

## ***Interactive comment on “Quantifying the relative importance of greenhouse gas emissions from current and future savanna land use change across northern Australia” by M. Bristow et al.***

**Anonymous Referee #1**

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This paper presents very interesting data from flux towers comparing an intact savanna with an adjacent site during a clearing event. Unfortunately the authors do not emphasise the strengths of their work, which is the detailed time series that can compare processes for the two sites. Rather they attempt to extrapolate the results across northern Australia in ways that are not transparent and appear to have a number of flaws.

Page 2 L4: elsewhere you say 30% of Australia. Also (a bit pedantic) the Savannas aren't going to influence national GHG budget, human land use decisions are. L 13: debris were... L 16: see comments in relevant section Page 7, L 5: "...we measured fluxes of...on a single paired site comprising an uncleared savanna and a ..."

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Extrapolating such a study is problematic from a statistical point of view. Please comment. L13: Firstly, the original reference (Hurst et al 96) should be cited, secondly that reference is inappropriate for the application you have put it to. It was a study of a natural savanna, where the fuel was predominantly grass and leaf litter, not woody debris which dominates your cleared site. The values for wood in Meyer et al. 2015 (in Carbon accounting etc by Murphy et al.) would be better, but even here they were not measured under extreme conditions of a raked up cleared site. Page 8 L 7 on. You are restating most of the information in Table 1. This is unnecessary. Further the vegetation description differs from that in the table. Can you include estimated biomass of each site broken into above ground etc? Page 9, L 3: In Table 1, you say that fire frequency is 0.3, but 5 in 13 years is 0.38. Why the difference? Background for CS would be the similar rather than 0? Even during the measurement period the CS was burnt twice albeit both in the same year! L 8: you don't mention first stockpiling in Table 2. Page 12, L 13, again these emission factors are inappropriate for a stockpiled log fire. L 18: you cites two allometric papers. Which did you use? It sounds like Williams et al. Page 13, L8: what did you do with the estimates of missing biomass? It would be inappropriate to take it away from allometric estimates because these were surely done on trees with hollows? It would be inappropriate to add it back in because it could have gone decades ago. L20: A Byram fire intensity value has meaning for combustion of fine fuel, not for logs. L 20/21: Meyer et al 2012 (JGR 117) showed that emission factors were not affected by season of burn within the dry season, so the logic of your argument is invalid. Rather, the bigger difference is between fuel types (Meyer et al 2015). This make your choice of Hurst et al values used by Russell-Smith et al 09 invalid. P14 L2: blew away where? Into the next plot? How far? What proportion? L 14-17: where were these data from to estimate these values? C of A 2015? Page 15 L1-5: It is not clear how you intersected single values for each state/territory with the savanna area. Next paragraph: again, I cannot see how these numbers were derived. It is not at all clear where 78605 ha /yr came from. Page 18, L22: what are the four pools? How is the CWD pool (line 22) different to the AGB of line 21? Page 19 L2:

C2

didn't you measure this? Can you estimate it from your flux data? The burning efficiency values of RS et al 09 are not appropriate to use for a fire that was in raked fuel and burnt for 10 days!!!. Line 21: Most clearing was in the 1980s during the ADMA scheme which failed. In recent years there was a clearing moratorium. It is no wonder values from 1990s are low. Line 23: Including CO2 is not consistent with Australian GHG inventory or with your own conclusions in line 7/8 Page 24. Page 20: L1: I still don't see how this figure was calculated and what components it includes. Line 2: "savanna burning emissions" P22, L 14 on: decades of accumulation? L 21: four decades of accumulation? Are you seriously suggesting a stand replacement event happened c. 1973? Cyclone Tracy did not go that far inland. It is hard to imagine floods killing a stand of E. Tetradonta. Stand killing fire in E tet vegetation are extremely rare unless invaded by African grasses. Was it cleared then? Do you have any evidence? Or is it just a case of slow in fast out cycles and you have just done your measurements during a slow in phases and incorrectly extrapolating it to decadal time scales? Page 24 L5: One page 9, L 5 you say return interval is 3.1 yr or frequency of 0.32. The range you give here is not consistent with that mean value. Line 14/15: I don't see the logic here. In the burning of savannas that remain savannas (ie not cleared), then it is reasonable to assume that the CO2 is taken up by next year's growth. However for a land-clearing event burning with clearing removes substantial carbon from the land and puts it into the atmosphere. This is a loss that needs to be accounted. Not sure what you are trying to say here. Page 25 L3: I just checked the 2013 data on total reportable emissions and LUC emissions and can't see where you got this figure from. It should be much higher. If you read Cook et al. 2010 Rangeland Ecol and Management, you will see that land clearing has been up to 30% of total emissions. Also when reporting % changes it can get confusing with % of what? Might be better using Gg units. References: there are many references (well some), that are cited but not in the ref list. Please check thoroughly.

Table 1: What is the meaning of Blain in soil type (I know, but few others would without a reference). The fire frequency for the CS would be the same as for the UC for the C3

past decades surely? Even during the observation period it had two fires not zero. Also 5 fires in 13 years is 0.38 not 0.3. Can you add above ground (or below ground) biomass or carbon stock? Table 4: For the deforestation area, it appears you have added the expanded Pertheram et al. values to the background values. Firstly is this valid given background clearing may be in same areas identified by P et al. Secondly, I still don't get how you intersected the state inventories with your savanna area. Thirdly, what is the Standard deviation. Is it year to year variation? What is the validity of this value if you have added a constant (P et al /5) to the rate? The emissions from deforestation seem low. In estimating emissions, how were the biomasses across the region estimated? Figure 2: The fonts are far too small to read

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