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What role does soil water erosion play in the organic carbon balance under three different land uses in a semiarid area of S.E. Spain?

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The soil organic carbon (SOC) pool represents a dynamic equilibrium of gains and losses. Conversion of natural to agricultural ecosystems causes depletion of the SOC pool by as much as 60% in soils of temperate regions. The depletion is exacerbated when the output of C exceeds the input and when soil degradation is severe.

Although semiarid ecosystems may not be so relevant in terms of the amount of C stored in them, they occupy about 47 % of the world's land (Lal, 2004) and are highly vulnerable to climate change (Snyder et al., 2002). Furthermore, carbon dynamics in semiarid lands are further complicated by their marked rainfall seasonality, which determines well defined pulses of biological activity.

There is an ongoing debate about the role of soil erosion in the global carbon budget. Thus, while several authors consider that soil erosion has a strong impact on the global C cycle, others do not consider this component while assessing the global carbon budget.

The objectives of this study were: 1) to evaluate the effect of soil erosion on the annual carbon balance under three different land uses in a semiarid Mediterranean ecosystem, and 2) to determine the influence of the land use change on carbon pools and fluxes.

To address the role of land use change in controlling C fluxes, and thereby soil C sequestration rates, we measured aboveground and belowground net primary production, soil respiration and soil water erosion rates for one year, in three different land

uses in a semiarid area: (i) a typical Mediterranean semiarid shrubland with scattered Aleppo pines, (ii) a non-irrigated olive grove, and (iii) an abandoned agricultural field.

The three selected areas showed a similar pattern in the annual carbon balance, as all of them displayed a C-source behaviour. Soil respiration was the largest component of carbon fluxes at each land use, accounting for more than 99 % of loss of C in the three land uses. The rate of soil C loss by erosion in the olive cropland and in the abandoned area was four and three times higher than in the natural area, respectively. However, in terms of the annual carbon balance soil erosion was not a key component, involving less than 1 % of the C outputs for each land use.

Losses of C by erosion, while important on century to millennial timescales, are too small to be major contributors to inter-annual C balance in net ecosystems production.