

Interactive comment on “Seasonal variation in nitrogen pools and $^{15}\text{N}/^{13}\text{C}$ natural abundances in different tissues of grassland plants” by L. Wang and J. K. Schjoerring

Anonymous Referee #1

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This is probably one of the best papers dealing with within-season variation in plant $\delta^{15}\text{N}$ and potential N emissions in grasslands. The authors monthly measure $\delta^{15}\text{N}$ of 5 plant fractions and relate seasonal patterns to fertilization events and climate. These are some important patterns. The seasonal patterns of biomass inorganic N and pH are also important. Ecologically, there really have been few studies of N emissions from vegetation in grasslands. This paper mechanistically analyzes the proximal determinants of NH_3 emissions (NH_3 and pH) and shows how they vary seasonally by different fraction. To see that NH_3 emissions are greatest for senesced leaves is interesting. In most grasslands, I could see people thinking that the senesced leaves are a sink for N due to their higher C:N, but in this improved pasture, it's the opposite. High

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pH and high NH_4 , generate conditions for NH_3 volatilization.

Granted, it is unknown how generalizable the results are. The pastures are fertilized fairly heavily and they are in a relatively cold, wet place. But, these limitations would apply to almost any single-site study. The authors work to relate their results to other studies and contextualize the work as best they can.

One question I would have is whether the absolute values of metrics (like $\delta^{15}\text{N}$ or $\delta^{13}\text{C}$) should be analyzed or the first derivatives (changes in values). Interpretation of some of the ^{15}N patterns are hard because there are multiple causal pathways that cannot be separated. The authors need to go through the paper and make sure that (reasonable) competing hypotheses are acknowledged. For example, when they state that “Peaks in gamma also appeared during the winter, coinciding with increasing $\delta^{15}\text{N}$ values, indicating absorption of N derived from mineralization of soil organic matter” is there really any way to be certain that this is the mechanism? Aren't there competing mechanisms?

Details:

Remove “very” from the text. Either be quantitative, or just state something is high/low.

P12319. L21. Can you define what constitutes events here?

12327 L5. Temperature, not temperate.

Discussion 4.1 first paragraph feels unnecessary. Actually, the whole section can be removed without any detriment to the paper.

In the discussion, could the authors discuss a little the role of tissue C:N in determining source/sink potential for litter. Once decomposition starts, this should be a control on NH_3 concentrations. This would help connect the work with others.

Can the authors state why chlorophyll was measured?

The authors should also discuss Frank and Evans 1997 more. There, they make clear

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statements about NH_3 volatilization and plant $\delta^{15}\text{N}$. are the authors results consistent with their interpretations? That would help others who think about grassland N dynamics.

Interactive comment on Biogeosciences Discuss., 8, 12317, 2011.

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