

Title: Investigation of changes in land use/land cover using principal component analysis and supervised classification from operational land imager satellite data: a case study of under developed regions, Pakistan

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Abstract: Monitoring and understanding Land Use/Land Cover (LU/LC) is critical for sustainable development, as it can impact various environmental, social, and economic systems. For example, deforestation and land degradation can lead to soil erosion, loss of biodiversity, and greenhouse gas emissions, affecting the quality of soil, air, and water resources. The present research examined changes in (LU/LC) within the underdeveloped regions of Balochistan and Sindh provinces, which are situated in Pakistan. In order to monitor temporal variations of LU/LC, we employed Geographic Information System (GIS) technique, to conduct an analysis of satellite imagery obtained from the Landsat 8 Operational Land Imager (OLI) during the time period spanning from 2013 to 2023. In order to obtain an accurate LU/LC classification, we used principal component analysis (PCA) and a supervised classification approach using the maximum likelihood algorithm (MLC). According to the results of our study, there was a decrease in the extent of water bodies (-593.24 km^2) and vegetation (-68.50 km^2) by -3.43% and -0.40% respectively. In contrast, the area occupied by settlements in the investigated region had a 2.23% rise, reaching a total of 385.66 square kilometers. Similarly, the extent of barren land also expanded by 1.60% , encompassing a total area of 276.04 square kilometers, during the course of the last decade. The overall accuracy (94.25% and 95.75%) and K value (91.75% and 93.50%) were achieved during the year 2013 and 2023 respectively. The enhancement of agricultural output in Pakistan is of utmost importance in order to improve the income of farmers, mitigate food scarcity, stimulate economic growth, and facilitate the expansion of exports. To enhance agricultural productivity, it is recommended that the government undertake targeted initiatives that aimed at enhancing water infrastructure and optimizing land use to foster a sustainable ecological framework. Integrating the sustainable ecological framework provides a foundation for informed decision-making and effective resource management. By identifying areas of urban expansion, agricultural intensification, or alterations in natural LU/LC, stakeholders can design targeted conservation strategies, mitigating potential environmental degradation and promoting biodiversity conservation. In conclusion, the integration of GIS and Remote Sensing (RS) may effectively facilitate the monitoring of land use patterns over a period of time. This combined approach offers valuable insights and recommendations for the judicious and optimal management of land resources, as well as informing policy decisions.

Keywords: Land use/land cover, Underdeveloped region, Principal component analysis, Supervised classification, Operational land imager, Environment

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