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Assessment of Land Subsidence Hazard, Vulnerability and Risk: A case study for National Capital Region in India

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Risk assessment and zoning are very important to risk management as it indicates how severe the hazard can be, and who would be most affected. It plays a crucial role in risk management, especially for densely populated areas.

Delhi- the capital of India, is the fifth most populous city in the world, with a population density of nearly 30,000 people per square mile. Like other global megacities, Delhi is also facing a looming water crisis due to urbanization and rapid population expansion. The increasing demand for water has translated into the extraction of larger quantities of groundwater in the region. One of the many consequences of groundwater over-extraction is land subsidence. Amongst all other ways to monitor land subsidence, Interferometric Synthetic Aperture Radar (InSAR) is considered to be the most effective and widely used technique. We used the InSAR technique and analyzed Sentinel-1 data acquired during 2014 - 2020 and identified some localized subsidence zones in the region. In addition to that, a risk assessment was also performed by considering hazards and vulnerability approach.

In this study, a land subsidence risk assessment index was proposed based on the Disaster Risk Index. The cumulative subsidence volume, the land subsidence velocity, subsidence gradient, and the groundwater exploitation intensity were collected, analyzed, and put together to create a land subsidence hazard evaluation map in the National capital region India. The population density, land cover, and population estimates were adopted as indexes to create the vulnerability map. Finally, the land subsidence risk map was created by combining the hazard and vulnerability maps using the matrix multiplication approach. Specifically, the final risk map was classified into three levels, i.e., high, medium, and low. The analysis highlights an approximate area of 100 square kilometers to be subjected to the highest risk level of land subsidence, demanding urgent attention. The findings of this study are highly relevant for government agencies to formulate new

policies against the over-exploitation of groundwater and to facilitate a sustainable and resilient groundwater management system in Delhi NCR.