Assessing Badland Sediment Sources using UAVs

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Badland erosion is a major sediment source for river systems in drylands (Poesen et al., 2002). Identifying their relevance as sediment sources is critical for measures aimed at reducing reservoir siltation. However, the spatial resolution of commonly available data products on topography is usually not sufficient to calculate sediment losses accurately (Laliberte et al., 2011; Mondal et al., a, 2017b). Unmanned aerial vehicles (UAVs) can help to overcome the gap between traditional, expensive, time-consuming ground-based assessment and insufficient data availability or quality at aerial photography or satellite imagery scale levels. This study investigates the use of UAVs for generating high resolution DTMs of badlands in a remote catchment in the Karoo highveld in South Africa, which is affected by severe soil erosion and reservoir siltation, but where the relevance of badlands as sediment source is unclear. The study describes a workflow for badland erosion estimation with the acquired UAV imagery. The results show that erosion volumes in badlands accounted for only 17.2 % of the reservoir storage capacity in the study area, which indicates that there are additional sediment sources within the catchment.

Laliberte, A.S., Winters, C., Rango, A., 2011. UAS remote sensing missions for rangeland applications. Geocarto Int. 26, 141–156. https://doi.org/10.1080/10106049.2010.534557

Mondal, A., Khare, D., Kundu, S., 2017a. Uncertainty analysis of soil erosion modelling using different resolution of open-source DEMs. Geocarto Int. 32, 334–349. https://doi.org/10.1080/10106049.2016.1140822

Mondal, A., Khare, D., Kundu, S., Mukherjee, S., Mukhopadhyay, A., Mondal, S., 2017b. Uncertainty of soil erosion modelling using open source high resolution and aggregated DEMs. Geosci. Front. 8, 425–436. https://doi.org/10.1016/j.gsf.2016.03.004

Poesen, J., Vandekerckhove, L., Nachtergaele, J., Oostwoud Wijdenes, D., Verstraeten, G., van Wesemael, B., 2002. Gully erosion in dryland environments. Bull LJ Kirkby MJ Eds Dryland Rivers Hydrol. Geomorphol. Semi-Arid Channels Wiley Chichester UK 229–262.