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Soil carbon sources and variations in southern African savannas

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Knowledge of the southern Africa soil carbon pool, its heterogeneity, sources and sinks, and potential response to climate change is extremely limited. In this study the Kalahari Transect (KT) was used as a representative savanna ecosystem to quantitatively evaluate the spatial heterogeneity of the soil carbon pool and its contributing sources. The KT encompasses a dramatic aridity gradient (from $\sim$ 200 mm to more than 1000 mm mean annual precipitation) on relatively homogenous soils. Two sites (Tshane and Mongu) were chosen along the KT, respectively representing dry and wet conditions. In February-March, 2005, soil samples were collected at each site along a 300-m transect. Stable carbon isotope (δ^{13}C) analysis and organic carbon content (%C) were utilized in the assessment through a geostatistical analysis of the spatial patterns observed in the soils. At the dry savanna site, well-defined patterns in both δ^{13}C and %C were observed that were related to the distribution of woody vegetation. At the wet savanna site, the spatial patterns of δ^{13}C and %C were somewhat less pronounced, but still were impacted by the distribution of woody vegetation. The relative contributions from C_3 and C_4 vegetation to the soil carbon pool at the wet site were independent of tree locations, but dependent on woody plant locations at the dry site. The relative contribution of C_3 woody vegetation and C_4 grasses differed at the two sites. At the dry site, $\sim$40% of the soil C was derived from woody C_3 vegetation, whereas at the wet site $\sim$90% of the soil C originated from C_3 vegetation. These results represent a vital step in the understanding the impact of regional climate change on C sequestration in southern Africa by providing quantitative information on soil C

spatial distributions and sources under different climatic conditions.