Sediment particle selectivity and its response to overland flow hydraulics within grass strips

Mingjie Luo[1], Chengzhong Pan[1], Yongsheng Cui[1], Yun Wu[2], and Chunlei Liu[1]

[1]Beijing Normal University
[2]Beijing Forestry University

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Abstract

Particle selectivity plays an important role in clarifying sediment transport processes in vegetative filter strips (VFS). 10-m long grass strips at slopes of 5* and 15*were subjected to a series of silt-laden inflows experiments with different particle sizes to investigate the sediment transport and its response to overland flow hydraulics. The inflow sediments came from local soil, river-bed sand, and mixed, with median particle size d50 of 39.9, 207.9, and 77.4 μm, respectively. Three independent repeated experiments were carried for each treatment. The results show that when the sediment trapping lasted for a certain length of time, the re-entrainment of some small-sized particles was greater than the deposition; that is, negative deposition occurred, which was not erosion of the original soil. Negative deposition of particles is mainly determined by the particle diameter. The coarser the inflow sediment particles and/or the steeper the slope, the coarser the particles can be negatively deposited. Deposited sediment causes the VFS bed surface to become smooth and hydraulic resistance decrease exponentially. Stream power P is more suitable than shear stress τ of overland flow to be used to describe the process of sediment particle transport in VFS. The relationship between P and d50 of outflow sediment is very consistent with the form of power function with a constant term. These results are helpful to understand the physical process of sediment transport on vegetation hillslopes.

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