

Interactive comment on “Soil nitrogen response to shrub encroachment in a degrading semiarid grassland” by Thomas Turpin-Jelfs et al.

Anonymous Referee #2

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This paper is an effort to address the impact of increased woody plant abundance on soil properties in an arid/semiarid grassland region in the southwestern USA. Woody encroachment is a significant land cover change occurring in grasslands, savannas, woodlands, deserts, and other ecosystem types around the world. The paper is logically written, well organized, and the discussion and conclusions are consistent with the results provided.

General Comment:

The appeal of this paper could be broadened by incorporating more literature addressing these ecological phenomena in other biogeographic regions beyond the desert southwest. For example, there is a rich literature documenting woody encroachment impacts on soil properties and processes throughout the North American Great Plains

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region from Texas, Oklahoma, Kansas, and northwards into the Dakotas. In addition, there are many comparable studies that have been based on work in South Africa, Australia, and the Mediterranean region. This paper tends to focus on work that has been conducted in the desert grasslands of the American southwest, which risks limiting the potential to appeal to a broader audience.

Specific Comments:

Page 2, Lines 12-13: This sentence is not a particularly new or novel result. It would be good to summarize and synthesize your findings in a way that adds something new to what we already know about the effects of shrub encroachment on N cycling in drylands. There are dozens of publications documenting the influence of this vegetation change on the N cycle.

Page 3, Lines 26-31: I appreciate that the objectives are presented clearly. Are there some hypotheses that could be offered to enhance the objectives?

Page 3, Lines 32-33: This sentence should be moved into the Study Site Description section.

Page 3, Lines 33-35: This sentence isn't necessary to your story.

Page 5, Lines 10-11: It would be good to provide a bit more information on the soils across the study areas. Is the taxonomy (i.e. order, series) identical across all of the sites? This information should be obtainable from USDA/NRCS soil surveys for this area. Perhaps soil order and soil series information could be added to Table 1.

Page 7, Line 18: Since ammonium and nitrate are ions, you should show their charges when you abbreviate their chemical formulae (i.e., $\text{NH}_4^+\text{-N}$ and $\text{NO}_3^-\text{-N}$). This should be corrected throughout the manuscript.

Page 13, Line 9: These C/N ratios for soils seem remarkably low. Although there may be exceptions, C/N ratios in arid and semiarid soils seem to be generally around 10-12. I'm wondering if your very low values are a consequence of the way that soil was pre-

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pared for measurement of organic C concentrations. On page 6 line 13, you indicate that all visible organic matter was removed from the sample using forceps. However, the traditional and more conventional way to prepare soils for organic carbon measurement is to pass the soil through a 2 mm screen and only remove the organic matter that remains on that 2 mm screen. By going after all visible organic fragments with forceps, you've almost certainly removed organic fragments that would have passed through the 2 mm screen and contributed to the size of the soil organic carbon pool as we traditionally measure it. This has probably led you to obtain artificially low soil organic carbon values, yielding the very low C/N ratios reported in this paper. Many of the visible organic fragments you removed likely would have passed the 2 mm screen, and these fragments likely had C/N ratios similar to plant tissue.

Page 15, Line 4: Another good paper to include with your citations on this line would be Schlesinger et al. 1990 (Science 247: 1043-1048). This is among the first papers to recognize and emphasize that woody invasion results in increased spatial heterogeneity of key soil properties.

Page 16, Lines 6-19. As another very relevant point of comparison for your work, see Creamer et al. 2016 (J. Geophys. Res. Biogeosci. 121: 1675–1688, doi:10.1002/2016JG003347). This study also examined woody plant encroachment into a formerly grass dominated region, and quantified changes in microbial community composition using PLFA analyses. This study also found that the fungi were a bit less responsive to woody encroachment compared to the bacteria.

Page 17, Line 17: Perhaps specify if this value for N deposition is total N, wet deposition only, or dry deposition only. Also, it might be good to check to see if your value derived from a 2006 paper is still valid at the present time. Excellent maps of N deposition values (total, wet, dry) are provided for the past several decades in the USA by the National Atmospheric Deposition Program through the web site <https://nadp.slh.wisc.edu/>

Page 17, Lines 28-29. The phrase “preferentially selects the development of” makes

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this phenomenon seem conscious and deliberate. To avoid this, replace that phrase with the word “modifies”.

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