

## ***Interactive comment on “Comparison of inorganic nitrogen uptake dynamics following snowmelt and at peak biomass in subalpine grasslands” by N. Legay et al.***

**Anonymous Referee #2**

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This paper compares spring N dynamics from 2010 to peak biomass N dynamics from 2005 in the same subarctic alpine tundra plots under two management types. The authors defend their use of different sample years throughout the paper, somewhat successfully, particularly because their field sampling is extensive and covers the two management types. They do use the same methods in both years. I am still uneasy with this comparison, because N dynamics are so very variable inter- and intra-annually. I also have a problem with the literature referenced – there is a lot of mention of freeze-thaw cycles, with no soil temperature records and only hypothetical support in the references that this is a driver of microbial community N dynamics in spring. Finally, I am not clear how monitoring the cycling of inorganic N through the microbial

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biomass is an adequate measure of MBN, when inorganic N is typically such a small and variable proportion of the MBN. My comments are supported by line references and other details below.

p.8889 14-19. The microbial crash in response to air-temperature freeze-thaw cycles has been supported in the lab, but rarely in the field. In the refs provided here, the concept that freeze-thaw cycles drive the thaw microbial biomass collapse is a hypothesis. More recent literature suggests that soil freeze-thaw cycles in the field are dampened, microbes may not be sensitive to these dampened cycles, and that osmotic pressure changes and predation may be the driver of the thaw microbial collapse. 20-22. provide reference

p.8892 4. provide precipitation record for longer time span (at least since 2005) 4-6. What years are the temp records from?

p.8893 25. MB15N is usually based on the total 15N in the fumigated vs non-fumigated. What proportion of the MBN is extractable IN? How is this inorganic N stored in the microbial biomass? Any N that has been immobilized by microbes and incorporated into amino acids over the 48 h incubation period will not be recovered with this method. May explain low MBN uptake (p.8904) in spring if microbes seasonally partition storage and biomass, and especially if microbial community structure changes between these two time periods (or years?).

p.8895 5. 48 h is a long time for measuring gross mineralization and probably resulted in microbial recycling of 15N. Error (underestimate of gross cycling rates as it reduces the soil solution 15N dilution rate, underestimate of MB15N), probably exacerbated by seasonal difference in microbial mineralization vs. immobilization

p.8897 20-24. Repeat of text above (on p.8895).

p.8898 1-2. Difficult to accept – there is so much interannual and intra-annual variability in soil DIN pools.

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p.8900 5-8. It is not clear how the difference between per area and per g MB differs so much, when MB does not differ - is this driven by changes in BD? See also p.8903 (line 16) – driven by changes in microbial density?

p.8901 10-12. this is not inconsistent - those studies found high nutrient pools during snow melt, that crashed at the end of snowmelt. You are measuring after snowmelt, so it is predictable that nutrient pools would be low.

12-17. The references for this 'contradiction' come from different biomes from this study (Arctic, boreal), with the exception of Bardgett 2002 and Brooks 1996, which may explain the discrepancies. Also, there may be a reference contradiction here as the same paper is cited on both sides of the contradiction (Edwards 2006).

24. This recovery rate is not unusual in field injections – what was the recovery rate in 2005?

p.8903 19-27. Studies that measure the microbial biomass at high frequency over thaw show that the microbial crash is during snowmelt, not after, so your spring sampling period is after the microbial community has already stabilized for the growing season.

p.8905 5. smaller DIN pools are less important than the different consumption rates (which explain pool sizes), which should be emphasized here 6. the word 'decrease' here suggests that this sample period was part of a continuous timeline - a bit of a stretch here (also confusing). How about "at the end of snowmelt soil DIN consumption was high and dominated by plant uptake; at peak biomass soil DIN consumption was lower and dominated by microbial immobilization"

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