

Response to comments by Anonymous Referee #1

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We appreciate the constructive comments raised by the Anonymous Referee #1 on May 5, 2015.

Our paper presented the comparison of average chain lengths (ACL) between woody and non-woody plants at single sites and found that no systematic difference existed. This finding contradicted the fundamental assumption that ACL was used as a proxy for vegetation dynamics, environment and climate changes. Our findings are consistent with conclusion of Bush and McInerney (2013) that “The variation in chain-length abundances within most groups is large, even when accounting for factors such as region and photosynthetic pathway. This makes it inadvisable to use *n*-alkane chain-length abundances as chemotaxonomic indicators for broad plant functional groups...”, but Bush and McInerney (2013) neglects the comparison between different types of plants at single sites, or as the referee stated that “... they did not test within sites...”. This makes us believe that our contribution is of significance to make this point clear. Moreover, for the purpose of proxy calibration, if we do not test the difference in ACL between various types of plants at single sites, it would be difficult for us to validate or refute ACL as a proxy. Therefore we asked the question in a different point of view from Bush and McInerney (2013), not only a subset of the question.

Question 1: “The authors of this study fail to place their results in the context of the previous study by Bush and McInerney (2013). I think this paper would be more interesting if they highlighted the potential importance of looking within a site and then directly compared their within-site results to those of the regional and global sampling by Bush and McInerney (2013)....”

We agree with the referee that the paper would be improved significantly if we compare our findings with the results by Bush and McInerney (2013). We will revise our discussion by incorporating the comparison, which will further support that application of ACL should be extremely cautious. We will also revise the Introduction and place our study in the context of previous studies.

Question 2: “This paper also does not articulate well why this is a new finding, given the results of Bush and McInerney (2013)”

We will revise the Introduction and explain clearly why we do the within-site comparison. The with-in site comparison is the fundamental basis to test the ACL as a proxy.

Question 3: “The question posed in the title “Is average chain length of plant lipids a potential proxy for vegetation, environment and climate changes?” is not actually addressed in this paper. The paper addresses only whether plant lipids serve as a proxy for woody vs non-woody vegetation. It is misleading to suggest that it also addresses climate and environment in its analysis.”

Because ACL has long been used as a proxy for past changes in environment and climate, the purpose of our paper is to test whether ACL is an appropriate proxy. If ACL could differentiate vegetation types, it could be used as a proxy for environment and climate changes; however, if ACL could not differentiate vegetation types, it can not be used as such a proxy. We will revise our Discussion and incorporate more information on the application of ACL to make the content of the paper fits the title.

Question 4: “Multiple other citations are incorrect or incomplete. If previous work were properly acknowledged, and a persuasive case were made for the importance of site-specific analysis such as performed here, this paper would make an interesting contribution. As it stands, it is not publishable due to its failure to properly recognize previous work and its failure to highlight what is new about this analysis.”

We appreciate the referee to point this out. We will carefully check the references and correct them.

Specific Comments:

SC1: “5478, Line 25- Cranwell 1973 is not an appropriate reference here. This paper looked only at.....”

We reread the original paper and will replace it with a new reference (Meyers and Ishiwatari, 1993) in P5478, Line25.

Meyers, P. A., & Ishiwatari, R. (1993). Lacustrine organic geochemistry—an overview of indicators of organic matter sources and diagenesis in lake sediments. *Organic Geochemistry*, 20(7), 867-900.

SC2: “5479, line 6- Cranwell 1973 is once again an incorrect citation. They were not examining

We would delete the citation and rearrange the statements here.

SC3: “5479 Line 10- Bush and McInerney 2013 is presented as if it only considered graminoids and woody plants but in fact it also considered forbs.....”

We will summarize the work by Bush and McInerney (2013) more clearly. In this paper, we mostly focus on the comparison of ACL between woody and non-woody plants, which is the fundamental assumption for ACL as a proxy.

SC4: “5479 Line 12- This part of the introduction could be better argued that, although Bush and McInerney (2013) compared groups globally and within regions (Temperate zone and Africa – Figure 5 and 6)), they did not compare woody and herbaceous taxa within sites.....”

We will make it clear and highlight the significance of this work, and acknowledge and put the previous work in the context of this paper.

SC5: “Section 3.1 and table 2. Why are *n*-alkanoic acids reported here rather than *n*-alkanes? I thought that Hou et al. 2007 measured both *n*-alkanes and *n*-alkanoic acids. The new data presented for Lake Ranwu is for *n*-alkanes and the literature data is all for *n*-alkanes. Why bring in *n*-alkanoic acids for one site? ”

We believe that it makes no differences whether using *n*-alkanoic acids or *n*-alkanes when discussing the differences between woody and non-woody plants. We are not comparing the ACL of *n*-alkanes with ACL of *n*-alkanoic acids. Although absolute value of ACL between *n*-acid and *n*-alkane for single plant is different, we only focus on the statistical result instead of the absolute value. In addition, there are several studies focus on acid (such as Wilkie et al.2013 and Douglas et al. 2012) in our database besides of Blood Pond. We will add the *n*-alkane data for Blood Pond plants.

SC6: “Page 5484 Line 1- Why is it surprising that there is no significant difference between woody and non-woody taxa at a single site? This is what has been observed at a global and regional scale already by Bush and McInerney 2013. Given the available information, this is the expectation, not the surprise.”

As the ACL has long been used as a proxy for past changes in vegetation, environment, and climate, it should show significant difference between woody and non-woody plants. Though no significant difference has been reported in global and regional scale in Bush and McInerney (2013), we nearly knew nothing about the difference at single sites before we did the statistics.

SC7: “Page 5484 Line 14- Cite Bush and McInerney 2013 here. This is what they showed previously. Page 5484 Line 15- Cite Bush and McInerney 2013 here. This is what they concluded previously.”

We will add the reference here.

SC8: “Page 5484 26- page 5485- Why would you expect the two botanic gardens to behave the same? They are most likely growing different plants. So it could be that the plants that differ. Not the watering regime.”

We agreed that growing plants might be one of the reasons that cause the differences, however, in Bi et al.,(2005), some samples are growing in greenhouse (personal communication by Email). In Maffei’s studies, all the samples are growing in open air (personal communication by Email). Hence, water regime could not be excluded. We will make this point clear in the text.

SC9: “Page 5485- Section 4.2- There is insufficient and incorrect citation of previous literature that consider the possible climatic effects on ACL. At a minimum, this section should discuss and reference”

Thanks the helpful suggestion and references, we will add more references and more discussion here.

SC10: “Castañeda et al (2009) is an incorrect reference here because this paper looked primarily at algal lipids in lake sediments and did not measure plant waxes in warm and cool regions as implied by the citation.”

We will replace it with a new reference (Kawamura et al., 2003) instead.

Kawamura, K., Ishimura, Y., & Yamazaki, K. (2003). Four years' observations of terrestrial lipid class compounds in marine aerosols from the western North Pacific. *Global Biogeochemical Cycles*, 17(1), 3-1.

SC11: “Page 5486, Line 10-13, This section should cite the work of Bush and McInerney 2013 that found no difference in ACL between sun and shade leave and leaves in different stages of senescence.”

We will put the reference here to improve the Discussion.

For Technical Comments

TC1: “Table 2, sample 48 should have a capital C for Carya”

We will revise it.

TC2: “Table 3, please spell out or provide footnote of climate terms. ”

According to Kottek et al.,(2006), we list the terms mentioned in the paper here,
Am = Equatorial monsoon

Aw = Equatorial savannah with dry winter
Bsh = Steppe climate (Hot steppe, $T_{\text{ann}} \geq +18^{\circ}\text{C}$)
Bsk = Steppe climate (Cold steppe, $T_{\text{ann}} < +18^{\circ}\text{C}$)
Bwh = Desert climate (Hot desert, $T_{\text{ann}} \geq +18^{\circ}\text{C}$)
Bwk = Desert climate (Cold desert, $T_{\text{ann}} < +18^{\circ}\text{C}$)
Cfa = Warm temperature climate, fully humid (Hot summer)
Cfb = Warm temperature climate, fully humid (Warm summer)
Cfc = Warm temperature climate, fully humid (Cool summer and cold winter)
Csa = Warm temperature climate with dry summer (Hot summer)
Csb = Warm temperature climate with dry summer (Warm summer)
Cwa = Warm temperature climate with dry winter (Hot summer)
Dfa = Snow climate, fully humid (Hot summer)
Dfb = Snow climate, fully humid (Warm summer)
Dfc = Snow climate, fully humid (Cool summer and cold winter)
Dwc = Snow climate with dry winter (Cool summer and cold winter)
ET = Tundra climate

TC3: “Figures 2, and 4: Terminology is inconsistent and unclear. Figure 4 uses Herb and Woody while figure 2 uses herb, shrub, tree, fern, vine and grass. In text, non-woody is used synonymously with herbaceous which is used synonymously with herb. In addition, herb can refer to a subset of non-woody plants, thus the terminology is confusing. Please define terms and use them consistently in text and figures. ”

Thanks for the suggestion. We will clarify the terminology in the manuscript in the Introduction. To be specific, in this manuscript we divided the terrestrial plants into two types, woody plants (including tree and shrub) and non-woody plants (grass and herb). We will change the terms in figure 2~4.