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Investigation of limestone exploitation area and its environmental impacts using GIS/RS techniques: A case study of Margalla Hills National Park, Islamabad

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The principal aim of the current study is to investigate the limestone (LS) exploitation area and its environmental impacts on water, vegetation, soil, etc., using low cost GIS/Remote Sensing techniques. Utilization of LS in Pakistan and other developing countries has been important for cement industry, construction material for roads and buildings, etc., however, extraction of LS from the Margalla Hills National Park (MHNP) cannot be allowed further due to the environmental impacts on the Federal city of Islamabad and Rawalpindi and the resulting degradation of water, soil, vegetation cover, air, etc. Satellite Remote Sensing and Geographic Information System have been proven as a powerful tool and low cost approach for LS exploitation investigation. Four Landsat Thematic Mapper / Enhanced Thematic Mapper satellite images have been taken over a span of 17 years (1992-2009). Digital Image Processing techniques including image enhancement, image classification and change detection have been applied to determine the temporal changes of various classes. Advanced Spaceborne Thermal Emission and Reflection Radiometer and Global Digital Elevation Model have been used for topographic information extraction. According to the results achieved, LS exploitation is deteriorating the ecosystem, biodiversity, landscape, vegetation, water quality and quantity of the MHNP, established in 1980 for the protection, conservation and management of biodiversity and ecosystem. Results of the study suggest that current LS extraction in the MHNP should be stopped immediately to secure the water, soil and air quality and quantity for growing population of the Federal capital city of Islamabad (estimated present population of Islamabad and Rawalpindi is about three to four million inhabitants) and initiatives should be taken for the rehabilitation of the already LS exploited areas of the MHNP and then to suggest alternative LS exploitation sites in the near periphery of Islamabad/Rawalpindi areas with EIA restrictions to avoid long term water, soil and air degradation and pollution.