

Throop, HL, SR Archer, HC Monger, S Waltman. 2011. When bulk density methods matter: implications for estimating soil organic carbon pools in coarse soils. *Journal of Arid Environments* (In Press)

## Abstract

Resolving uncertainty in the global carbon (C) cycle is paramount to refining atmospheric chemistry and climate predictions. Soil organic carbon (SOC) is a major component of terrestrial C pools, and accuracy of SOC mass estimates are only as good as the multiple measurements and assumptions used to obtain them. Bulk density ( $\rho_b$ ), soil mass per unit volume, is crucial for estimating SOC pools on an areal basis. Here, we review the methods used for calculating  $\rho_b$ , and assess their prevalence. We then show how treatment of coarse fragments (particles >2mm diameter; e.g., pebbles and stones) in soil samples influence  $\rho_b$  values and discuss the implications of these different methods for SOC estimates in drylands. In four dryland soil examples, methods that varied in treatment of coarse fragments led to substantial (up to 26%) differences in  $\rho_b$ . Calculated SOC pools responded proportionally, with SOC differing by up to 518 g C m<sup>-2</sup> to 20 cm depth. We suggest a revised method for properly accounting for coarse fraction volume in  $\rho_b$  calculations. A large portion of the world's soils fine enough to allow  $\rho_b$  determination with cores contain coarse fragments that would substantially impact SOC mass estimates if not explicitly accounted for.