## Exploring shifting patterns of land use and land cover dynamics in the Khangchendzonga Biosphere Reserve (1992-2032): a geospatial forecasting approach

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Abstract	Global land use and land cover changes (LULCC), driven by natural and anthropogenic factors, are threatening biodiversity and ecological stability in important reserves worldwide, such as the Khangchendzonga Biosphere Reserve (KBR) in the Indian Himalayas. KBR, the third-highest peak in the world, is renowned for its numerous glaciers and rich biodiversity, which includes a wide variety of flora and fauna. This study aims to analyze LULCC for the years 1992, 2002, 2012, and 2022 within the KBR and forecast future trends up to 2032. This study utilized Landsat imagery and the Cellular Automata-Markov (CA-Markov) model, while the support vector machine (SVM) technique was employed for image classification. The validation of the CA-Markov model was conducted using the receiver operating characteristic (ROC) curve. Results reveal a 15% reduction in dense forest cover and a 20% increase in open forests and rocky areas over the past three decades, indicative of the impacts from both human activities and natural disturbances. Projections suggest a further 10% decline in dense forests and a 12% increase in open forests and rocky areas over the next decade. Additionally, a 5% increase in agricultural land and a 3% rise in built-up areas are anticipated. The model's accuracy, as validated by the ROC curve, reached 85%. Future research should aim to enhance model accuracy and incorporate the effects of climate change to improve LULCC projections. This comprehensive assessment underscores the importance of proactive strategies in balancing development with ecological preservation, serving as a crucial resource for policymakers and conservationists in the KBR region.
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