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Role of soil water erosion on the organic carbon balance in a Mediterranean ecosystem.

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The soil organic carbon (SOC) pool represents a dynamic equilibrium of gains and losses. Conversion of forest ecosystems into croplands causes depletion of the SOC pool by as much as 60% in soils of temperate regions. Alterations in the size of the soil C pool at a specific location are determined by the relative changes in the inputs (aboveground and belowground net primary production) and outputs (decomposition of plant material and soil organic matter, root respiration and erosion) of C over yearly and longer time scales.
The total global area of lands with a Mediterranean-type climate is about 2.75 million km2 (Rambal 2001). Coupled General Circulation Models (GCM) and ecophysiological models such as GOTILWA predict 1°C warming and 15-20% lower soil water availability for the next three decades in Mediterranean ecosystems as a result of smaller annual amounts of precipitation and also changes in rain distribution (IPPC, 2001; Sabaté et al., 2002), which may alter soil carbon dynamics.
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.
In the present study we evaluate the effect of soil erosion on the annual carbon balance under three representative land uses in a dry Mediterranean ecosystem (,a typical Mediterranean semiarid shrubland with scattered Aleppo pines, (ii) a rainfed olive grove, and (iii) an abandoned agricultural field) and determine the effectof land use changes on the 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 C loss via water erosion for two years, in each of the land use selected.
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 field 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.