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Interactive comment on "Degradation of net primary production in a semi-arid rangeland" *by* H. Jackson and S. D. Prince

Anonymous Referee #2

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General comments

Overall I found that the manuscript accomplished its stated objectives using a novel approach to address the main limitation of LNS, was for the most part clearly written, and stands to make a contribution both conceptually in understanding the prevalence and rates of degradation, as well as methodologically through improving remotely sensed rangeland monitoring, areas of research in much need of advancement. In order of importance, I particularly welcome the use of shifting annual reference NPP pixels to demonstrably improve LCC classification (although the reliability of some reference sites might be questioned), the attempt to evaluate LCC classification using independently-derived datasets measuring elements of land potential, and the generally pragmatic, conservative decisions made at several steps that improve the robustness of the analysis. This being said, I do think the manuscript could be stronger in

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Discussion paper

several respects. Some assumptions are unaddressed or under-stated, the precipitation gradient in the region was not well utilized, and the organization and presentation of results could be much clearer, especially the tables.

Specific comments

“The method is limited spatially only by the capacity to classify the land,” (page 1, line 24): I’m not sure exactly what this means, but I doubt it’s true. A key assumption of the analysis is the accuracy of MODIS NPP in the study area. In tropical grasslands both dry and wet, this data can be unreliable for different reasons. In fact, it could explain why weak NPP and degradation gradients were observed. If there are relevant assessments for the region, cite them. If not, best to evaluate the MODIS data to the extent feasible, or use more than one method for NPP.

Another assumption is that use of foliage projective cover (FPC) in defining LCCs did not unduly alter the analysis and conclusions. The soil and weather data are arguably independent of degradation, vegetation condition is not. While I understand the logic in using FPC, and it is not necessarily problematic, I’d prefer a mention of what factors the classification was robust to when included (or not), and a correlation matrix of factors used for LCC classification at minimum.

The manuscript missed an opportunity to use the (large) rainfall gradient in the region productively. Analyses were presented and interpreted at river basin scales, which to me is not the natural unit of aggregation for analysis in this case (as hydrology is not the primary focus). I would have preferred to see, for example, mean precipitation isohyets delineated at increments from the coast, and degradation trends analyzed specifically within and between these areas. Addressing rainfall explicitly would have greatly increased the amount of information produced by the analysis.

With regard to the manuscript’s presentation, most importantly, some numbers do not appear to add up, and their derivation must be checked and clarified. Table 2 gives -1.71 (non-degraded) and -3.90 (degraded) MgCm-2yr-1 as the average LNS values

for these 2 degradation classes, which firstly form the basis for the whopping “2.14 MgCm-2yr-1” typo (hopefully) in the abstract, text, and Table 2. Secondly, Tables 5 and 4 respectively provide -97.5 (non-degraded) -209.1 (degraded) gCm-2yr-1 as apparently the same values. If river basins must be used to organize the tables, they would be more effective if reorganized. Cutting down the table text and combining tables to align figures on degraded area, trend categories, and/or degradation classes would present the results much more clearly. Finally, including the reference NPP, rainfall, or some other indicator of overall productivity potential would make the reported values more meaningful. Alternatively, summarize such relevant statistics by basin in an appendix. Finally, it would have been nice to see a map with degradation class-by-trend combinations, to show where is degraded, where is being degraded, and where is recovering. Finally, some tables and figures should be shifted to supplementary materials.

Technical corrections

Page 4, line 27: GLMLCC is static, not dynamic as in the UMDLCC approach here Page 5, line 18: “soil erodibility” was apparently not used Page 5, line 34: missing end parenthesis; what is a “distributary”? Page 7, line 5: “accounts,” not “allows” Page 8, lines 3-4: as compared to a reference mean of . . . what? Page 8, lines 9-10: reword; typos Page 8, lines 14-16: “had”? Page 8, line 21: “smaller”? I think you mean “lower” Page 9, lines 4-10: Does not match the figure legend. Page 10, line 11: “were occurred in”? Page 10, line 18-24: naturally ‘bare’ ground is undergoing degradation? Page 10, line 33-36: reword Page 12, line 12: Table 2, not Table 1 Page 12, lines 4-20: These numbers do not match the tables. Also, permanent degradation cannot be inferred here. Page 12, line 29: “strong” correlation? What is the evidence? Page 32: Clarify that points are years, not LCCs or something else Page 34: Figure 3. . .? Page 35: Figure 4. . .?

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