Geophysical Research Abstracts, Vol. 8, 05087, 2006
SRef-ID: 1607-7962/gra/EGU06-A-05087

Influence of aeolian processes on biogeochemistry of soils

G.S. Okin, J. Li, L. Hartman, and H.E. Epstein
University of Virginia, Department of Environmental Sciences (okin@virginia.edu)

Since the publication by Schlesinger et al. (Science, 1990) of a general model, arid and semiarid land degradation has been thought of as the reduction or redistribution of net primary production, accompanied by a similar reduction or redistribution of soil resources. Both the action of water and wind in redistributing and removing nutrients have been implicated as possible mechanisms for the reorganization of soil resources. Recent studies have shown that water erosion cannot, by itself, account for the depletion of soil fertility associated with land degradation.

In a large-scale vegetation manipulation experiment in a former semiarid grassland, we have monitored aeolian transport and the change in soil resources. Our results indicate that 1) There is a threshold at lateral cover = 0.09 above which horizontal flux and dust emission are essentially at "background" levels, 2) The horizontal flux is potentially more sensitive to the size distribution of unvegetated gaps than to lateral cover, 3) Aeolian transport is a major cause for the loss of soil nutrients in susceptible environments and increased aeolian flux is adequate to remove more than 20% of the TOC and TN from the surface soils over only one windy season, 4) the range of spatial autocorrelation for samples in plots susceptible to dramatically increased wind erosion increases in a single windy season, and 5) aeolian transport may significantly impact the size of the seedbank in areas undergoing active erosion.

We conclude that: 1) aeolian processes alone are sufficient to explain reduction and redistribution of soil nutrients associated with the islands of fertility model of arid land degradation in wind-erodible systems, 2) significant changes in both the amount and spatial distribution of surface nutrients occur in a single windy season, and 3) biotic changes in terms of viable seeds and photosynthetic rates of extant plants are altered in only two years from initiation of a disturbance.