

Needles in a Haystack: Identifying Thresholds in Annual Grass-Dominated Rangelands



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Introduction

- Cheatgrass (*Bromus tectorum*) is an invasive winter annual grass that is widely distributed throughout most of the western United States and has many negative impacts on vegetation communities (Whisenant 1990).
- Identification of ecological and economic thresholds within annual grass-invaded systems is a primary challenge for land managers.
- Thresholds are still somewhat ill-defined, therefore an increased understanding of where these thresholds exist is crucial for making well-informed annual grass management decisions at a landscape scale.

Objective & Methods

- Determine if there is a direct, predictable relationship between pre-treatment vegetation condition and post-treatment increases in perennial grass biomass and other vegetation characteristics.

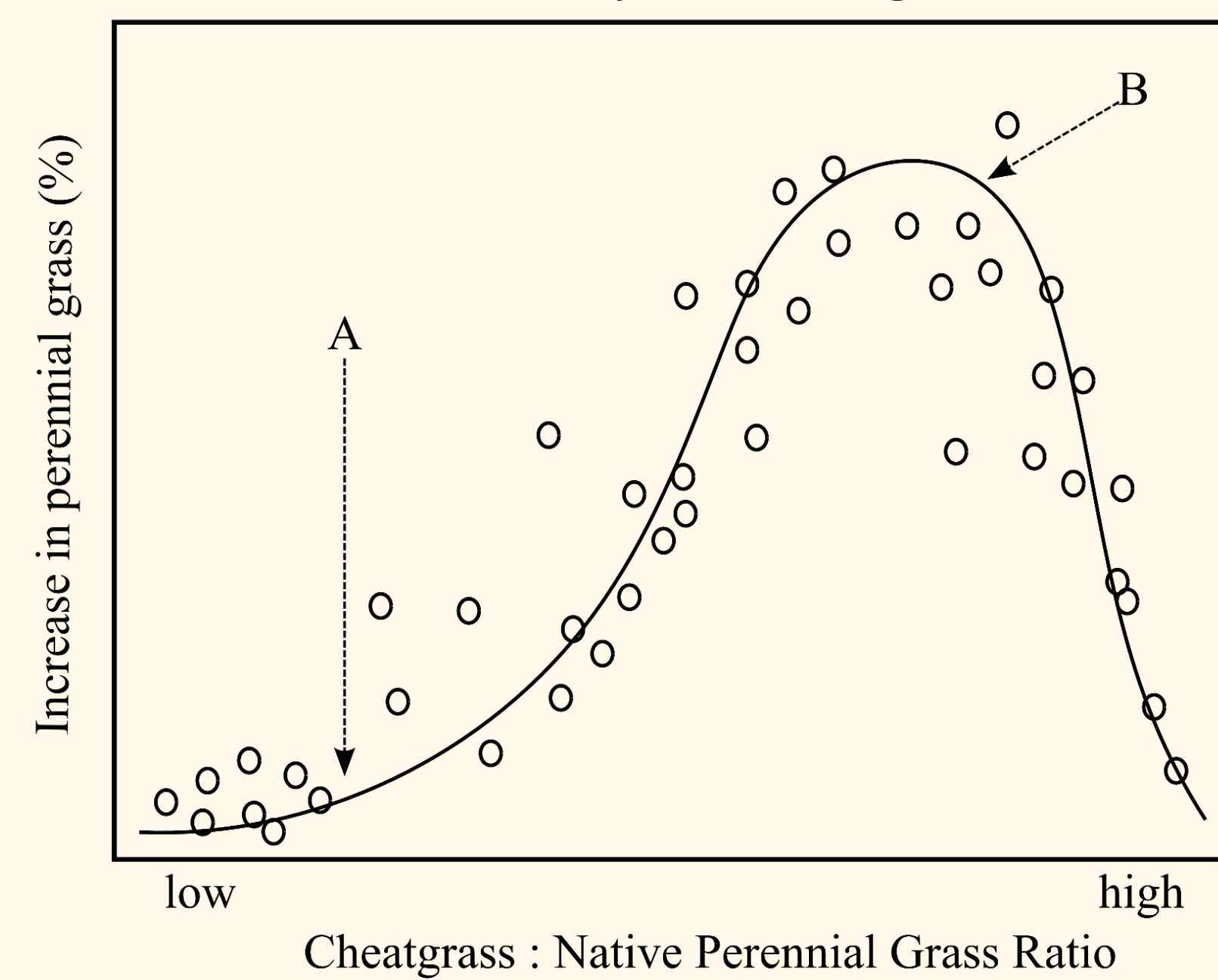


Figure 1. Hypothesized relationship between cheatgrass : native perennial grass ratio and post-treatment increase in perennial grass. Points A and B represent thresholds that may exist within cheatgrass-invaded rangelands.

Timeline

Pre-Treatment Data Collection:

- Saratoga and Pinedale – June 2015
- Hyattville and Sheridan – June 2016

Aerial Herbicide Applications:

- Saratoga and Pinedale – September 2015
- Hyattville and Sheridan - Fall 2016

Post-Treatment Data Collection:

- Saratoga and Pinedale – June 2016, 2017
- Hyattville and Sheridan – June 2017

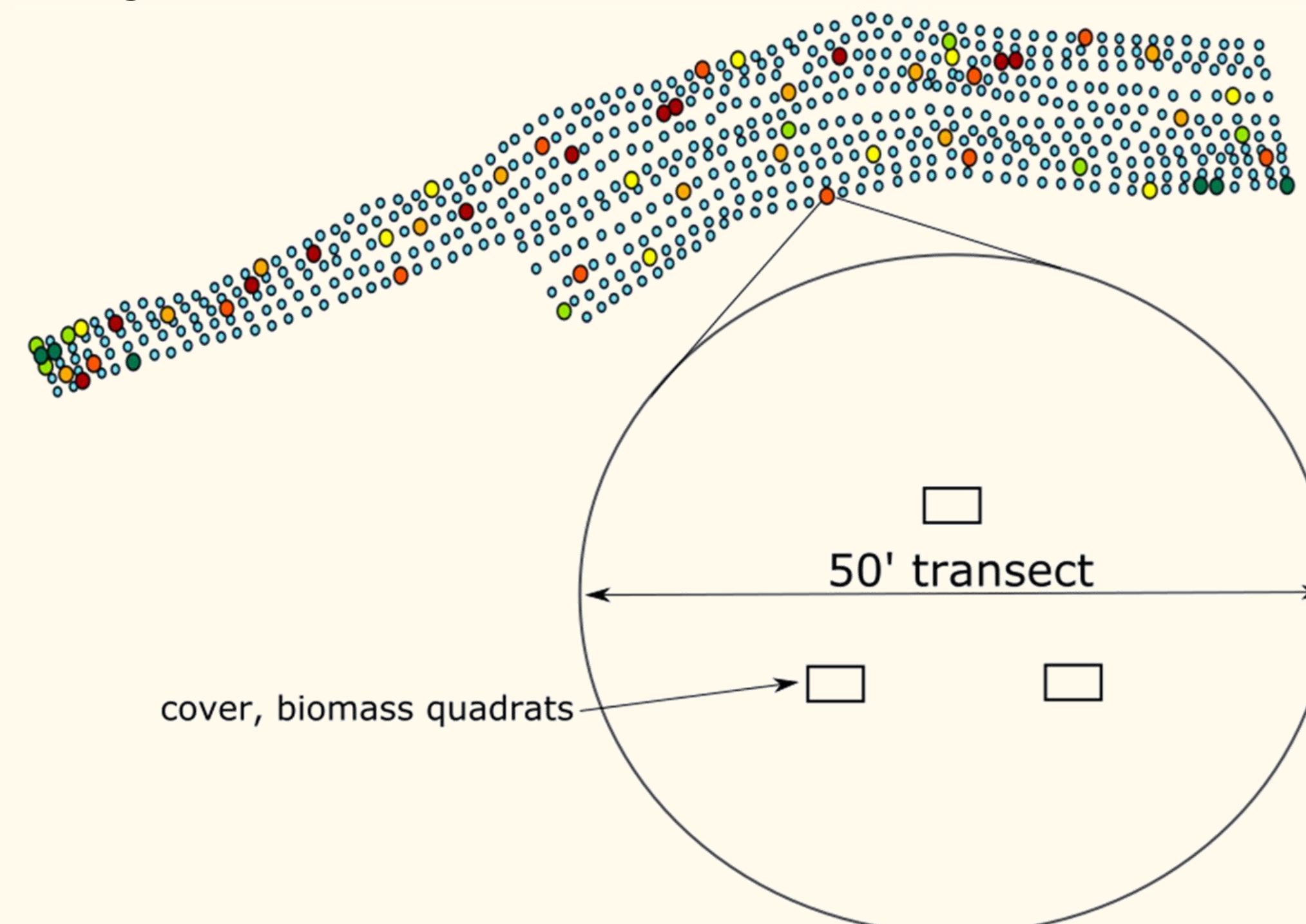


Figure 2. Intensive sampling methods.

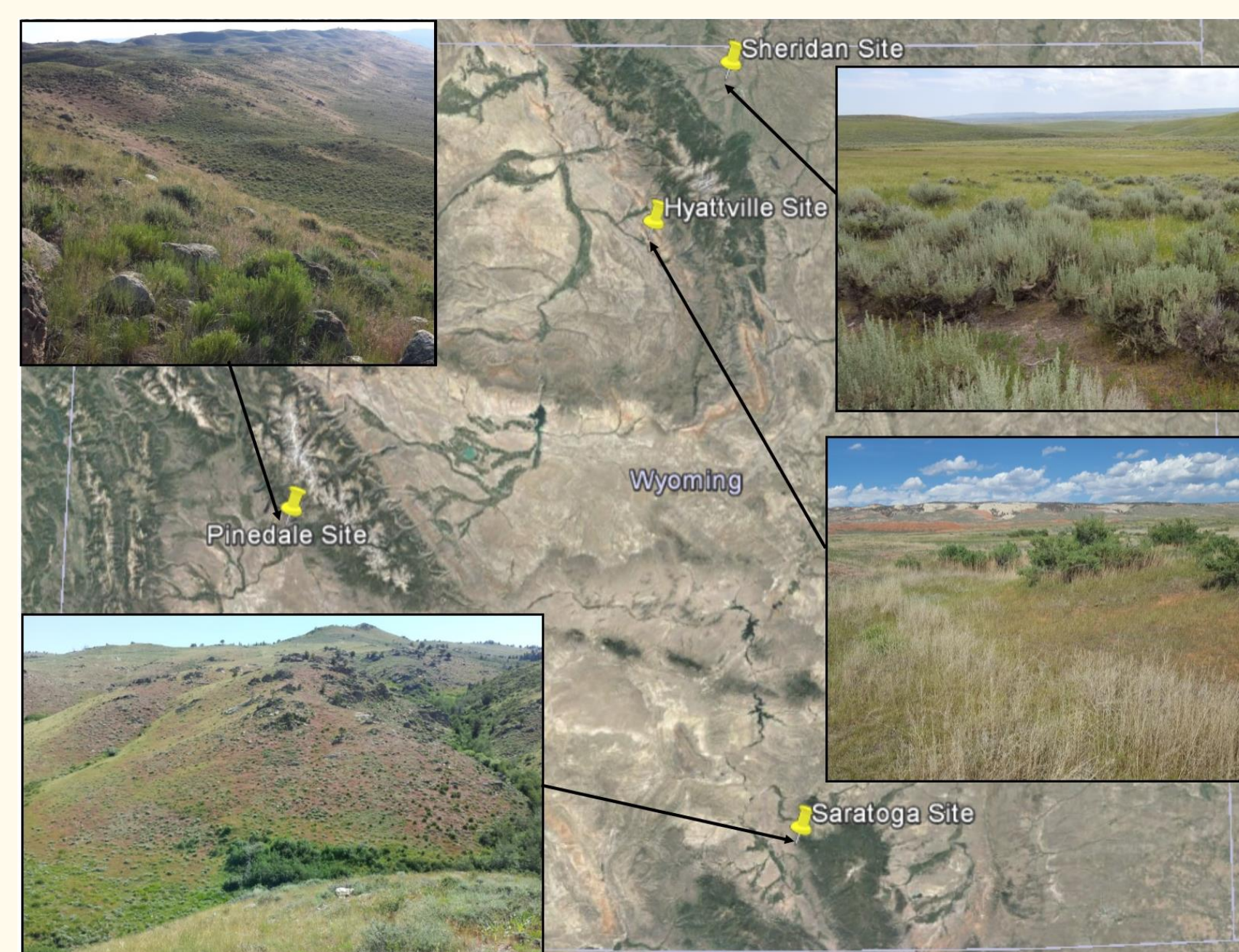


Figure 3. Study sites with general view photos of each.

- Aerial herbicide applications occurred in September 2015 and August 2016 using rates of Plateau ($123 \text{ g ai} \cdot \text{ha}^{-1}$) and Open Range G ($135 \text{ g ai} \cdot \text{ha}^{-1}$).
- We calculated change in cheatgrass and perennial grass (cover and biomass) by subtracting pre-treatment values from post-treatment values.
- We analyzed biomass and cover change data by comparing interactive (ANCOVA), non-interactive linear (simple) regression models, and LOESS curve fitting in R statistical software.

Acknowledgements

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Literature Cited

Whisenant, S.G. 1990. Postfire population dynamics of *Bromus japonicus*. *American Midland Naturalist* 123:301-308. • R Core Team (2014). R: A language and environment for statistical computing. R Foundation for Statistical Computing, Vienna, Austria. URL <http://www.R-project.org/>.

Results and Discussion

- Pre-treatment cheatgrass cover across treatment areas was highly variable with higher cheatgrass cover typically occurring on south facing slopes (Figures 4-6).
- Visual reductions in cheatgrass cover were observed in post-treatment mapping data collected in 2016 and 2017 at Saratoga and Pinedale (Figures 4-5).

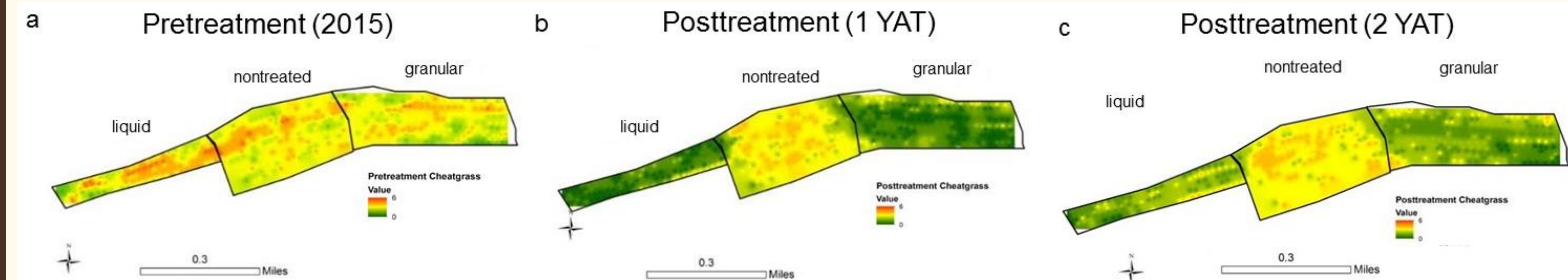


Figure 4. Pinedale cheatgrass cover pretreatment (a), one year after treatment (b), and two years after treatment (c).

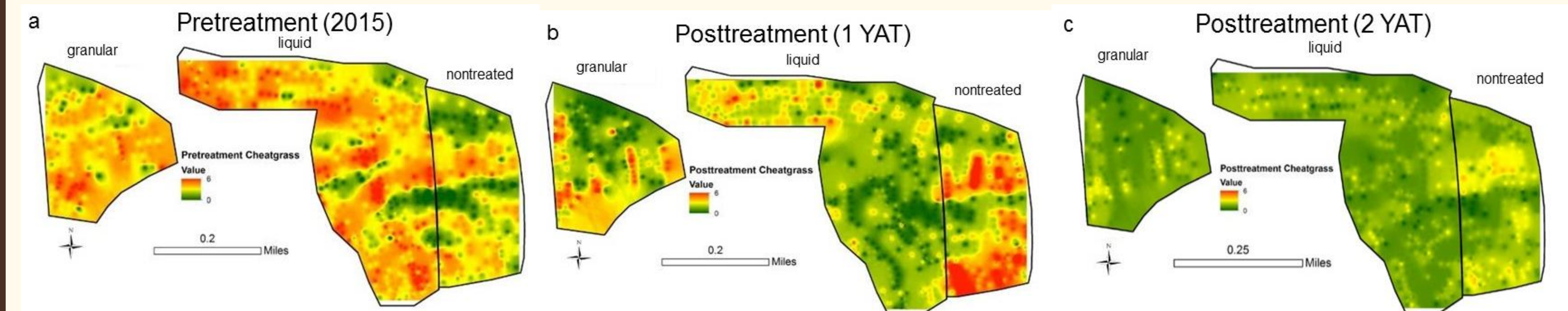


Figure 5. Saratoga cheatgrass cover pretreatment (a), one year after treatment (b), and two years after treatment (c).

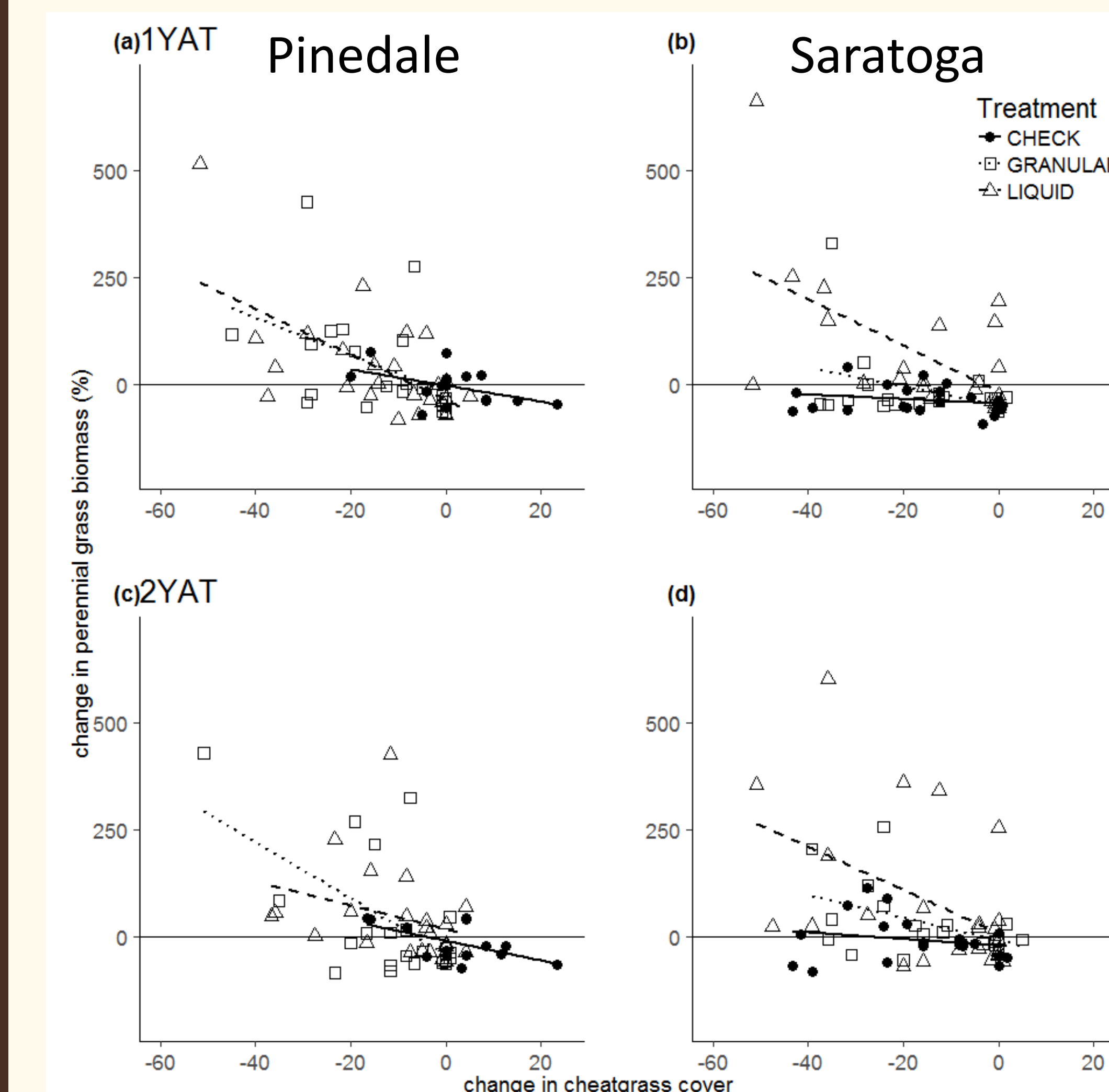


Figure 6. Percent change in perennial grass biomass in relation to change in cheatgrass cover one and two years after treatment at Pinedale and Saratoga.

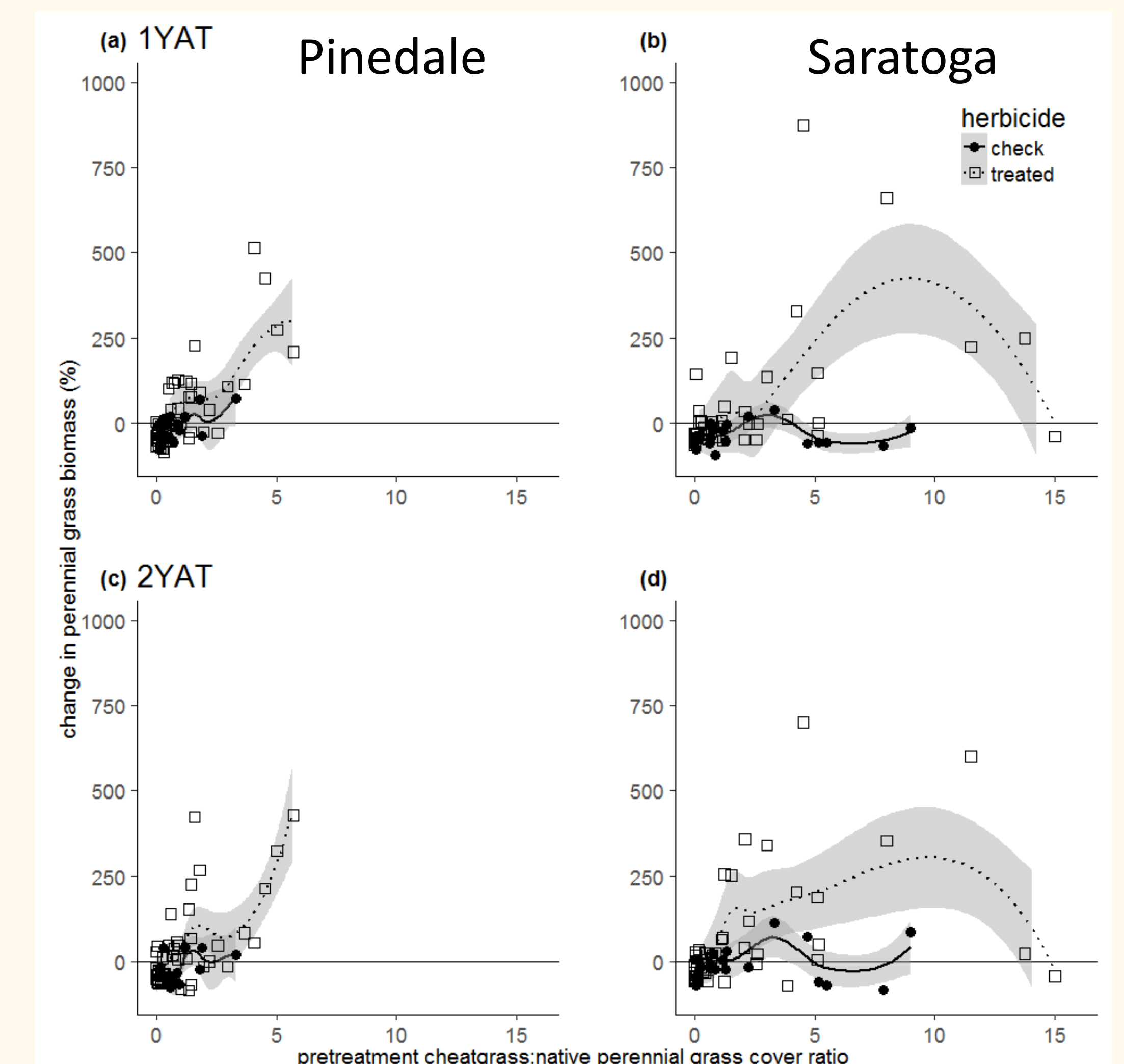


Figure 7. LOESS analysis of percent change in perennial grass biomass relative to pretreatment cheatgrass: native perennial grass cover ratio one and two years after treatment at Pinedale and Saratoga.

- Perennial grass biomass increased more where cheatgrass cover reductions greater as a result of both herbicide formulations at Pinedale (a, c), but at Saratoga the liquid formulation provided the greatest perennial grass biomass increases (b, d) (Figure 6).
- Threshold values become apparent at Saratoga, with a 3:1 ratio representing a threshold where management will likely result in increases in perennial grasses, and a ratio of 10:1 indicating where additional increases may not be realized (Figure 7).