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Interactive comment on "Comparing Stability in Random Forest Models to Map Northern Great Plains Plant Communities Using 2015 and 2016 Pleiades Imagery" *by* Jameson Brennan et al.

Anonymous Referee #1

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Overview

This manuscript describes how vegetation groups switch between years based on random forest classification models utilizing remote sensing imagery. The authors demonstrate how to produce highly accurate images with purely spectrally based predictors, and also quantify the variability in their vegetation groups between years. Understanding these shifts is an important undertaking for ecology and remote sensing, however there are several factors that lead to confusion in the interpretation of the results. In addition, the application of Random Forests is limited compared to what is set out in the intro, and when coupled with what seem like arbitrary (or unexplained) decisions

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in the approach, I feel their objectives have not been fully met. Specifically the confusion between community types and functional groups needs to be addressed in the manuscript through defining terms, and clarifying the difference between community changes and production differences of functional groups between years. For the assessment of random forests, there is opportunity to develop the analysis much deeper. There are unanswered questions that could be explored with RF models. For example, what number of trees are needed for the model to stabilize, how does the months of imagery (what if I have two instead of five each year) change the classification, why separate models for on and off prairie dog towns (when transitions between these and the three off town types may be important), etc.

Specific Comments

Line 44 – Awkward sentence, and if I understand this correctly, then I disagree. I actually am not surprised by changes in species dominance between years. Composition may stay the same, but representation can change depending on growing season conditions.

Line 48 – Vegetation classification can be done at many scales in multiple vegetation hierarchies, you need to be much more specific here (and throughout) about what you are looking at and where in a vegetation hierarchy your results are relevant.

Line 55 – Very broad and general and probably needs a citation. Take a look at (Browning, D. M., A. Rango, J. W. Karl, C. M. Laney, E. R. Vivoni, and C. E. Tweedie. 2015. Emerging technological and cultural shifts advancing drylands research and management. Frontiers in Ecology and the Environment 13:52-60) to think about how remote sensing fits into monitoring and assessment for rangelands.

Line 90 – You are not exploring “plant and animal interactions” in this paper, although this is the aim of your larger project. This is out of place and confusing. In addition, “plant and animal interactions” is vague, I started thinking about a wealth of LIDAR and similar studies used to create thematic vegetation maps for animal habitat studies. Do

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you mean there is limited studies on animal space use across vegetation communities?

Line 101 –Three examples don't prove that RF is better in all situations. And as written, it seems like you cite one study that actually compares RF with other techniques, and this used Landsat, very different than your study. Nothing majorly wrong here, you just need to introduce applications of RF to vegetation classification problems as one useful technique.

Line 114 – Probably this illustrates a limitation in predictor variables, rather than Random Forests. The tool can work at broad scales if the data and processing power is available. See Jones, M. O., B. W. Allred, D. E. Naugle, J. D. Maestas, P. Donnelly, L. J. Metz, J. Karl, R. Smith, B. Bestelmeyer, C. Boyd, J. D. Kerby, and J. D. McIver. 2018. Innovation in rangeland monitoring: annual, 30 m, plant functional type percent cover maps for U.S. rangelands, 1984-2017. Ecosphere 9.

Line 120 – Plant community classification (used here and throughout) can be conducted on many different levels of vegetation hierarchies (like the USNVC). Or you can ask other questions, like changes in productivity between years. Community type generally shifts when a system crosses a threshold from disturbance/stressors, through succession, etc. You need to define much better in this manuscript what you mean, and what you are looking at in regards to, for example, plant community classification vs. plant community species or productivity. A single Landsat image may work very well for some purposes, but for the more detailed questions like yours, multiple images may be required (although you did not actually test accuracy differences between the number of images). You seem to be focused more on classification of functional groups rather than a community.

Line 121 – The three references here are specific studies (two over 10 years old), not reviews of plant classification studies. Maybe in the past it was more common to use a single time period, but seems now with increased computing power and the availability of the entire Landsat achieve, etc., it is very common for much more robust and multiple

acquisition studies. Maybe phrase this more to acknowledge this evolution. Line 135 – Again, what is a plant community. Have you really found or are looking that the community changes? Or are you looking at species representation within a community, i.e. functional group dominance and shifts in this between years.

Line 143 – NGP probably too broad for the implications of your study. Be more specific with the MLRA, or mixed grass prairie systems, etc. that you are testing.

Intro – Lots of general and vague statements in here and limited citations supporting broad brush statements. I suggest going through the intro to make it more specific. For example, landscape, local, various etc. scales will mean different things to every reader. Define these or what they are for the studies you cite. Also make sure your statements are supported by citations or explained. For example, line 61 – 65 is not a summation or conclusion of the paragraph, so these new statements should be supported. Finally, you should mention this is part of a larger study looking at cattle use compared to prairie dog prevalence and impact to pastures, but the paragraph starting on line 130 had me confused between what this study was going to do, and what the larger study did.

Line 174 – These sound more like plant functional groups than communities. Nothing wrong with mapping those, but the terminology issues are prevalent and I believe confuse your conclusions. Changes in representation are common between years, changes in community are a different boat.

Line 199 – Why not compare them all together? You need to add rationale for why separating these out beforehand is appropriate. If you want to scale up your study, how will you separate out prairie dog towns at the “landscape” scale (watershed, county, etc.). As another option, I would find this much more compelling if the comparisons and RF models were tested to separate out all five groups. This would be a much more thorough test of RF.

Line 217 – Do you think the wider spectral bands (compared to Landsat or UAV options

available) played into your results at all?

Line 227 – Again, this needs more justification then saying they are mutually exclusive. You either decided to map prairie dog towns separately from the rest of the study area (which you need to justify why) or you could test what the implications are of not having mapped towns in the first place (which also can vary between years).

Line 239 – Why only 100, when the default is higher (which is used for the number of nodes)? You may be ok here, but in many cases, at this point the model error is just beginning to stabilize. You could examine the impact of the number of trees on your model by looking over a range of "number of tree" values.

Line 241 – Why just spectral bands as input into the models? You don't explicitly say your objective is to use just satellite imagery (and prior to the RF algorithm you used other data, e.g. to differentiated prairie dog towns and off site)

Line 246 – How did you apply your models to produce predictions for prairie dog towns vs. off town locations? I think you run the predictions on two separate parts of the study area (be explicit).

Line 262 – The way your "communities" were picked seem to almost guarantee this? You picked areas "dominated" by three (or two) very different functional groups. Is this overlap more than you expected, and what is the overlap? This very much may help explain the differences between years.

Line 287 – Are the models unstable, or does this indicate the models are accurate within years, but species representation (as seen through your methods) changes between years in heterogenous areas?

Line 303 – These peaks seem like they very much may affect the production of warm vs. cool season grasses between the years as well.

Line 304 – Was there a temperature difference between years as well? These curves seem farther apart then I would expect just based on precip

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Line 328 – Is there a transition zone at the edge of the prairie dog towns too?

Line 340 – Based on your discussion so far, what is a more accurate thematic map? Which year is the truth, if the heterogeneous transition zones may switch categories depending on which group dominates in a given year? How about comparing this map to the two yearly maps?

Line 351 – Any limitations in the approach though? How about the lack of coefficients for your variables? I.e. good for prediction, not as good for understanding relationships

Line 353 – Why not include the variable importance for the combined model?

Line 562 – Break this out to be more specific on the changes per year (what was it in 2015 and what is it now in 2016) rather than lumping the switches between types that switch both ways in the two years. If there is a dominant pattern of switch that would be useful for your conclusions.

Line 588 – How are the draws mapped? These are not one of your groups, need to talk about this in the methods.

Technical Corrections

Line 3 – Consider replacing stability, I think this could be confused with other definitions and is not quite what you mean

Line 32 – Replace highly with high

Line 46 – Replace instability with disagreement

Line 66 – Remove colonization and replace dog with dogs

Line 86 – First time you use the acronym NDVI. Write out fully.

Line 98 – Replace several with many (or similar idea)

Line 101 – Replace proven with demonstrated

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Line 109 – There are a lot more RF packages and implementation options now, compared to 2013. Standard software like R, ERDAS Imagine, QGIS, and ArcGIS have RF, as well as more specialized options like Ecognition (and even Google Earth Engine). I don't think you need this sentence, not relevant to the paper.

Line 173 – Need year you accessed the Mesonet data

Line 181 – About how big are these (median, range, etc.)

Line 192 – How were they randomly located?

Line 236 – Did you consider other potential predictors that you could derive from these inputs?

Line 239 – What is the default number of nodes. Define this.

Line 256 – A table of the species for each of the five groups would really help. Would also help understand what "dominated" means for your training sites.

Line 267 – Mishra and Crews should be outside parentheses

Line 310 – What was the 2014 precip then? Dry?

Line 355 – For the town or off-site model?

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