Dear Editors and Reviewers:

Thank you for your letter and for the reviewers' comments concerning our manuscript entitled "Soil carbon fractions and enzyme activities under different vegetation types on the Loess Plateau of China". Those comments are all valuable and very helpful for revising and improving our paper, as well as the important guiding significance to our researches. We have studied comments carefully and have made correction which we hope meet with approval. Revised portion are marked in blue in the paper. The main corrections in the paper and the responds to the Editor's and reviewer's comments are as flowing:

Anonymous Referee #2

-- The topical subject is not clear. I have well understood the purpose of this study was to compare the difference of soil organic carbon and soil enzyme activity among the three vegetation types. However, in the introduction section, it states "there is a lack of the information on the relationship between the soil carbon and enzyme activity". This is blurred as a study topic.

Response: Thank you very much for your suggestion. "there is a lack of the information on the relationship between the soil carbon and enzyme activity" has been replaced by "there is a lack of information on the relationship among SOC, MBC, EOC, DOC and enzyme activities for soils with forest, forest steppe and grassland vegetation types".

-- Author just stated "Vegetation type was an important factor influencing the variation of soil enzyme activities and carbon fractions on the Loess Plateau". Whereas which vegetation type is more beneficial to improve soil fraction or soil enzyme activity was ambiguous.

Response: We added "Forest vegetation type was more beneficial to improve soil fraction and soil enzyme activity." in line 381-382.

-- The scientific design on different vegetation is reasonable. Whereas the second and third hypotheses in introduction are not specific.

Response: We changed hypotheses to "i) whether the content of soil labile organic C

fractions and three enzymes were higher in the soils of forest than in the forest steppe and grassland? ii) does three labile organic C fractions exert various effects to enzyme activities in soils of difference vegetation types? iii) does the three vegetation types exhibited a similar vertical change along soil profile?"

-- The sampling soil method in grassland is not reasonable. Author stated that the plot size for grassland is only 1×1 m, and 9 sub-samples were collected. How variable the results could be? I think the plot size is too small.

Response: Thank you very much for your valuable suggestion. Within each plot, based on an S-shaped sampling pattern, the incompletely-degraded litter was removed and 9 sub-samples were simultaneously and randomly collected by soil auger (20 cm ×5 cm), then mixed them in the same bag which as a representative soil sample, separately at 0-5 cm and 5-20 cm depth. And the plot size for grassland was 1×1 m which also appeared in other paper (Cheng et al., 2015).

-- The title is not very clear, the word "impact" or "variation" or the other should be added.

Response: We changed title to "Variations of soil carbon fractions and enzyme activities under different vegetation types on the Loess Plateau of China".

-- The abstract is well organized, whereas the conclusion miss points.

Response: We added "Forest vegetation type was more beneficial to improve soil fraction and soil enzyme activity." in abstract.

-- How to remove the living grass in grassland when sampling soil.

Response: The living grass was cut off by scissor when sampling soil, then each soil was sieved (2 mm) to remove large roots, stones and the macrofauna.

--The more basic information on the three study sites (Fuxian, Ansai, Lian Daowan), such as topography, soil types, the management history on the different vegetation types need be reported and discussion. 4 representative plant communities were selected under one vegetation type.

Response: Soils are described as Calcaric Cambisols according to the FAO classification system in our study sites (Jiao et al., 2013). And the other information should be found in Table 1.

-- How much is the variation of soil organic carbon and soil enzyme activity under these representative plant communities.

Response: At 0-5 cm soil layer, SOC, MBC, EOC and DOC contents of forest vegetation were 2.93, 2.14, 4.60 and 1.31 times compared with forest steppe. And SOC, MBC, EOC and DOC contents of forest vegetation were 4.12, 3.85, 5.18 and 1.76 times compared with grassland vegetation. Analogously at 5-20 cm soil layer, SOC, MBC, EOC and DOC contents of forest vegetation were 3.58, 2.09, 4.10 and 1.28 times compared with forest steppe. And SOC, MBC, EOC and DOC contents of forest vegetation were 3.73, 4, 4.42 and 1.31 times compared with grassland vegetation.

At 0-5 cm soil layer, urease activity of forest vegetation was 1.43 and 2.05 times compared with forest steppe and grassland vegetation, analogously at 5-20 cm soil layer, sucrase activity of forest vegetation was 1.65 and 2.21 times by comparing with forest steppe and grassland vegetation. At 0-5 cm soil layer, sucrase activity of forest vegetation was 1.71 and 2.03 times compared with forest steppe and grassland vegetation, analogously at 5-20 cm soil layer, sucrase activity of forest vegetation was 1.46 and 1.70 times by comparing with forest steppe and grassland vegetation. At 0-5 cm soil layer, alkaline phosphatase activity of forest vegetation was 1.20 and 2.38 times compared with forest steppe and grassland vegetation, analogously at 5-20 cm soil layer, alkaline phosphatase activity of forest vegetation was 1.25 and 2.39 times by comparing with forest steppe and grassland vegetation.

-- Fresh soils are recommended in some assay. Author stated that the soil sample was kept at -20◦C. Whereas air-dried soil was adopted for measuring urease activity and Soil DOC.

Response: Thank you very much for your suggestion. The representative soil sample was split into two parts, one was stored intact at -20 ℃ in order to determine MBC, and the other was air-dried for measuring soils' enzyme, physics and chemical properties.

-- CCA is the common abbreviation of canonical correspondence analysis, and it is not proper to be used in line 179 and the following parts.

Response: We changed “A canonical correlation coefficients analysis (CCA)” to “Canonical correlation analysis (CCA)” (Huang et al., 2015)

-- In 3.4 section, I suggest that the both section of 3.4.1 and 3.4.2 should be combined.

Response: Thank you very much for your valuable suggestion. Both section of 3.4.1 and 3.4.2 had been combined.

-- Some section should be reduced: In introduction section, the impact of vegetation restoration on soil property should be reduced, and enhance more substance on the effect of different vegetation types.

Response: Thank you very much for your suggestion. “Recently, some studies have concentrated on the vegetation restoration, for instance, Jiao et al., (2011) found that revegetation had positive effects on the soil physical properties. In the protected vegetation areas, relative humidity of air increased and wind velocity is greatly reduced. Additionally, bulk density of the surface layer (0-20 cm) significantly decreases while soil porosity, water-holding capacity, aggregate stability, and saturated hydraulic conductivity significantly increase. SOC stocks are increased by 19% in the surface soil layer at 0-20 cm soil depth from 1998 to 2006, because of the vegetation restoration in the Loess Plateau (Wang et al., 2011).” this part was removed.

“Cheng et al. (2015) investigated shrubland CK16 (16-year-old Caragana korshinskii Kom.), shrubland CK26 (26-year-old C. korshinskii Kom.), shrubland AS (Armeniaca sibirica Lam.), natural grassland and artificial pasture vegetations, she found that conversion to C. korshinskii shrublands and protection of natural grassland should be promoted to improve the contribution of vegetation to SOC sequestration. Fu et al. (2010) selected transitional belt. Korshinsk Peashrub (KOP), purple alfalfa (ALF), natural fallow (NAF) and millet (MIL) vegetation types, and found that ALF and NAF compared with MIL, did not show much potential to increase SOC in study. Alpine swamp meadow (ASM) was compared with alpine meadow (AM), alpine steppe (AS) and alpine desert (AD) vegetations, it was the best system conserving soil nutrient (especially labile fractions) and microbial activity in permafrost regions of the China's

Qinghai-Tibet Plateau (Shang et al., 2016). The Wang et al. (2012) showed that after 30 years of restoration, nutrients content in the soil of mixed forest of black locust and amorpha increased significantly. However, nutrients content in the soil of mixed forest of Chinese pine and amorpha decreased. As to soil enzyme activities increased while polyphenol oxidase activity decreased compared to non-restoration and climax community soils." this part was added in introduction section

-- In the discussion section, more sentences are descriptive, and do not clearly support the objective of the study.

Response: Thank you very much for your suggestion. "In the protected vegetation areas, relative humidity of air increased and wind velocity is greatly reduced. Additionally, bulk density of the surface layer (0-20 cm) significantly decreases while soil porosity, water-holding capacity, aggregate stability, and saturated hydraulic conductivity significantly increase (Jiao et al., 2011)." and "SOC stocks are increased by 19% in the surface soil layer at 0-20 cm soil depth from 1998 to 2006, because of the vegetation restoration in the Loess Plateau (Wang et al., 2011)." were added in the discussion section.

References:

Cheng, M., Xue, Z. J., Xiang, Y., Darboux, F. and An, S.S.: Soil organic carbon sequestration in relation to revegetation on the Loess Plateau, China, Plant and Soil, 397,31-42,2015.

Huang, Y. M., Liu, D., An, S. S.: Effects of slope aspect on soil nitrogen and microbial properties in the Chinese Loess region, Catena, 125, 135-145, 2015.

Jiao, F., Wen, Z. M., and An, S. S.: Changes in soil properties across a chronosequence of vegetation restoration on the Loess Plateau of China, Catena, 86, 110-116, 2011.

Jiao, F., Wen, Z. M., and An, S. S and Yuan, Z.: Successional changes in soil stoichiometry after land abandonment in Loess Plateau, China, Ecological Engineering, 58, 249-254, 2013.

Shang, W., Wu, X. D., Zhao,L., Yue, G. Y., Zhao, Y. H., Qiao, Y. P. and Li, Y. Q.: Seasonal variations in labile soil organic matter fractions in permafrost soils with different vegetation types in the central Qinghai-Tibet Plateau, Catena , 137, 670-678, 2016.

Fu, X. L., Shao, M. A., Wei, X. R., and Horton, R.: Soil organic carbon and total nitrogen as affected by vegetation types in Northern Loess Plateau of China, Geoderma, 155 , 31-35, 2010.

Wang, B., Xue, S., Liu, G. B., Zhang, G. H., Li, G. and Ren, Z. P.: Changes in soil nutrient and enzyme activities under different vegetations in the Loess Plateau area, Northwest China, Catena, 92, 86-95, 2012.

Wang, Y., Fu, B., Lü, Y., and Chen, L.: Effects of vegetation restoration on soil organic carbon

sequestration at multiple scales in semi-arid Loess Plateau, China, Catena 85, 58-66, 2011.

We tried our best to improve the manuscript and made some changes in the manuscript. These changes will not influence the content and framework of the paper.

We appreciate for Editors/Reviewers' warm work earnestly, and hope that the correction will meet with approval.

Once again, thank you very much for your comments and suggestions.

Thank you and best regards.

Yours sincerely,

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