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Interactive comment on "Cyanobacterial species richness and *Nostoc* highly correlated to seasonal N enrichment in the northern Australian savannah" *by* Wendy Williams et al.

Anonymous Referee #3

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The title of the manuscript by Williams et al. and a well-written abstract promise an interesting contribution to understanding the factors (both biotic and abiotic) that control nitrogen fixation in Australian Northern savannahs. However, while I found the topic of great interest, I also found some important weaknesses in the way the data are presented throughout the manuscript and in how the manuscript is structured. For example, in the introduction there a several cases where too general sentences leave the reader thinking what the direction of the paper will be. Unfortunately, that sensation never completely disappeared as the manuscript progressed. P3 L1-2 I don't think that this is a good citation here, as this study deals with lichens and not soil microbial communities. P3 I suggest I merging the last two paragraphs of goals and hypotheses

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and rewrite them for clarity. P4 Please, report coordinates of the study site as part of the site description. P4 L19 Chlorophyll a may or may not be a good indicator of cyanobacterial biomass, but is certainly not well suited in dry environments where scytonemin is typically the most abundant pigment in soil. Therefore, I suggest avoiding the (unnecessary) use of the term biomass and just refer to pigment content, which may be a better reflection of photosynthetically active cyanobacteria. P4 L24. What is the method 4? Please, describe briefly. And the same goes for the ARA in the next line. P4 L26 and P5 L13-15. Please, explain more clearly how you estimated your conversion factor. Then I think it is probably going too far to estimate annual nitrogen fixation rates based on your ARA measurements in the lab. P6 L1-2 This is very poor description of your statistical analyses and the program used. For example, you mention a non-significant interaction in P6 L15-17 but this type of analysis is not described. P7 L3-5 Report isotopic values as delta 15N. P8 L14 Citation about nitrogen fixation in anaerobic environments in Mars does not make sense. P8 L19 5 kg of N per ha is a reasonable estimate but I would suggest stressing the need of considering this number with caution as this is only based on a few measurements in controlled conditions and I am still unconvinced about the conversion factor that you used. P9 L28-30 These conclusions come out of the blue after reading a whole paper about cyanobacterial richness, nitrogen fixation and bioavailable N. You never mentioned anything about land management and rain use efficiency before and thus I think that it would be better to restrict your conclusions to what you have really learnt with this study.

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