

A Comparison of Wind and Water Erosion Rates among Grassland, Shrubland, and Forest Ecosystems

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Abstract

Wind erosion is major land surface process that operates in most dryland ecosystems of the world. Although wind erosion has been quantified in several different agricultural lands and ecosystems, methodologies have generally not been sufficiently consistent to allow comparisons among different semiarid ecosystems, such as grasslands, shrublands, and forests. Further, the magnitude of wind erosion relative to water erosion in a given ecosystem may indicate its relative importance as a land surface process, but studies quantifying the wind erosion relative to that of water erosion within and across ecosystems is largely lacking. Our objectives were to (1) estimate wind erosion rates in a semiarid grassland and a semiarid forest, and to compare them with rates reported for a semiarid shrubland, (2) estimate and compare projected wind erosion rates with water erosion rates in these three ecosystems, (3) discuss possible trends and hypotheses about the relative roles of wind and water erosion in semiarid grasslands, shrublands, and woodlands. Based on data from passive Bagnold sample collectors, we found that wind erosion rates at a semiarid grassland site (Aurora, Colorado, USA) and a semiarid forest (Los Alamos, New Mexico, USA) were less than an order of magnitude of those reported for a semiarid shrubland (Carlsbad, New Mexico, USA). We calibrated these wind erosion rates by comparing estimates from a Bagnold sampler to those from a another passive sampler (BSNE) with a known calibration to obtain estimates of wind erosion fluxes for the three sites: grassland, shrubland, and forest. Using meteorological data (wind and precipitation) from each site, we estimated decade-scale total amounts of wind erosion and water erosion at all three sites. Our results indicate water erosion is dominate at the grassland and forest sites, whereas wind erosion is dominant at the shrubland site. On the basis of our results, we present hypotheses about general trends in the roles of wind and water erosion across semiarid grassland, shrubland, and forest ecosystems.