Utilizing Geostatistics to Increase the Efficacy of Sampling Protocols Used to Measure Soil Organic Carbon

Kiara S. Winans a*, Pierre Goovaerts a, Suhas Wani b, K. Ramesh Reddy a
a Department of Soil and Water Science, University of Florida, Gainesville, FL, 32611, USA
b International Crops Research Institute for the Semi-Arid Tropics (ICRISAT) Patancheru P.O. 502 324, Andhra Pradesh, India

Abstract

Several studies have suggested that geostatistics could increase the efficacy of sampling protocols used to measure soil organic carbon, thereby providing incentives for the management practices that improve soil quality. In this paper, we show how information about the range of spatial autocorrelation can be used to determine the sampling density required for achieving a given accuracy in the estimation of the mean number of soil organic carbon stocks and equivalent carbon credits on a per hectare basis. We quantify the improvement in spatial accuracy resulting from utilizing secondary data. An empirical application to semi-arid cropping systems in a micro-watershed of Andhra Pradesh, India shows that information about the spatial autocorrelation of soil organic carbon could be extremely valuable for incentivizing farmers' management practices that improve soil quality. Accounting for spatial autocorrelation reduces the standard errors and narrow the confidence intervals associated with sample estimates of the mean number of carbon credits produced per hectare. This information may be useful for land-use managers in terms of future challenges in implementing carbon credit policies.

Keywords: *Soil organic carbon (SOC), kriging, spatial autocorrelation, carbon credits, incentivizing farmers' management practices*