

Interactive  
Comment

***Interactive comment on “Biogeochemical factors contributing to enhanced carbon storage following afforestation of a semi-arid shrubland” by J. M. Grünzweig et al.***

**J. M. Grünzweig et al.**

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Response to comments by referees

We would like to thank the referees for their helpful comments that assisted us in revising the manuscript for Biogeosciences.

Reply to referee 1:

Heating potential of reduced albedo: We agree that this point should be considered in an overall analysis of the effect of afforestation in semi-arid regions on the climate. However, to include it is beyond the scope of this paper. We shortly mentioned this topic in the revised paper.

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Reply to referee 2:

**Grazing regimes:** The shrubland is under moderate to heavy grazing probably for several millennia. Herbaceous vegetation in the forest was removed mechanically or chemically during the first 12 years after afforestation, and since then is subjected to a moderate to heavy grazing regime.

**Mixing models for SOC analysis:** Because the small isotopic signal in this C3-all system might limit the SOC analysis, we compared the results of two isotope mixing models that use different parameters for the computation of the fraction of forest-derived C in forest soil. In both cases, the models were adapted to the small isotopic signal by making use of SOC fractions as parameters of the model. The models yielded fairly similar results, thus justifying the use of the C3 isotopic signal.

**Harvested woody biomass:** There is no inconsistency between Table 4 and the text. In Table 4, total harvested tree biomass was presented, while in the Results section, harvested woody biomass was calculated as a medium- to long-term store of C. However, we slightly altered this parameter following comments by referee 3 (see below).

**Shrubland C stocks:** To calculate total shrubland C and N stocks, stocks obtained for the shrub and intershrub microsites were weighted with the respective percentage ground cover.

Reply to referee 3:

**General comments:**

We certainly agree that our data will be important for evaluating the carbon sequestration potential in semi-arid lands, and therefore refer in the revised ms to the suggested work on the economic potential in the framework of the Kyoto Protocol. The paper by Nosetto et al. 2006 has already been cited in the original ms.

**Specific comments:**

**BGD**

4, S1394–S1396, 2007

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Belowground herbaceous biomass: Inclusion of herbaceous biomass as roots and as a result of deflection by grazers in belowground C stocks was mentioned in the Methods section of the revised ms.

Method for measuring SOC: The measurement technique for organic C was implicit in the Methods section of the original ms. SOC was determined in the elemental analyzer following treatment of ground soil samples with 1N HCl according to Midwood & Boutton (1998).

Calculation of shrubland-derived SOC in the forest soil: The shrubland-derived SOC remaining in the forest soil, was determined by the difference between total forest SOC and forest-derived SOC in the forest soil obtained from Eqs. 1 and 2.

Harvested woody biomass: We agree that the original inclusion of harvested woody biomass in total long-term C stocks produced by the forest is a somewhat simplistic approach. We refined this calculation in the revised version by assuming that all stems of >10.2 cm diameter were processed by industry into products of medium lifetime. Lower-diameter stems and branches were assumed to be burned within a few months after harvest. Leaves of the harvested trees were included in the litter layer. This estimate was not intended to present the potential standing C stocks, since the latter would indeed be affected by thinning.

Relationship between aboveground and belowground biomass: The absence of a relation between standing belowground C stocks and standing aboveground biomass and the presence of a statistically significant relation with produced aboveground biomass seemed noteworthy. We presented data for the top 20 cm of the soil profile (logarithmic; Fig. 3) and for the 0-10 cm layer (linear; text). Regardless of the type of relation (linear or logarithmic), this phenomenon shows that the legacy of harvested biomass is apparent in total forest SOC.

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