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Interactive comment on "Wildfire effects on ecosystem nitrogen cycling in a Chinese boreal larch forest, revealed by ^{15}N natural abundance" *by* Weili Liu et al.

Anonymous Referee #1

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This manuscript examined the wildfire effect on nitrogen cycles in a boreal forest in northeastern China using 15N natural abundance. The results showed higher TIN and ammonium concentrations in the mineral soil and higher net mineralization rates in the organic soil in the sites which was burned 4 years ago, compared to the control sites. The N isotopic ratios of organic soil and plant leaves were greater in the burned sites than in the control. The authors propose that the environmental modification caused by wildfire affected the soil N dynamics and ammonium volatilization was the main driver of the N loss, which lead to 15N-enrichment in the burned sites. As the authors describe in Introduction, the increased frequency of wildfire and its consequences on

N cycles are a global environmental issue. I think that this manuscript is concisely well written. However, there are several issues as mentioned below to be addressed before recommendation for publication in Biogeosciences can be made.

General comments: The pattern that 15N values of plant and soil increase after wildfire and return to the pre-fire values has widely been observed in many terrestrial ecosystems (Szpak, 2014). This study provides new data on the isotopic pattern from a boreal forest in China. In this manuscript, the authors conclude that ammonium volatilization is the main driver of the increase of 15N (Line28, Lines 282-284). Although I also think ammonium volatilization is one of possible explanations about the increase of 15N, there seems not enough evidence supporting this conclusion. The authors argued that difference in ammonium and nitrate pools and N mineralization rates between burned and unburned sites could be due to ammonium volatilization. However, the present results were based on only one-time estimation, and thus they seem not convincing enough to suggest the occurrence of greater ammonium volatilization in the burned sites. As the authors discussed, N loss due to nitrate leaching could also have caused the enrichment in soil 15N. Further, greater dependence of plants on deeper soil N, or less dependence on N derived from mycorrhizal fungi in the burned sites might also have increased the 15N. These 15N-enrichment mechanisms appear to be equally plausible at this stage. To explore the enrichment mechanisms, it would be necessary to investigate N budget of the studied forests, 15N values of DIN and TN, root distribution, and infection rates of mycorrhizal fungi in the roots. Unfortunately, however, these data were not presented in this manuscript. As such, the authors would need to modify Discussion section to discuss these explanations more carefully about the increase of 15N.

The discussion about openness of ecosystem N cycle (Line 325) could be made in conjunction with the earlier paragraphs about ammonium volatilization and nitrate leaching, because these two processes are the main N loss pathways when N cycle become open.

The authors used average 15N values of all plant species for the comparison between burned and unburned sites (Table 2). However, this comparison would need to be performed for each plant species, because different plant species have distinct niches for N acquisition, which are reflected in variation in 15N among plant species (Table 2).

Reference Szpak, P., 2014. Complexities of nitrogen isotope biogeochemistry in plant-soil systems: implications for the study of ancient agricultural and animal management practices. Front Plant Sci 5, 288.

Minor comments: L79: A reference would be needed. L128: Please explain in more details how the soil temperature was measured. L134: Please add more explanations about the sampling (e.g., tree species). L136: Please describe the species name of the moss. L170: total nitrogen (TN), total carbon (TC) L181: It would be better to avoid the expression “XX was reduced (or increased) after fire” throughout this manuscript, because this study did not examine the pre- and post-fire effects in the same sites, but compared the soil properties between burned and unburned sites. L259: Please add more explanation about “potential mineral N rates”. L281: References would be needed for the effect of soil temperature on NH4 volatilization. L289-293: Please clarify this sentence.

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