

Environmental Monitoring by Using Unmanned Aerial Vehicle (UAV) Images and Spatial Data: A Case Study of Mineral Exploitation in Brazilian Federal District, Brazil

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Abstract : Mining is an important socioeconomic activity in Brazil although it negatively impacts the environment. Mineral operations cause irreversible changes in topography, removal of vegetation and topsoil, habitat destruction, displacement of fauna, loss of biodiversity, soil erosion, siltation of watercourses and have potential to enhance climate change. Due to the impacts and its pollution potential, mining activity in Brazil is legally subjected to environmental licensing. Unlicensed mining operations or operations that not abide to the terms of an obtained license are taken as environmental crimes in the country. This work reports a case analyzed in the Forensic Institute of the Brazilian Federal District Civil Police. The case consisted of detecting illegal aspects of sand exploitation from a licensed mine in Federal District, nearby Brasilia city. The fieldwork covered an area of roughly 6 ha, which was surveyed with an unmanned aerial vehicle (UAV) (PHANTOM 3 ADVANCED). The overflight with UAV took about 20 min, with maximum flight height of 100 m. 592 UAV georeferenced images were obtained and processed in a photogrammetric software (AGISOFT PHOTOSCAN 1.1.4), which generated a mosaic of geo-referenced images and a 3D model in less than six working hours. The 3D model was analyzed in a forensic software for accurate modeling and volumetric analysis. (MAPTEK I-SITE FORENSIC 2.2). To ensure the 3D model was a true representation of the mine site, coordinates of ten control points and reference measures were taken during fieldwork and compared to respective spatial data in the model. Finally, these spatial data were used for measuring mining area, excavation depth and volume of exploited sand. Results showed that mine holder had not complied with some terms and conditions stated in the granted license, such as sand exploration beyond authorized extension, depth and volume. Easiness, the accuracy and expedition of procedures used in this case highlight the employment of UAV imagery and computational photogrammetry as efficient tools for outdoor forensic exams, especially on environmental issues.

Keywords : computational photogrammetry, environmental monitoring, mining, UAV

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