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Clarifying the role of vegetation in sediment transport processes on sparsely-vegetated semi-arid landscapes with Structure from Motion

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On sparsely vegetated arid and semi-arid rangelands, a feedback mechanism is thought to exist between vegetation patches and sediment transport processes. Relationships between plant cover and soil erosion and deposition have historically been inferred from the rates of detachment and transport of sediments presents in samples collected at the outlets of bounded observation areas. These point-scale traditional soil erosion assessment methods lack the spatial resolution needed to differentiate between the oft-described detachment-reducing and deposition-promoting effects of vegetation on net sediment yield. With the advent of low-cost three-dimensional (3D) reconstruction techniques such as Structure from Motion (SfM), it is possible to combine traditional erosion and runoff measurement techniques with 3D soil surface reconstructions to gain insight into the role of the amount and spatial distribution of vegetation in controlling sediment transport processes. In this study, we combine hydrology, soil loss and high-resolution SfM data from rainfall simulation experiments conducted on 84 plots across 7 sparsely vegetated sites of the western United States to understand how detachment and transport processes are impacted by the spatial distribution of vegetation. Previously developed surface change metrics were used to characterize erosion and transport processes from the SfM data and related to hydrology and biotic and abiotic land surface characteristics. This study sheds light into the dynamics of sediment transport on sparsely vegetated landscapes but also provide a framework for the integration of 3D surface change data to augment soil erosion assessment.