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Interactive comment on "Soil properties determine the elevational patterns of base cations and micronutrients in plant-soil system up to the upper limits of trees and shrubs" *by* Ruzhen Wang et al.

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Comment 1: My main concern is the lack of information from the study systems and sampling design which currently limits the ability to fully interpret the results. Information of the elevations studied at each location – which should automatically provide elevational ranges studied – is needed to provide information on, and assess, the comparability among sites studied. Reply: We have provided the information of elevational ranges including soil parent materials, bedrock and ranges of both MAP and MAT in Table S1. This has also been mentioned in Lines 146-147 of main text. Comment 2: Other relevant information to include would have been MAT and MAP

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along the studied elevational ranges at each gradient. Water movement is important for the movement and concentrations of soil base cations and nutrients, and is influenced by slope and inclination (local topography at each elevation). So if available, this information would be valuable to include. Another factor that can influence soil properties and processes is the underlying bedrock, and it should be particularly relevant here. Reply: Thanks for the comments. We have provided ranges of MAT and MAP along elevational gradients for each site in Table S1. Unfortunately, we do not have data of local topography at each elevation. The information about soil parent material and bedrock was also added for each study site in Table S1. Comment 3: The approach used – sampling soil and plant tissues from/under trees and shrubs – can be valuable to address how plant-soil linkages changes along environmental gradients. The species elevational range is provided in the methods, but it is not clear which part of their range was sampled or why these specific plant species were targeted for this study. For instance, are they species that are well adapted to certain environmental conditions represented by each location? And/or are they the commonest species of these growth forms at each location? This kind of information is relevant in describing the context of the study and study systems. Reply: Thanks so much for the observation. We agree with the point that sampling soil and plant tissues from/under trees and shrubs can be valuable to address how plant-soil linkages changes along environmental gradients. This kind of linkages has been discussed in section 4.2 from Lines 349 to 365. Indeed, the targeted plant species in this study are the well adapted and commonest species of the elevational ranges acting as treeline trees or shrubline shrubs. This kind of relevant information has been added in the main text in Lines 132-133. Comment 4: Additionally, the species chosen are functionally rather different which consequently could influence soil properties in different ways. While this is explicitly addressed, given that SOC and pH are important drivers for many patterns, the identity of the species may be an important factor influencing the results (which the authors also briefly mention in the discussion on lines 350-352). Although site is a random factor in the analysis across site effects, I wonder if treating them as main

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factors (trees versus shrubs) without accounting for the differences among species within these growth forms may mask some important information that seems central to the study question of plant-soil linkages and how they may change with elevation. Reply: Thanks so much for mentioning this. For each site, the targeted tree species were the dominant species and the shrubs were the commonest species within each chosen elevational range, serving as the treeline tree or shrubline shrub. Thus, we grouped them into different life forms of tree and shrub. If we replace site as a random factor with life form as a main factor, it seems we would no longer make a distinction between sites, which we believe is necessary. However, we initially expected to find consistent elevational patterns of base cations and micronutrients across sites instead of considering differences caused by sites and life form (please see the hypotheses in Lines 97-102). Additionally, we analyzed soil base cations and micronutrients under tree and shrub canopies separately at each site (please see Table S2). Specific comments: Comment 5: Line 117-123: Is the MAP values reported relevant for the study locations/gradients? Does MAP change with elevation along the range studied at the three gradients, or only from the Changbai mountain? Reply: Indeed, MAP change with elevation along the range. We have provided ranges of MAP and MAT along the elevational range in Table S1. Comment 6: Line 125-130: Why were these specific plant species studied? Reply: These studied species are the commonest species of the elevational ranges acting as treeline tree or shrubline shrubs. This has been mentioned in Line 132-133. Comment 6: Line 135-140: More information on sample handling prior to analysis would be valuable here. Were the samples for each species/below each species bulked? Reply: The samples were not bulked for each species/below each species. At each elevation, we selected 6 plots to serve as 6 replicates. And within each plot, 6-10 samples were collected and composited. The related information has been presented in Line 139-144. Comment 7: Line 143-154: Was all soil dried? A number of these analyses should be done on wet soils (e.g. lines 150-153). Reply: Not all the soil was dried. We separated soil samples into two parts with one of them being air-dried and the other stored at 4 °C for further analyses

(see Lines 149-150). Soil nitrate and ammonium concentration were determined on fresh soil samples. This information has been incorporated in Line 156. Comment 8: Line 170-185: The abstract and results mention results from a multiple regression but this analysis is not mentioned in the methods section. Reply: The multiple regression analysis has been removed in both abstract and results as it contributes little to our discussion and makes our manuscript too long (as commented by Reviewer #1). Comment 9: Line 185-190: Soil pH under tree canopies decreased with elevation, but increased with elevation under some shrubs. Are there any understory species growing under trees, or was the ground more or less open, or covered with litter from the target tree only? Sampling soil specifically under a tree and specifically under a shrub may be very different in terms of targeting the influence of the actual species on soils. Reply: We agree with the point that great difference exists between soil samples under tree canopy and under shrub canopy. Indeed, soils were covered with more litter from targeted trees than that from shrubs. Comment 10: Line 279-295: Or could it indicate species specific responses and effects on soil properties? Reply: Thanks so much for pointing this out. We agree with this view and incorporated this in Lines 305-307. Comment 11: Lines 337-341, 350-352: It seems plausible that the concentrations of nutrients in the soil are important to determine plant tissue nutrient concentrations and also vice versa, but it is not clear how the final conclusion (referring to Hobbie 1992, lines 350-352) can be drawn from the data or the discussion in this same paragraph. Reply: Thanks for the nice comment. We have rephrased the sentence into “Inconsistent elevational patterns of plant nutrient concentrations could also be derived from the fact that individual plant species reinforced patterns of soil nutrient availabilities in their vicinity causing a positive feedback between plant and soil” (Lines 362-365). Comment 12: The findings by Campo-Alves (2003) should be relevant to discuss in relation to this study. Campo-Alves J. 2003. Nutrient availability and fluxes along a toposequences with tropical dry forest in Mexico. Agrociencia 37:211-219. Reply: This reference has been cited in the manuscript (Line 347). Comment 13: Technical corrections: Line 70âĂŤThere is a word missing to connect

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the first part with the second part of the sentence. Line 365: Word missing: “one of (the) main. . .” Reply: We thank the reviewer for the observation and apologize for the oversight. These have been corrected in Line 73 and 376.

Please also note the supplement to this comment:
https://www.biogeosciences-discuss.net/bg-2017-298/bg-2017-298-AC2-supplement.pdf

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