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Introduction

- Atmospheric nitrogen (N) deposition has the capacity to alter soil microbial activity and organic matter decomposition..
- β -glucosidase, N-acetylglucosaminidase (NAGase), phosphatase, and peroxidase activity was measured in soils exposed to experimental N inputs for 13 years.
- We hypothesized that soils exposed to high N would have lower extracellular enzyme activity.

Methods

- Surface (0-10 cm) soil was sampled from the Sky Oaks Field Station (Fig. 1) and Santa Margarita Ecological Reserve (Fig. 2) in the spring of 2003, 2005, 2007, 2009, 2011, 2013, and 2015.

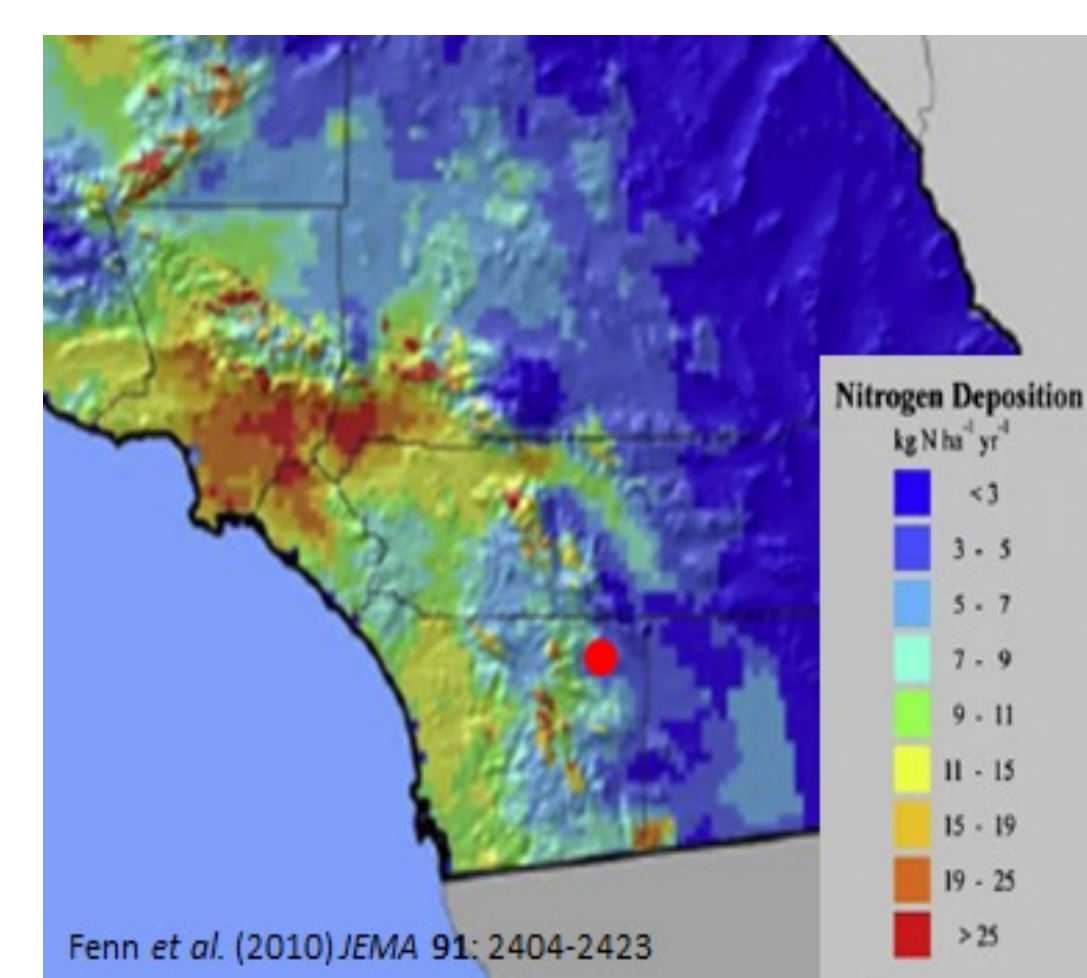


Fig. 1. Sky Oaks Field Station (SOFS) is evergreen chaparral.

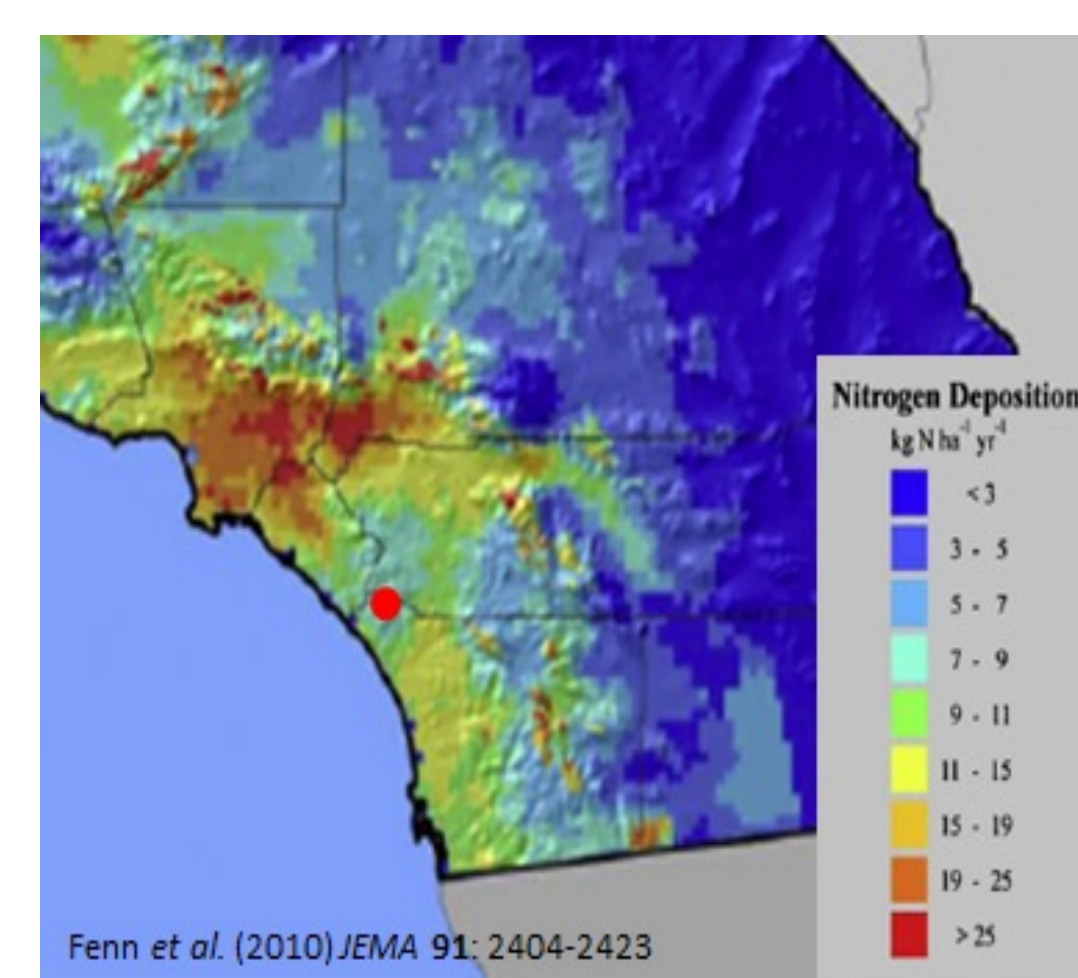
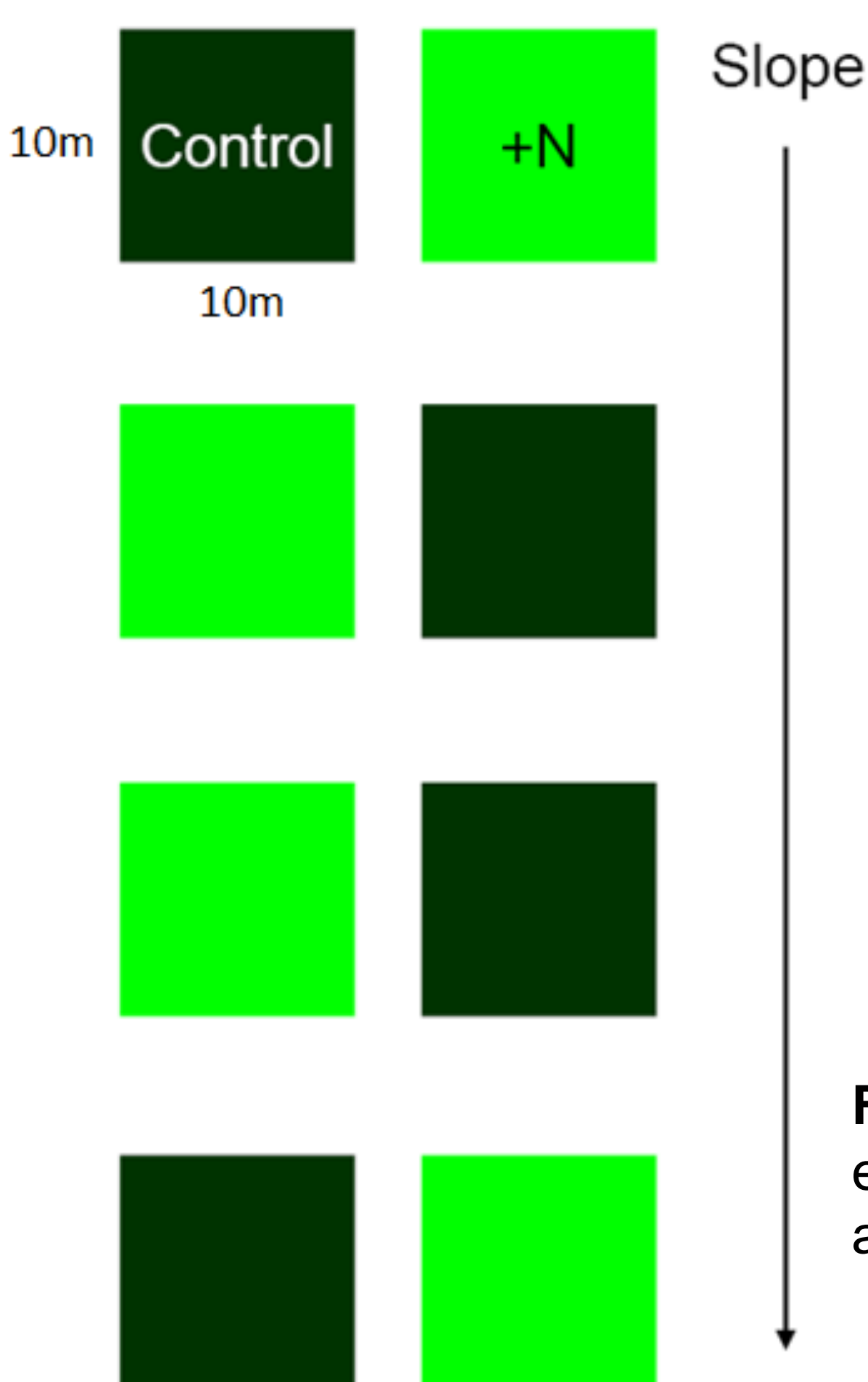


Fig. 2. Santa Margarita Ecological Reserve (SMER) is semi-deciduous coastal sage scrub.



- The experimental design consisted of eight-10 x 10 m plots arranged in a paired-design (Fig. 3).
- N plots have been fertilized annually since 2003 with 50 kgN/ha of dry N fertilizer, which is applied during the summer and fall of each year.

Fig. 3. Schematic of the field experimental design at SOFS and SMER.

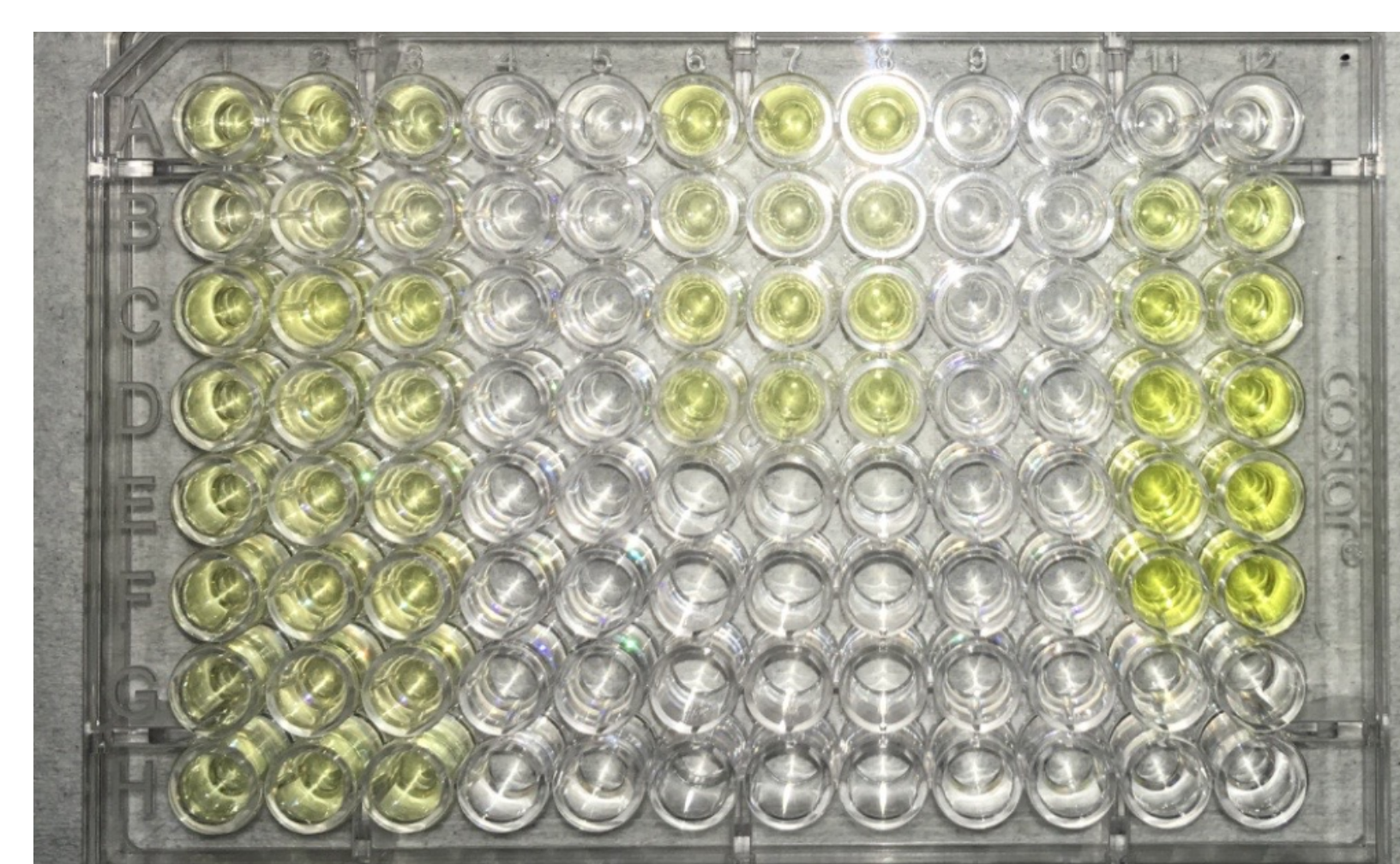


Fig. 4. Arrangement of the enzyme assay plates. Rows A-H the soil slurries from the plots (n = 8/site). Each plot was run in triplicate (columns 1-3 SOFS and 6-8 SMER), blanks were run in duplicate (columns 4-5 SOFS and 9-10 SMER), and the standard curve was run in duplicate (columns 11-12).

- Enzyme analyses followed methods described by Jackson et al. (2013)
- Five grams of soil/plot was incubated in 5 mL of 50 mM acetate buffer for 24 hours.
- Soil slurries were incubated with the corresponding substrate for the recommended time (Fig. 4).
- The absorbance was read at 410 nm for all substrates except for peroxidase, which was read at 450 nm.
- Differences between control and N plots were calculated as the LN-response ratio [LN(N)-LN(control)] (Hedges et al. 1999).

Literature Cited

Results

- β -glucosidase and phosphatase activity declined over time in added N plots at SOFS but not SMER, while peroxidase (Fig. 5) activity increased in added N plots at SOFS but not SMER.
- NAGase activity was not affected by N addition at either site.

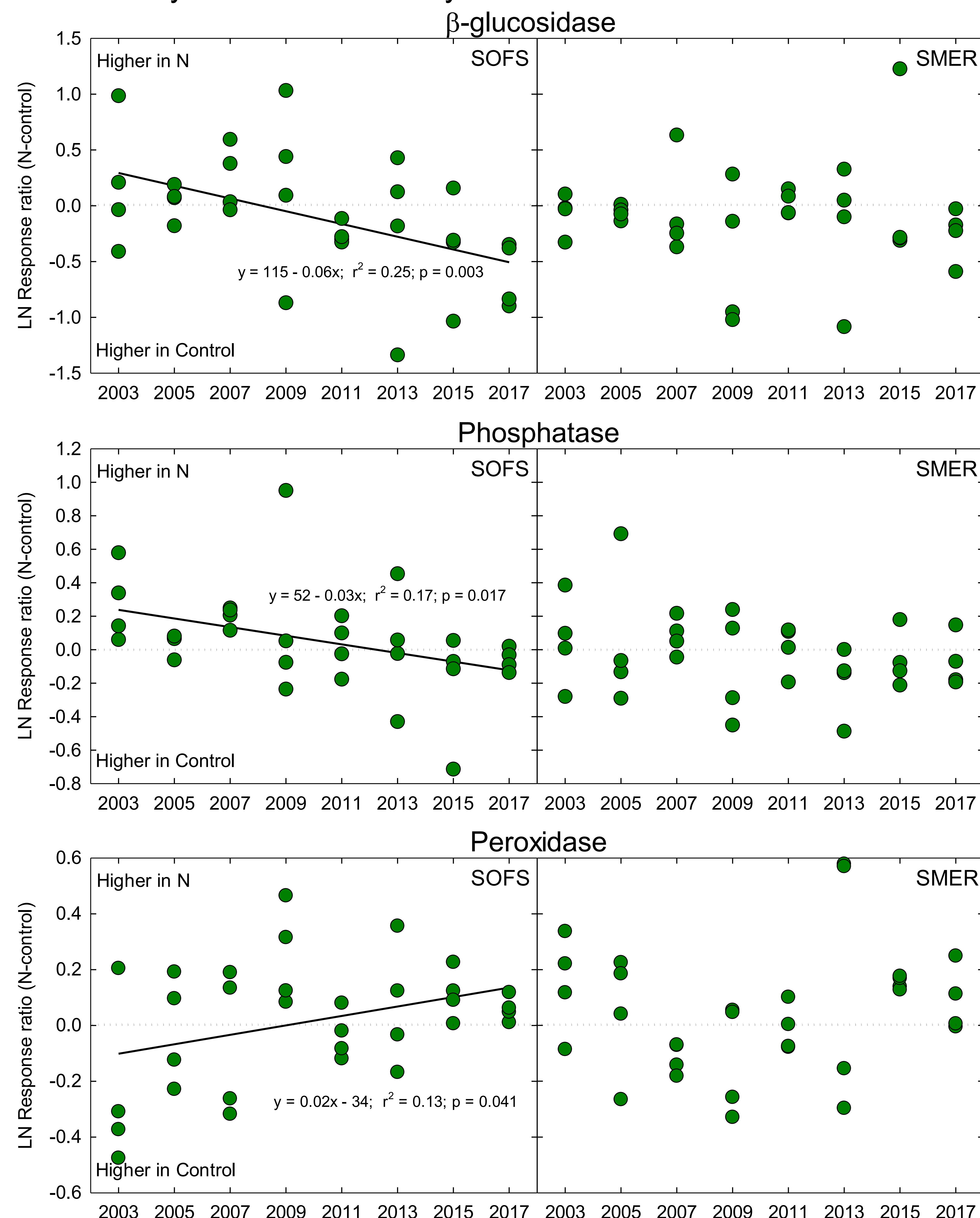


Fig. 5. LN-response ratio of soil β -glucosidase (top), phosphatase (middle) and peroxidase (bottom) activity at the Sky Oaks Field Station (SOFS) and the Santa Margarita Ecological Reserve (SMER). The LN-response ratio was calculated as LN(N) – LN(Control). Positive values indicate higher activity in added N plots while negative values indicate higher activity in control plots.

Conclusions

- We found that added N stimulated peroxidase activity but inhibited β -glucosidase and phosphatase activity over time for SOFS, which is contrary to other experiments in deciduous forest (Carreiro et al. 2000; Keeler et al. 2009).
- Decomposition and enzyme activity are affected by organic matter quality (Knorr et al. 2005). Decomposition of more recalcitrant organic matter (SOFS) may be inhibited by N while more labile litter (SMER) may not be affected by added N.

Acknowledgements