Quantifying a Novel Method of Grassland Restoration Using the Plug and Spread Treatment in a Shortgrass Prairie System in Northern New Mexico

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Abstract

North American shortgrass prairies have declined up to 85% . In the southwest, climate change analysts predicts extended drought, seasonally unpredictable monsoons, and intense brief storms (Knapp, et al., 2002). This may exacerbate declines of these prairies. The Plug and Spread treatment is a novel approach to restore grasslands by utilizing seasonal runoff that increases surface hydrologic connectivity disrupted by human activities on the landscape (Zeedyk, 2016). This study quantifies vegetative response to re-connected surface hydrology. Using three earthen plugs in two study sites, paired with grade control rock structures, formerly channelized gully runoff is re-distributed back to the grasslands. The plugs also stem erosion, pond surface water, and redistributes sheet flows in controlled velocities. We use percent cover, biomass and species richness and diversity to measure vegetative recovery, and measure soil infiltration to quantify changes in hydrologic connectivity. Pre- and post-treatment and seasonal changes with annual monsoon events will elucidate vegetation changes across various spatiotemporal scales. Plug and Spread treatment may increase grassland resilience in systems facing climate change challenges.

Goals

- Restore lost ecological processes by providing connected surface water availability on the landscape
- Increase grassland habitat by:
  - Increasing habitat resources for flora and fauna
  - Decreasing soil loss and erosion
- Quantify the effects of the treatment by comparing pre- and post-restoration response variables, including:
  - Plant abundance, structure, biomass, cover and composition
  - Soil moisture and infiltration

Research Questions

- How does the Plug and Spread treatment affect hydrologic connectivity in shortgrass prairies in northern New Mexico?
- What are the effects of this treatment across different spatiotemporal scales?

Study Area

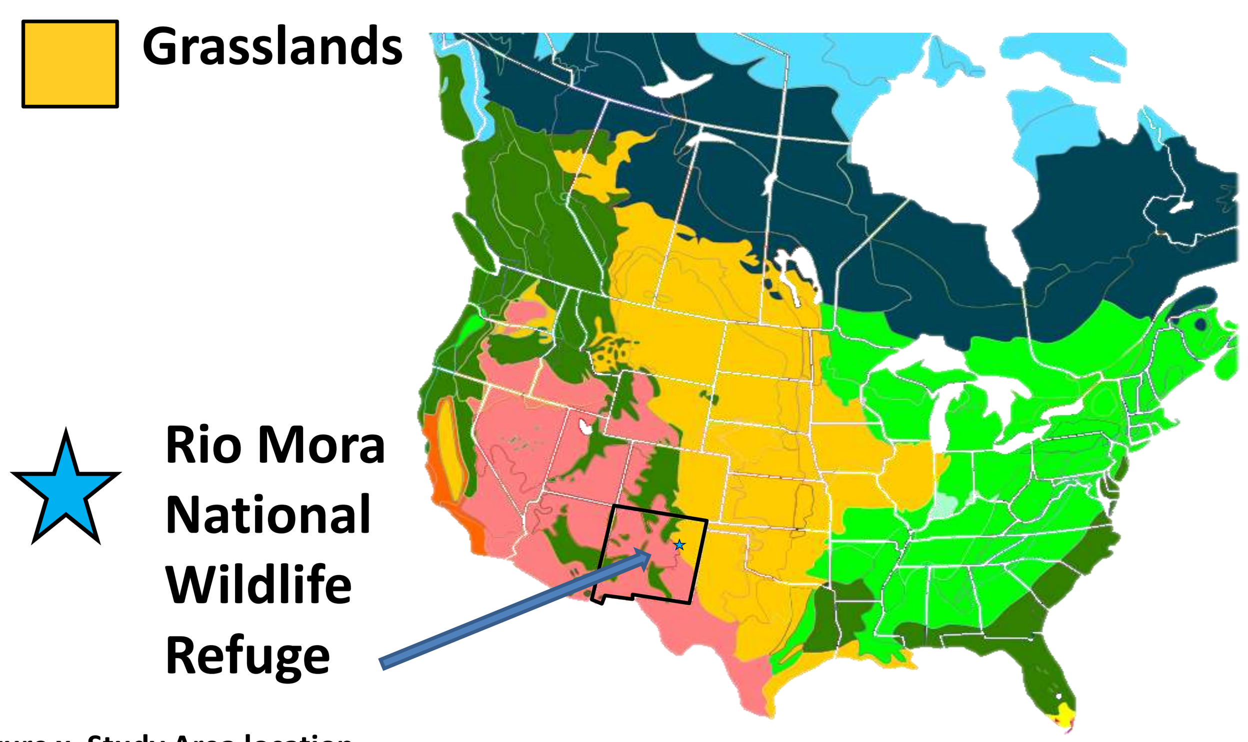

Figure x. Study Area location

Loss of Grassland Function

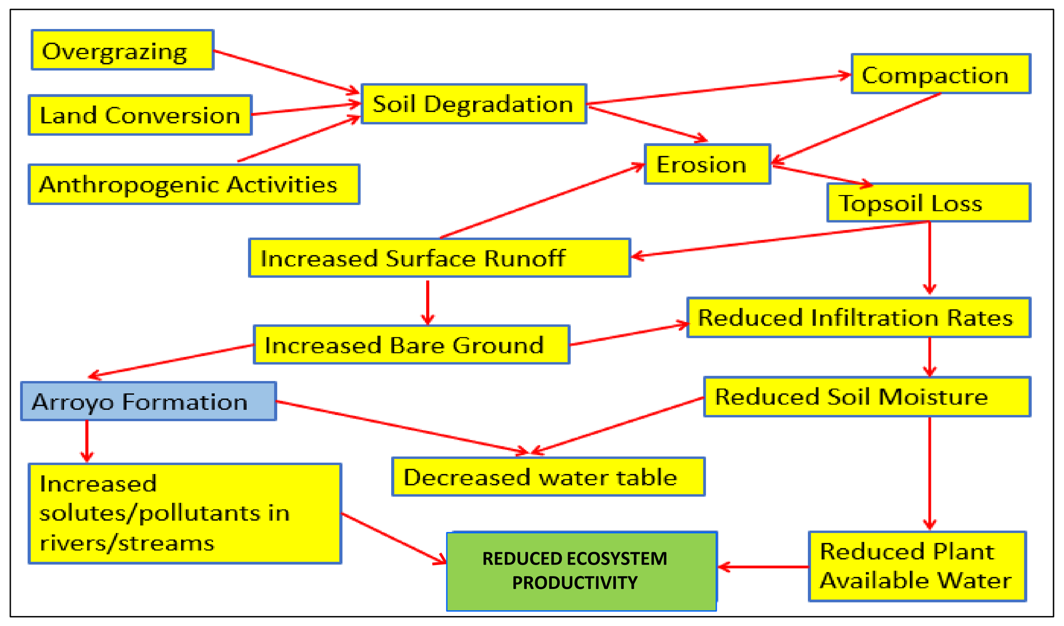

Figure 2. Conceptual framework detailing loss of grassland function

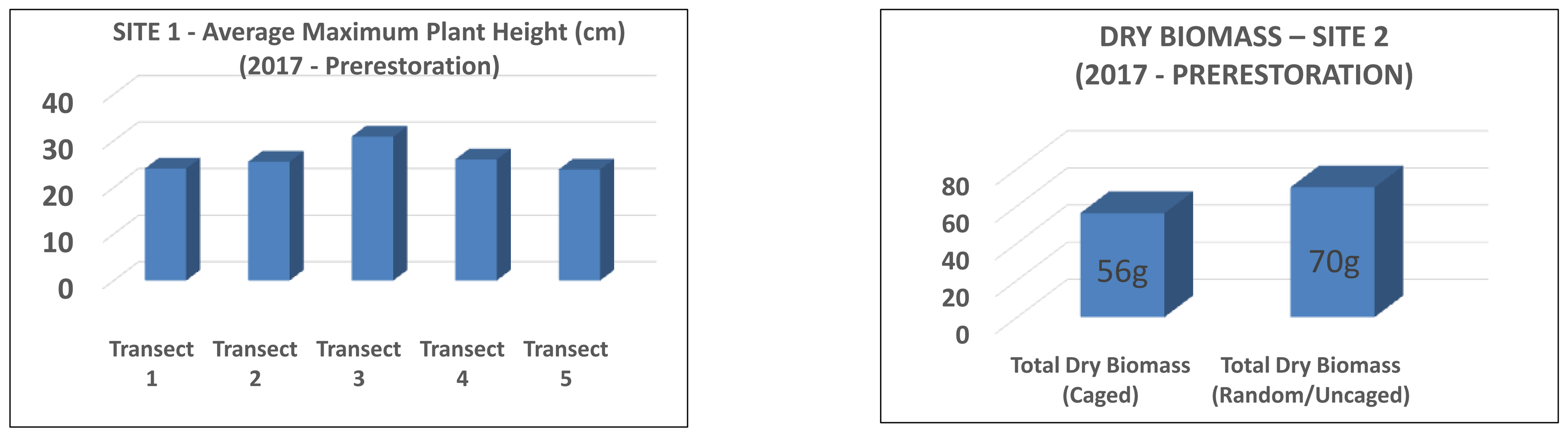

Figure 3. Vegetation preliminary results

Study Sites

Figure 4a. Study site 1

Figure 4b. Study site 2

Treatment

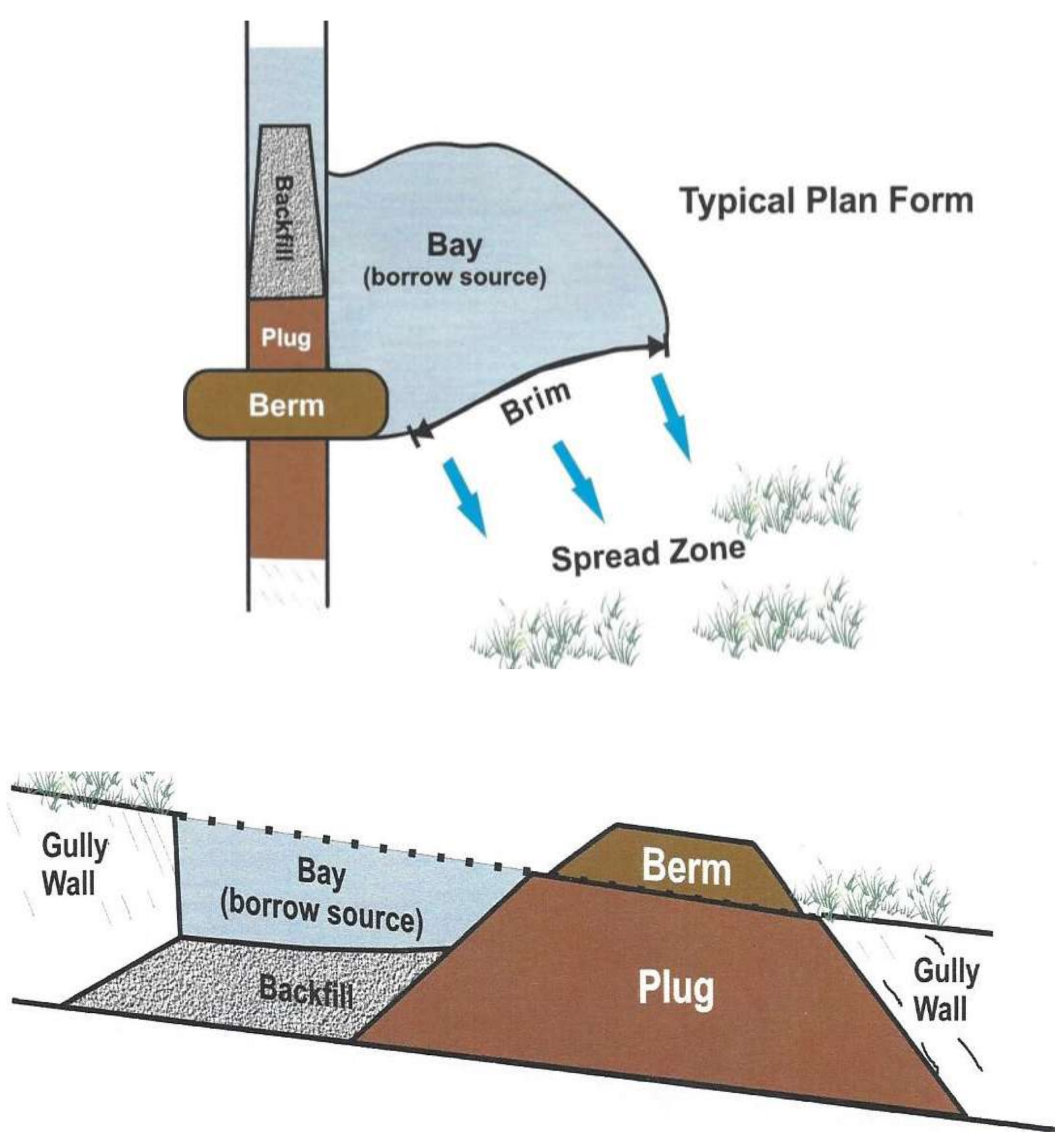

Figure 5. Restoration treatment in the Study Area based on the Plug and Spread Treatment by Bill Zeedyk

Methods

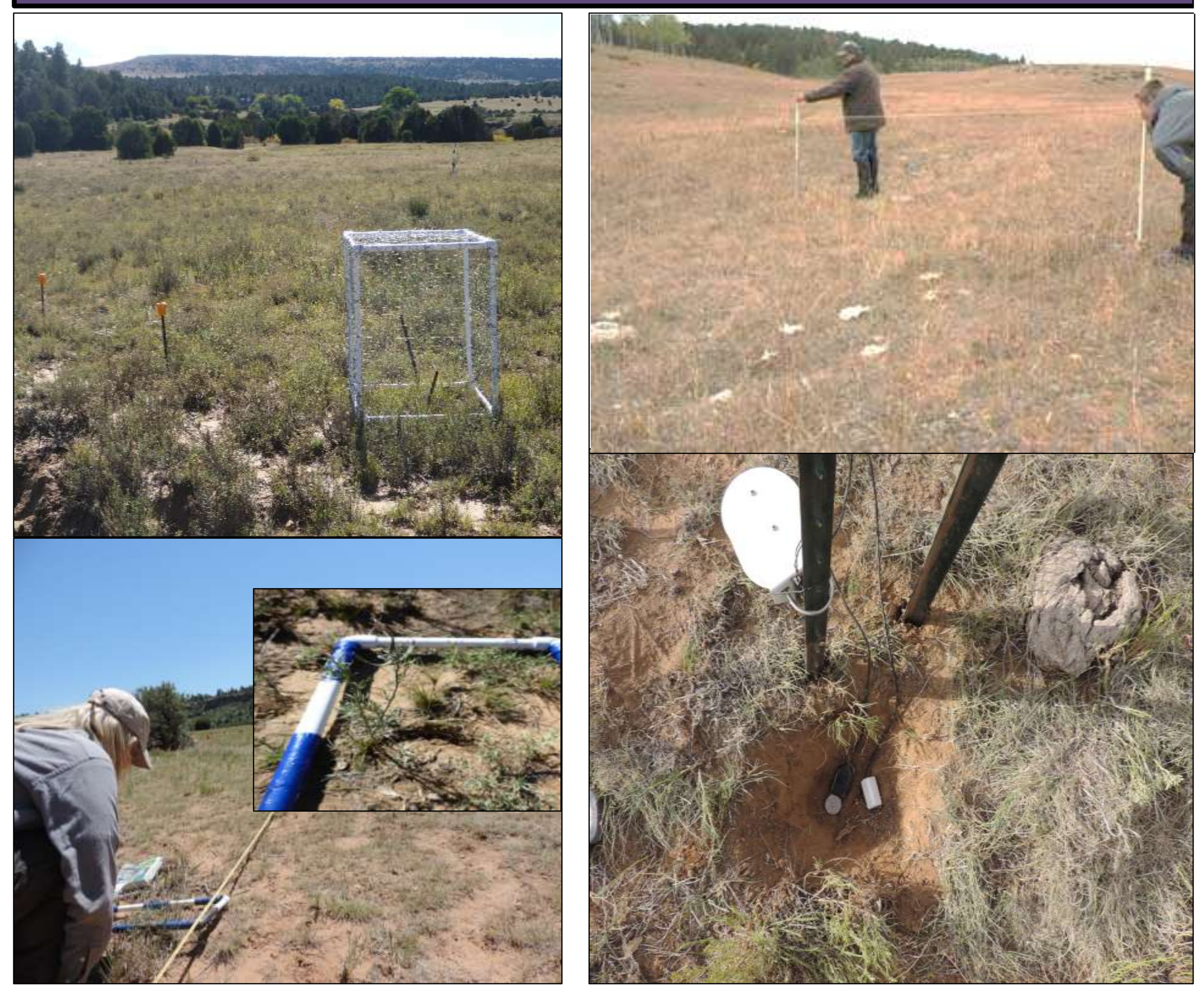

Figure 6. Pictures of sampling design in the study sites

Expected Results

- Cover will increase and bare ground will decrease
- Biomass and overall plant composition in treated sites should increase
- Xeric-adapted plants such as broom snakeweed (e.g. *Gutierrezia sarothrae*) will decline, and dominant grasses such as blue grama (e.g. *Bouteloua gracilis*) will increase
- Vegetation structure will increase
- Vegetative response and soil infiltration rates will be heterogenous according to the distance from the treatment bay
- Plant abundance within arroyos, will increase and plant communities may transition to become more mesic-adaptive

Justification For This Study

- Plug and Spread may be an effective tool for land managers to increase grassland productivity in degraded sites impacted by anthropogenic activities and stressed by climate change
- This treatment focuses on rehabilitating disrupted ecological process limits further degradation es. Re-establishing surface hydrologic connectivity and restore ecosystem function for long-term resilience

References

Zeedyk B., (2016) the Plug and Spread Treatment: Achieving Erosion Control, Soil Health and Biological Diversity. The Quivira Coalition, Santa Fe, New Mexico : 31pp

Knapp A.k., Fay P.A., Blair J.M., Collins S.L., Smith M.D., Carlisle J.D., Harper C.W., Danner B.T., Lett M.S., McCarron J.k. (2002) Rain Variability, Carbon Cycling, and Plant Species Diversity in a Mesic Grassland. Dec 13;298(5601):2202-2205 pp

Acknowledgments

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