Liu, F., X. Ben Wu, E Bai, TW Boutton, SR Archer. 2009. Spatial scaling of ecosystem C and N in a subtropical savanna landscape. **Global Change Biology**: In Press.

Abstract

Widely occurred woody encroachment in grass-dominated ecosystems has the potential to influence soil organic carbon (SOC) and total nitrogen (TN) pools at local, regional, and global scales. Evaluation of this potential requires assessment of both pool sizes and their spatial patterns. We quantified SOC and TN, their relationships with soil and vegetation attributes, and their spatial scaling along a catena (hill-slope) gradient in the southern Great Plains, USA where woody cover has increased substantially over the past 100 years.

Quadrat variance analysis revealed spatial variation in SOC and TN at two scales. The larger scale variation (40-45 m) was approximately the distance between centers of woody plant communities and their adjoining herbaceous patches. The smaller scale variation (10 m) appeared to reflect the local influence of shrubs on SOC and TN. Litter, root biomass, shrub and tree basal area (a proxy for plant age) exhibited not only similar spatial scales, but also strong correlations with SOC and TN, suggesting invasive woody plants alter both the storage and spatial scaling of SOC and TN through ecological processes related primarily to root turnover and, to a lesser extent litter production, as mediated by time of occupancy. Forb and grass biomass were not significantly correlated with SOC and TN suggesting that changes in herbaceous vegetation have not been the driving force for the observed changes in SOC and TN. Because SOC and TN varied at two scales, it would be inappropriate to estimate SOC and TN pools at broad scales by extrapolating from point sampling at fine scales. Sampling designs that capture variation at multiple scales are required to estimate SOC and TN pools at broader scales. Knowledge of spatial scaling and correlations will be necessary to design field sampling protocols to quantify the biogeochemical consequences of woody plant encroachment at broad scales.