

Topographic Characteristics Derived from UAV Images to Detect Ephemeral Gully Channels

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Abstract : A majority of total soil losses in agricultural areas could be attributed to ephemeral gullies caused by heavy rains in conventionally tilled fields; however, ephemeral gully erosion is often ignored in conventional soil erosion assessments. Ephemeral gullies are often easily filled from normal soil tillage operations, which makes capturing the existing ephemeral gullies in croplands difficult. This study was carried out to determine topographic features, including slope and aspect composite topographic index (CTI) and initiation points of gully channels, using images obtained from unmanned aerial vehicle (UAV) images. The study area was located in Topcu stream watershed in the eastern Mediterranean Region, where intense rainfall events occur over very short time periods. The slope varied between 0.7 and 99.5%, and the average slope was 24.7%. The UAV (multi-propeller hexacopter) was used as the carrier platform, and images were obtained with the RGB camera mounted on the UAV. The digital terrain models (DTM) of Topcu stream micro catchment produced using UAV images and manual field Global Positioning System (GPS) measurements were compared to assess the accuracy of UAV based measurements. Eighty-one gully channels were detected in the study area. The mean slope and CTI values in the micro-catchment obtained from DTMs generated using UAV images were 19.2% and 3.64, respectively, and both slope and CTI values were lower than those obtained using GPS measurements. The total length and volume of the gully channels were 868.2 m and 5.52 m³, respectively. Topographic characteristics and information on ephemeral gully channels (location of initial point, volume, and length) were estimated with high accuracy using the UAV images. The results reveal that UAV-based measuring techniques can be used in lieu of existing GPS and total station techniques by using images obtained with high-resolution UAVs.

Keywords : aspect, compound topographic index, digital terrain model, initial gully point, slope, unmanned aerial vehicle

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