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Peer Review

Review of: "Exploring the Impact of Future Land Uses on Flood Risks and Ecosystem Services, with Limited Data: Coupling a Cellular Automata Markov (CAM) Model, with Hydraulic and Spatial Valuation Models"

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This study offers an integrated and innovative approach to assessing the impacts of future land use changes on flood risks and ecosystem service values in northeast Indiana, USA. By coupling a Cellular Automata Markov (CAM) model with HEC-RAS hydraulic modeling and a spatial Ecosystem Services Valuation (ESV) framework, the research effectively bridges land use forecasting, hydrological-hydraulic simulation, and economic assessment.

A key strength of this work is its methodological integration. The CAM model, implemented in Python and GIS, provides future land cover projections supported by statistical validation. These projections are then fed into a rain-on-grid HEC-RAS model to quantify changes in flood inundation under a design storm scenario. The authors further extend their analysis by monetizing the impacts of these changes using a spatial ESV model, estimating potential ecosystem service losses of up to 1.5 million USD by 2051.

The study demonstrates novelty by combining these three components—land use forecasting, hydraulic modeling, and ESV—into a single workflow, and by using minimal required input data to enhance replicability. The public availability of datasets and code increases the transparency, transferability, and reproducibility of the methodology, making it particularly valuable for application in other data-limited regions.

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However, some limitations should be noted. The use of a single design storm event constrains the generalizability of flood risk predictions across varying climatic conditions. Similarly, while the CAM model projections are statistically validated, potential uncertainties from climate change impacts on rainfall patterns are not explicitly addressed. Including a sensitivity analysis of hydrological parameters and multiple storm scenarios could strengthen the robustness of the conclusions.

Overall, this research represents a meaningful contribution to the field of land use change impact assessment, especially in contexts where data availability is limited. Its integrated modeling framework offers both scientific and practical value, enabling stakeholders to anticipate and mitigate future flood risks while quantifying the associated economic trade-offs in ecosystem services.

Declarations

Potential competing interests: No potential competing interests to declare.