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Comparison of gully erosion estimates using airborne and ground-based LiDAR on Santa Cruz Island, California.

Authors: Perroy, Ryan L.¹ *perroy.ryan@uwlax.edu*
Bookhagen, Bodo²
Asner, Gregory P.³
Chadwick, Oliver A.²

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Abstract: Abstract: Gully erosion removes comparatively large volumes of soil from small areas. It is often difficult to quantify the loss of soil because the footprint of individual gullies is too small to be captured by most generally available digital elevation models (DEMs), such as the USGS National Elevation Dataset. Airborne LiDAR (Light Detection and Ranging) has the potential to provide the required data density, but an even newer class of ground-based sensors may provide better local resolution at lower cost. In this study, we compared digital elevation models produced by airborne and ground-based LiDAR systems with ground-based geomorphic and geodetic survey data to determine their utility in quantifying volumetric soil loss due to gully erosion in a heavily degraded watershed ($7.55 \times 10^{-2} \text{ km}^2$), on southwestern Santa Cruz Island in southern California. Volumetric estimates of the eroded sediment were produced by comparing the LiDAR-

derived DEMs of the gully system to a modeled pre-erosion surface. Average point densities were significantly higher for the ground-based LiDAR system and provided more detailed information; however, its limited scanning footprint and side-looking orientation presented serious challenges in collecting continuous data from deeply incised gullies, making the airborne system preferable for this type of investigation and likely for most applications where heavy topographic shadowing is prevalent. [Copyright & Elsevier]

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Author ¹Department of Geography and Earth Science, University of Wisconsin-La
Affiliations: Crosse, 1725 State Street, La Crosse, WI 5460, USA
²Department of Geography, 1832 Ellison Hall, UC Santa Barbara, Santa
Barbara, CA 93106-4060, USA
³Department of Global Ecology, Carnegie Institution, 260 Panama Street,
Stanford, CA 94305, USA

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