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Recognition of debris-flow deposits and man-made topographic features on an alpine alluvial fan.

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Alluvial fans of alpine torrents are both natural deposition areas for sediment discharged by floods and debris flows and preferred areas for agriculture and settlements. Hazard assessment on alluvial fans depends on proper identification of flow processes and their potential intensity. In this context, the recognition of surficial features in various parts of the alluvial fan is essential to outline areas with evidence of debris flows and areas affected by floods with bed-load. The recognition of man-made features due to human activity development is needed to avoid misinterpretation with natural features and to evaluate their possible role in flow propagation. The detection of surficial features of alluvial fans is commonly obtained by field surveys and interpretation of aerial photographs. An useful integration to traditional methods can be given by high-resolution spatial data from airborne laser altimetry (LiDAR). This study used LiDAR data to examine the morphology of the alluvial fan of a small alpine stream (Moscardo Torrent, Eastern Italian Alps). A high-resolution DEM from ground base LiDAR data was used to calculate shaded relief maps, curvature and an index of topographic roughness at fine scale based on the standard deviation of topography within a moving window. The surface complexity of the alluvial fan, also influenced by human activities, clearly arises from the analysis. Shaded relief maps with varying angles of illumination allowed the identification of landforms ascribed to debris-flow deposits, as well as human-induced features. The curvature parameter and the local topography variability due to surface roughness were also compared with a previous classification of the fan surface based on aerial photo interpretation and field surveys. Results of DEM analysis and field verification demonstrate that topographic analysis of ground base LiDAR DEM can be an useful tool to objectively investigate fan morphology and hence for alluvial fan hazard assessment.