Anonymous Referee #2

Received and published: 15 June 2015

General comments:

The manuscript presents a study in which natural abundance car- bon isotopes are analyzed from SOM across a precipitation transect and from depth profiles. Isotopic signal is used as an indicator of occurrence of vegetation thickening on a spatial scale and to study the effect vegetation thickening on SOM dynamics in the soil profile. The study utilizes the difference in isotope composition of woody species with C3 photosynthetic pathway and grasses with C4 photosynthetic pathway.

The manuscript is well written and the methods and results are clearly presented. I think that the only problem in the manuscript is that sometimes the conclusions remain rather weak. There are multiple possible factors that can cause isotopes to fractionate during decomposition processes, which makes the interpretation of such data challenging. However, the authors are well aware of the difficulties in interpreting the data and explain that well and in detail in the Introduction and Discussion sections. The relevant literature is also extensively referred. More detailed knowledge on the land use changes and their timing from other sources, if available, could have helped to interpret the observations and improve the manuscript.

The manuscript fit well within the scope of the journal and will be of interest to the soil science community and also to the stable isotope user community.

We thank the reviewer very much for his/her comments. We agree that the combination of other sources, such as aerial photography or remote sensing, could provide complementary interpretation of the findings presented in this work. This may be an aspect to explore in future work to be conducted in combination with the remote sensing community.

We provide answer to the specific comments below. Our comments are in bold font.

Specific comments:

Please, determine ”radiocarbon age” in the Methods section. How is the mean residence time calculated? The description of methods in the Table 1a should be moved to Methods section.

Revised as suggested. We have moved the descriptive methods on the determination of radiocarbon age and calculation of MRT to the Material and Methods section.

In the Conclusions section you could more clearly explain what the new findings of this study were. Especially the last two sentences are very general and should be explained in the context of this study.

We have modified the conclusion section quite substantially. We now recall the three main objectives of the paper, and then highlight the novel findings of this study.

Technical comments:

Figure captions are rather long and include information that has been or should have been presented in Methods section.

Revised as suggested. We have moved whole sentences from the captions to the main text in two of the figures (2, 4) in line with recommendations also posed by Reviewer #5.

Page 8104 lines 17-22 could be moved to Methods

We have preferred to leave a brief description of the two stands in the Discussion section, as it is quite useful to understand the reasons behind the specific SOM dynamics described in that section.