Delineation of Surficial Karst Manifestations using Photogrammetry (Lidar) in Ordovician Carbonates of Colorado Bend State Park, Central Texas

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ABSTRACT

Large-scale delineation and characterization of karst terrains using surficial manifestations of subsurface occurrences is becoming increasingly accessible for researchers. Sinkholes are characteristic of karst topography and represent subsurface groundwater flows which dissolve underlying rocks, mainly limestone, which causes voids or caves. Sinkholes only partially represent void development found in karsted terrains, and are considered significant geohazards. This study, conducted in order to enhance Best Management Practices in karsted terrains, delineated karst features within the Ordovician Ellenburger carbonates in San Saba, Lampasas, and Burnet counties, Texas. The main study area is Colorado Bend State Park where the Texas Speleological Survey had previously identified more than 400 individual karst features. Traditionally surveying karst terrain requires time-intensive, field-based, traverse mapping; with the advent of lidar (light detection and ranging) along with other remote sensing techniques, surveying will be more efficient in large regions. Lidar processing yielded a high resolution digital elevation model (DEM) which was used to locate sinkholes based on DEM surface modeling of slope and overland flow accumulation; however, the resolution of features that were identifiable was limited to features greater than one meter in diameter and more than 20 centimeters deep due to data resolution. Subsequent analyses by raster convolution allowed for automated detection with specific algorithms and rules regulating karst classifications. Satellite and aerial imagery will be utilized in support of the study providing vantage views and remote in situ measurements of individual features prioritizing specific features for further field-based characterization. Using this particular method of karst exploration helps manage time and effort in the field, consequently saving financial burden and providing efficient management of labor. In addition, the use of remote sensing will dramatically increase the area of investigation, enabling more effective delineation of spatial distribution of karst development.

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