Biogeosciences Discuss., 6, S953–S959, 2009
www.biogeosciences-discuss.net/6/S953/2009/

Biogeosciences Discussions

Interactive comment on "Large regional-scale variation in C3/C4 distribution pattern of Inner Mongolia steppe is revealed by grazer wool carbon isotope composition" *by* K. Auerswald et al.

K. Auerswald et al.

Received and published: 30 April 2009

We have revised the manuscript carefully considering the advice and criticism offered by the reviewers. Below, we explain the changes made to the manuscript keyed to the specific reviewers' comments and at the end we also reply to the comment by E. Bui.

Specific comments to reviewer 1:

The geostatistical techniques are novel for this particular application, although they could use a little more explanation and justification.

We included a general explanation on how geostatistics can help to evaluate the spatial pattern of a property, rephrased the paragraph and provided additional reference.

Specifically, the discussion should refer to the photorespiration effect on net C3 photosynthesis across a range of light levels (from light limited to light saturated)

The reviewer is right. We carefully revised the manuscript (Introduction and Discussion) to avoid any ambiguity that could result from the use of cross-over temperatures based on quantum yield or light-saturated photosynthesis. Thus, where appropriate, we replaced the term 'quantum use efficiency' by 'light use efficiency', and - for further discussion - we referred to Sage and Kubien (2003) and Still et al. (2003). However, beyond that, we did not expand the discussion on the putative ecophysiological causes of the C3/C4 distribution, since this was not warranted by the data.

Page 550, lines 23-29 Describe in more detail your paired hair-vegetation sampling so readers do not have to consult the Zhao et al .(2007) paper.

Changed as requested.

Page 555, line 24 Remove the word Evidently from the beginning of the sentence.

Changed as requested.

Page 556, line 11 Delete one repetition of area in this sentence.

Changed as requested.

Page 557, lines 14-15 Yes, but the temperature also probably decreases with increasing MAP; thus the two effects are confounded.

Yes; this is shown in chapter 3.2.

Page 560, line 20 This sentence is too strong. The direct competition is not controlled just by these factors (this statement would need to include a variety of other factors and processes to be correct). You should re-state it.

We revised the sentence.

Page 561, lines 5-6 You should cite Taubs work in the American Journal of Botany

BGD

6, S953–S959, 2009

Interactive Comment

(2000).

Citation included.

Page 561, line 7 I think you mean the 13C discrimination will decrease with precipitation as the proportion of NADP-ME species (with lower 13C discrimination) increases.

Yes, you are right. We changed as requested.

Specific comments to reviewer 3:

P546L10: 13C enrichment of 2.7 per mil: provide estimate of variability on this average.

Information was added.

P546L18: "was significantly higher above and lower below the 22C isototherm": if its higher above, then its obviously lower below: one of both statements can be omitted

We revised the sentence.

P546L19-20: "which was averaged from high-resolution ..." :perhaps rephrase to e.g., "which was obtained from annual high-resolution maps and averaged over the different sampling years" ?

Changed as requested.

P547L1-2: merge these two sentences P457L9: here perhaps you should introduce other factors that may influence soil d13C ? E.g. move the 2nd paragraph on P548 to this section?

The influence of soil d13C was not moved because this paragraph treats the implications of C3 and C4 vegetation.

P547L18-19: rising atmospheric CO2 stimulates C3 photosynthesis more than C4: needs relevant references here.

Citation added.

BGD

6, S953–S959, 2009

P548: this section assumes that no significant variations in d13C signatures of C4 plants occur, but this assumption is not mentioned explicitely. There are in fact environmental conditions (and taxa-specific differences) but these are not mentioned here and are only reported much further in the ms (section 4.3) -mention should also be made here.

We now mention this variation also in this the paragraph.

P548L28: "when... and post-ingestion fractionation of C isotopes is known": yes, but also assumes that this is similar for a C4 and C3-based diet ?

We added that post-ingestion fractionation can be influenced by differential digestibility of C3 and C4 plants.

P549L7 "How is the C3/C4 pattern... " :rephrase, e.g.: How are C3 and C4 grass species spatially distributed in ...

Changed as requested.

P550L9-11: this is not very clear: "Bulked leaves were collected within approx. 1000 m2 on a reduced scale of apparent species-level contribution to total standing biomass" That could be anything.

We revised the sentence.

P550L21: "ten sites beyond the periphery": mention why sites outide the study area were sampled (is done only in section 2.8), and if/where the data are presented further on ?

We included more details and a reference, why sampling beyond the periphery is improving the spatial interpolation.

P551L12-14: how are the different sections of wool assigned to a specific period ?

We included an explanation and a citation.

BGD

6, S953–S959, 2009

P552: "with d13Ca continuously decreasing over time": Yes, there is a long-term de creasing trend in d13C of atmospheric CO2 but a few more words on this would be useful + relevant references.

We included a citation.

P553: Again, this approach assumes that the d13C of the C4 end member is constant but this assumption is not mentioned explicitely untill section 4.3.

We now explicitly state this here in addition to the information already added to the introduction.

P553 L22: "can be estimated from Eq (1) from d13C-c or from ..." : first part of this phrase is confusing

We changed the sentence.

P554L1-3: so here, the dietary shift in 13C is not assumed to be similar for C3 and C4-based diets ?

We changed the sentence.

Section 2.8 is a tough read for those not familiar with geostatistial techniques.

We included a general explanation on how geostatistics can help to evaluate the spatial pattern of a property, rephrased the paragraph and provided additional reference.

P556L1-3 and corresponding legend of Figure 2 are somewhat confusing : the data on "vegetation from wool (farm scale" on panel 2B are clearly calculated, but the data on which the 2.7 per mil offset is based are not shown here (right?) -> perhaps it would be useful to have an additional figure to show the farm-scale dataset on which this offset is based. Also: X-axis on Figure 2: most negative d13C are commonly placed on the left side ?

We changed Fig. 2 as requested. We did not include an extra figure but provide the

BGD

6, S953–S959, 2009

mean and CI95

Figure 3: is this essential ?

Yes, three important informations are retrieved from this graph (the data uncertainty, the strength of the pattern and the spatial extension of the pattern). Further, persons that are not familiar with geostatistics can better comprehend the steps of geostatical analysis, while for those familiar with geostatistics this graph is essential to judge the quality of the geostatistical analysis.

P557L10: needs a comma between "evident" and "the"

Changed as requested.

P557L13: "On average of all wool samples..." awkward, rephrase

Changed as requested.

P559L6: Though: -> However

Changed as requested.

P560 L5: "Differences ... between C3 and C3 plants": should be "C3 and C4"

Changed as requested.

P560 L6-8: "Nonetheless, several studies ..., the opposite was also reported": awkward, rephrase.

We rephrased the sentence.

P562L4-5: something wrong with this sentence.

We changed the sentence.

P652L27: enormous -> a high;

Changed as requested.

BGD

6, S953–S959, 2009

Reply to the comment by E. Bui

I think that a better approach to mapping and exploring potential environmental drivers of C3/C4 would be decision trees rather than geostats

Decision trees, like regressions or regression trees are methods of conventional statistics that have several advantages and disadvantages in common. The major disadvantage for pattern analysis is that they do not quantify autocorrelations and hence cannot answer the questions whether there is a pattern at all and how pronounced the pattern is. Hence they are also not able to answer the question how much of a certain pattern can be explained by a certain decision tree. This is not trivial as a decision tree in contrast to geostatistics combines the uncertainties of the dependent variable and the uncertainties of the independent variables. Furthermore, the number of independent variables is potentially infinite and a proper selection of meaningful physical and socio-economical parameters can only be done based on sound a priori knowledge with the pattern itself being an important a priori knowledge. Furthermore, decision trees of spatial data without doing geostatistical analysis are difficult to interpreted in a statistical manner because it cannot be determined, whether the samples are independent, a prerequisite for conventional statistics, or whether they are autocorrelated. Conventional statistics, by ignoring autocorrelation also ignores scale. The proper scale for the independent variables remains unknown and the scale for which a certain decision tree is applicable cannot be made explicit. Finally, decision trees are not a straight forward approach to test a clear hypothesis like crossover temperature, which is well justified on the plant scale but needed to be validated for the regional scale to be used in regional global change scenarios. Nevertheless, in the past we have used many methods of conventional statistics including regression trees and we will use them in the future and hence acknowledge their advantages in other cases than pattern analysis.

Interactive comment on Biogeosciences Discuss., 6, 545, 2009.

BGD

6, S953–S959, 2009

Interactive Comment