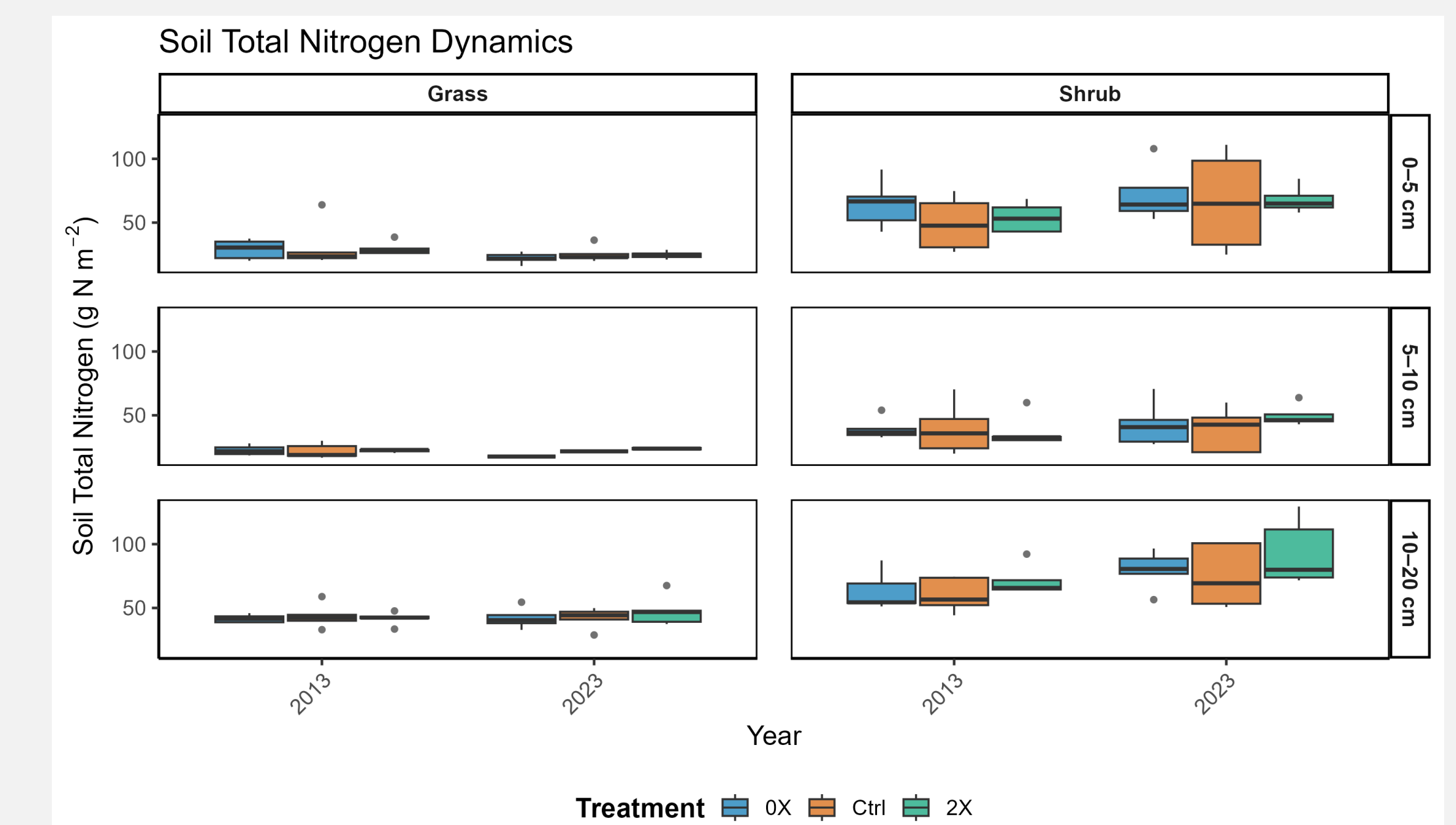


Figure 6. STN in grass and shrub plots under litter treatments in 2013 and 2023. Boxplots show the median, interquartile range, and outliers. Shrub plots had significantly greater STN than grass plots, whereas litter treatment and year had no significant effects

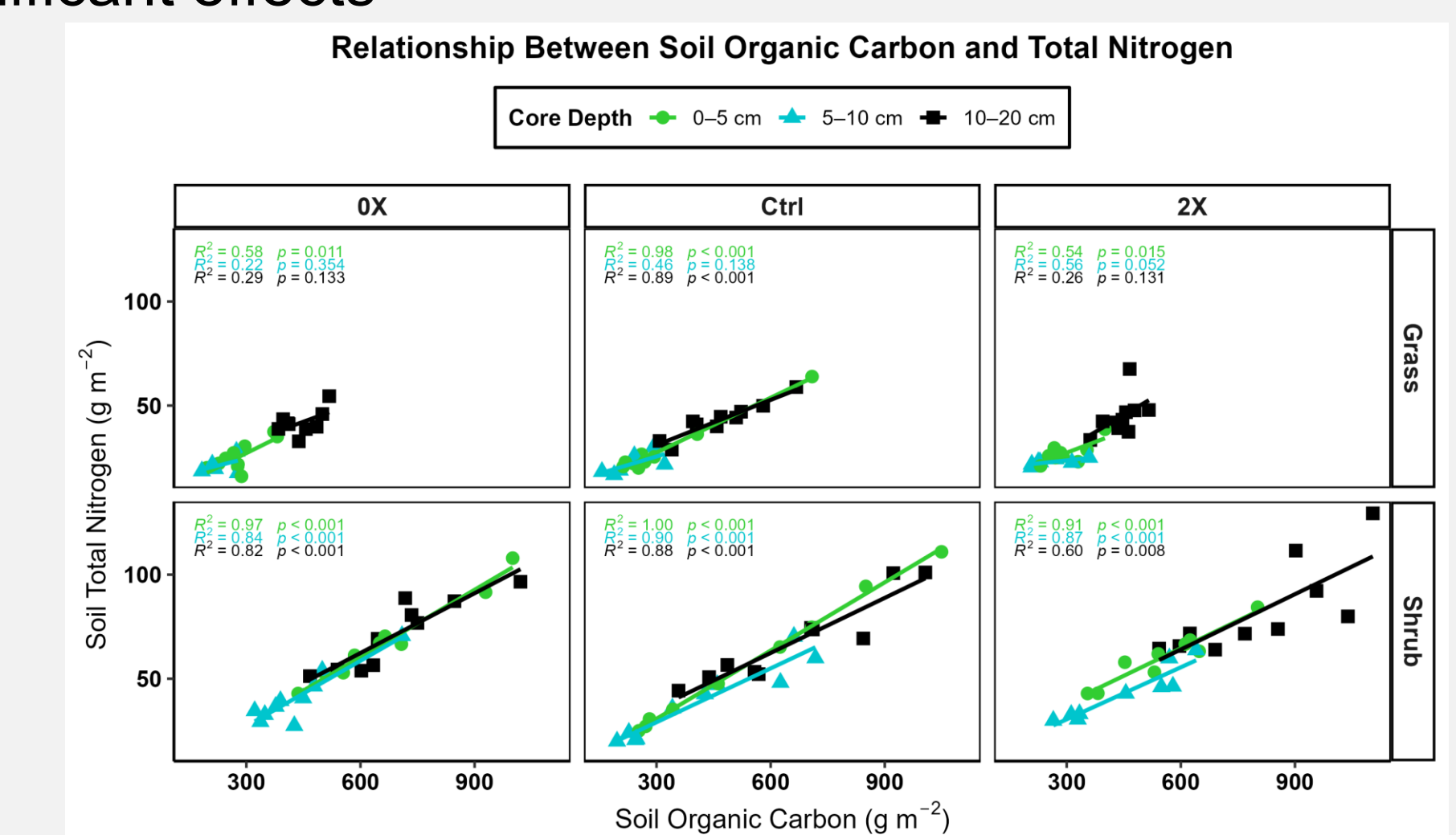


Figure 7. Relationship between SOC and STN in 2013 and 2023. SOC and STN were strongly and positively related across all soil depths, with greater SOC associated with greater STN.

ONGOING AND FUTURE WORK

After 10 years of litter manipulation with no significant change in SOC, a key question remains: Where did the carbon from the added litter go? Ongoing density fractionation and isotope analyses will determine the stability and distribution of litter-derived carbon in the soil. Future work will examine soil respiration, microbial activity, environmental factors, and use the TECO model to predict future SOC changes in D-DIRT.

Learn more about D-DIRT: <https://dirtnet.wordpress.com/santa-rita/>

ACKNOWLEDGMENTS

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