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Interactive comment on "Divergence of dominant factors on soil microbial communities and functions in forest ecosystems along a climatic gradient" *by* Zhiwei Xu et al.

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Reviewer 2

(1) The authors present a comprehensive study of soil microbial communities and extracellular enzyme activities in different forests along a climatic gradient. The methods are technically sound. This paper clearly elucidates the dominant factors controlling microbial communities and enzyme activities in each climatic zone. The authors also attempt to emphasize the importance of climatic zones in addition to forest types. However, it's unclear for readers why different dominant factors exhibit in different climatic zones. For example, the authors state that "soil clay content had most influence on the

soil enzyme activities in subtropical forests" (Line 353). However, the following discussion is very general and does not explain why this is only found in the subtropics.

AN: We have improved this part. Therefore, soil enzyme activities and microbial PLFAs were highest in the SCBs forest with finely texture. Except SCBt in the temperate zone and PT in the warm temperate zone, the soil clay content were not significant different among other three forest types. However, the soil clay contents of the four forest types in the subtropical zone were significant different from each other and important for variations in microbial communities and functions (Table 1). (P14, Line 376-381).

(2) Here is another example, soil nutrients (N, P) are more important in warm temperate and subtropical forests than in temperate forests, because nutrients are more likely limiting factors in warm temperate and subtropical forest. This kind of comparison between different climatic zones should be expanded in Discussion and could add value to this study.

AN: We have improved this part as "The soil TN and TP were lower in the warm temperate and subtropical zone than in the temperate zone in our study (Table 1), and these two kinds of nutrients were more likely limiting factors in warm temperate and subtropical forest (DeForest et al., 2012; Xu et al., 2017). Therefore, soil TN and TP are more important in warm temperate and subtropical forests than in temperate forests." (P13, Line 354-357).

(3) I have a few more suggestions to improve the presentation of this study: In Conclusions, soil clay fraction is identified as an important predictor in subtropical zones. However, "soil clay" is not mentioned in Abstract.

AN: We have improved the abstract. Our results showed that the main controls on soil microbes and functions vary in different climatic zones, and that the effects of soil moisture content, soil temperature, clay content, and the soil N/P ratio were considerable. (P2, Line 47-50).

(4) Line 266-268: I don't understand the logic here. The authors are talking about microbial/enzyme responses to forest types in Section 4.1. The concluding sentence addresses "climatic region may be more important than forest types" without any expanded discussion, though I understand "climatic effects" may be indirectly discussed in Section 4.3.

AN: We have moved this sentence to the section 4.2 and improved it as "This was also demonstrated by the stronger effect of climate on soil enzyme activities and the combined interaction effect of climate and forest type on soil microbial communities. Other studies have reported that precipitation and mean annual temperature played important roles in explaining on the large-scale distribution of soil microbial community composition and functions (de Vries et al., 2012; Xu et al., 2017)." (P11, Line 311-312; P12, Line 313-316).

(5) Line 298-300: This clause does not explain why there are more Gram-negative bacteria, less Gram-positive bacteria, and (less?) bacteria PLFAs under increasing pH.

AN: We have improved this part as "Soil G+/G− ratios were highest in the subtropical forest where G− bacteria PLFAs were least abundant, which may reflect microbial growth strategies. The G+ bacteria are primarily K-strategists that can survive over long periods in the soil under harsh conditions with lower soil pH (Andrews & Hall, 1986). Increased pH causes an increase in bacterial diversity and a shift in the bacterial community to more G− and fewer G+ bacteria PLFAs (Wu et al., 2009; Shen et al., 2013). "(P12, Line 321-326).

(6) Line 210-212: please spell out G- (Gram-negative bacteria) and G+ (Gram-positive bacteria) when they are first introduced.

AN: DONE (P8, Line 222-223).

(7) Line 241-243: The causal explanation herein is not specifically related to the results

in Section 3.3 and Fig. 4a. Does the "higher inputs of mixed litter" mean higher litter C/N and lower litter TN? To my understanding, from Fig.4a, BG/NGC/LAP activities are positively correlated with litter C/N and negatively correlated with litter TN. The following explanation for the warm temperate zone is more informative.

AN: We have improved this part as "Soil microorganisms are usually considered to be C limited, and the litter inputs with high C/N ratio of PCB in the temperate zone will stimulate microbes to grow and secrete more enzymes (Table 1). Therefore, all enzyme activities were highest in PCB in the temperate zone." (P10, Line 267-270).

(8) Line 262: please spell out SLA and LDMC.

AN: We have deleted this part.

(9) Line 328: please spell out F/B ratio.

AN: DONE (P13, Line 342).

Please also note the supplement to this comment:
https://www.biogeosciences-discuss.net/bg-2017-243/bg-2017-243-AC2-supplement.zip

Interactive comment on Biogeosciences Discuss., https://doi.org/10.5194/bg-2017-243, 2017.

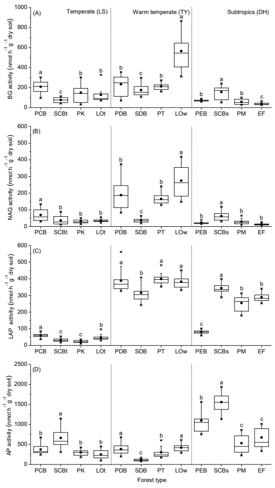

Figure 1. Soil enzyme activities under different forest types in different climatic zones. BG, b-1, 4-glucosidase; NAG, b-1,4-N-acetylglucosaminidase; LAP, leucine aminopeptidase; AP, acid phosphatase. The capital letters A, B, C, and D represent the variations in the enzyme activities of BG, NAG, LAP and AP, respectively. Different lowercase letters indicate significant differences between forests in the same climatic zone. The abbreviations of the sampling sites are shown in Table 1.

Fig. 1.

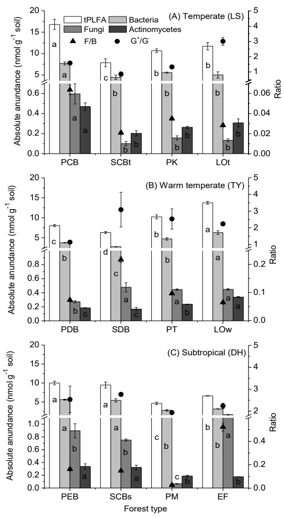

Figure 2. The PLFA contents, Fungi:Bacteria ratios, and G^+/G^- for different forest types in different climatic zones (A. Liangshui; B. Taiyue; C. Dinghu). Different lowercase letters indicate significant differences among forests in the same climatic zone. F/B, fungi/bacteria; G^+/G^-, Gram-positive bacteria/ Gram-negative bacteria. The abbreviations of the sampling sites are shown in Table 1.

Fig. 2.

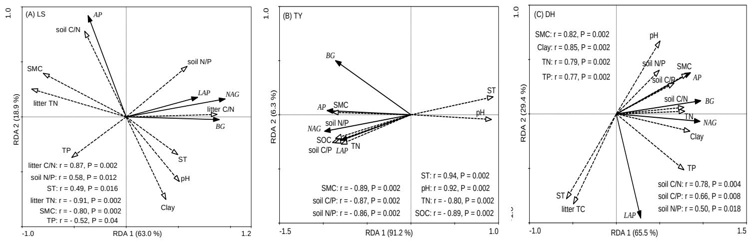

Figure 3. Redundancy analysis (RDA) ordination biplot of soil enzyme activities and environmental properties for the different forest types in different climatic zones (A. Liangshui; B. Taiyue; C. Dinghu). Only the environmental variables that were significantly correlated with RDA1 are shown. The dotted lines and solid lines represent the environmental variables and enzyme activities. The variables in this table were abbreviated as follows: TC(litter) = litter total carbon; TN(litter) = litter total nitrogen; C/N(litter) = litter total carbon/nitrogen; ST = soil temperature; SMC = soil moisture content; Clay = soil clay content; SOC = soil organic carbon; TN = soil total nitrogen; TP = soil total phosphorus; C/N = soil carbon/nitrogen; C/P = soil carbon/phosphorus, and N/P = soil nitrogen/phosphorus.

Fig. 3.

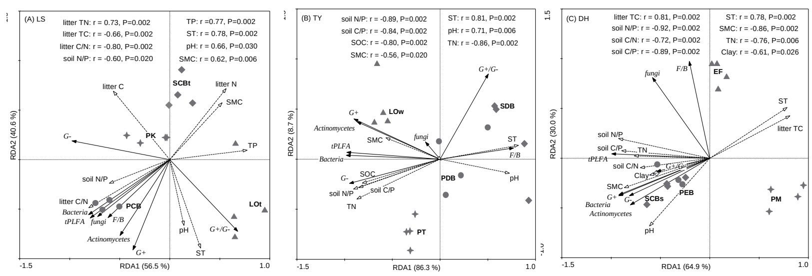

Figure 4. Redundancy analysis (RDA) ordination biplot of soil microbial community structure and environmental properties for different forest types in different climatic zones (A. Liangshui; B. Taiyue; C. Dinghu). Only the environmental variables that were significantly correlated with RDA1 are shown. The dotted lines and solid lines represent the environmental variables and lipid signatures. The abbreviations of the variables included in this figure are shown in Figure 4.

Fig. 4.