

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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Potential competing interests: No potential competing interests to declare.

The research explores the synergy of the CAM model, HEC-RAS hydraulic model, and spatial valuation model (for quantifying the value of ecosystem services induced by specific land use patterns) within northeast Indiana, US. It also connects future predicted land use patterns within the spatial region with climatic attributes and flood risks, etc. The topic itself is interesting and has scientific novelty. However, many parts of the manuscript should be rewritten in a better manner, or some details in the manuscript have to be explained in a clearer manner.

Major Points to be Addressed

(1) Introduction: The authors have mentioned the use of GIS, remotely sensed datasets, and machine learning techniques to retrieve land use maps, as well as the use of various statistical parameters for assessing the accuracy. They should take reference to some existing studies (especially in developing cities) that have adopted these / some of these approaches in assessing changes in land use patterns. Some references are:

<https://www.mdpi.com/2072-4292/13/16/3337>

<https://link.springer.com/article/10.1007/s10661-023-11224-7>

<https://www.sciencedirect.com/science/article/pii/S1574954122004058>

The authors should add a detailed description / overview of these approaches in the Introduction too.

(2) Paragraph 2 of the Introduction should connect with the sustainable development of society, as well as future smart city mission(s).

(3) Paragraph 5 of the Introduction: What are the “established values” found in the literature? How trustworthy are these “values”? Please give a better account and description of the reliability of these quantities/tables.

(4) Figure 1: How do you obtain these land use maps? The methodology and retrieval processes or the preprocessing of satellite datasets have not been fully discussed and described in the manuscript; please add relevant contents.

(5) Page 5: The authors associated the study with the flood of 1982 and the flood of 2009. What were the inputs in those

studies? Are the methodology/implications applicable and connected to the current study? If so, please provide some specific details.

(6) Section 3.1: How was the process conducted with the aid of a spatial analysis software? Please provide some technical details.

(7) Figure 2B: What are the input datasets?

(8) Table 2: For the ESV coefficients of Urban and Barren Land, the values are 0. Why? Please quantify and explain.

(9) Section 4: The authors should focus more on the advantages and effectiveness of the Python model or packages. Further details should also be included.

(10) Below Figure 3: How are the “validation statistics” parameters being obtained? Via taking temporal average or in other ways?

(11) After Table 3, the authors concluded that water bodies have been the greatest contributor to ESV, but why do other land use types not contribute much to ESV? Please explain with proper observations and references.

(12) Regarding the suggestion given in the Conclusion, how do we determine the number of factors / attributes that we should ingest into the model? Any criteria / categorization was laid down? What are the applications of these modeling approaches in future study?

(13) In Conclusion, the authors mentioned that one can adjust the transition probability matrices to obtain more satisfactory validation results. But how?

Minor Points to be addressed

(1) The title should be changed: Exploring the impact of future land uses on flood risks and ecosystem services: Coupling of Cellular Automata Markov (CAM) with hydraulic and spatial valuation models

(2) Keywords: Please include "(CAM)" after the long form of the model, and please provide the full form of GIS, HEC-RAS, and HEC-HMS respectively before showing the abbreviation.

(3) Introduction: Are the future land use maps generated by applying these matrices as rules iterative to the current and historic data? Or simply historic data?

(4) At the end of the Introduction, the authors stated that some case studies were conducted in places with limited datasets. Do you refer to underdeveloped cities / spatial regions? Perhaps it would be great to include some concrete examples within the context.

(5) Equation (2): What are i and j in your study? $i = j = 5$?

(6) Equation (3) is the “Overall Accuracy.”

(7) Equations (4) and (5): Should be actual_i and predicted_i ? Also, the summations there were presented in a poor manner; please change it to $i = 1$ to N ? Or similar based on the current context.

(8) Section 3.2: Please provide some descriptions and mathematical equations for the following technical terms, including but not limited to “Saint-Venant equations,” “computational mesh” (i.e., what is the mesh adopted in this study); also, you should be discretizing the terrain into a grid that contains N cells (the N should be filled in too).

(9) Table 1: Which data entries were being adopted in this study / research? The table is quite confusing; please only highlight some useful parameters or data entries related to the current study.

(10) Equation (7): What is the summation with respect to?

(11) Page 11: Please show the mathematical equations of the “Full Momentum Method” and “Diffusion Wave Method”. What statistical modeling techniques were included within this study too? The authors should provide details and elaborations of some of these approaches.

(12) After Figure 5, where are the “zonal statistics” as mentioned in the manuscript? Couldn't find any meaningful statistical tables, etc.

(13) About the categorization of colors in Figure 7, what kind(s) of categorization approach are the authors using? The range of the numbers sounds awkward - 0-182, then 182-3963 suddenly?

(14) Conclusion Line 2: The authors mentioned “validation”; what are the datasets and their resolutions? The authors should include relevant details in the Methodology and Data section.

Grammatical Mistakes

(i) Abstract

- The land use map outputs are then ingested into a HEC-RAS hydraulic model...
- give their place to built-up areas,...
- million USD by 2051
- The novelty of this study lies in integrated character...
- This application uses the minimal necessary input....
- publicly available, thus contributing to the transferability

(ii) 1. Introduction

- Page 2: Moreover, future land use can be necessary...
- Page 2: However, to our knowledge....predicted land use maps are analyzed...
- Page 3: especially those related to land cover changes
- Page 3: A hydraulic model is developed in the HEC-RAS software to produce inundation maps under different future land use scenarios

- Page 3: The ESV is performed based on a value transfer....
- Page 3: Another contribution of the present approach is...
- Page 3: Thus, the overall framework can easily be applied to other case studies....

(iii) Section 3.1

- from the land use type i in year t to the land use type...
- and allows us to handle the land use changes...

(iv) Section 3.2

- HEC-HMS was used to create the basin model and delineate it, process the drainage, produce the reaches...
- Page 7: The land use maps can also be inserted into...
- Page 7: For the rain-on-grid simulation, and...

(v) Caption of Figure 2(D): Inserting the land use map layer into the GIS platform

(vi) Table 2: Built-up areas

(vii) Section 3.3: The ESV can then be estimated...; In this paper, this was estimated for each historical year (2011, 2016, and 2021)

(viii) Caption of Figure 5: Land use simulation during the period 2026-2051

After addressing all aforementioned comments, I am happy to provide a review of this manuscript once again. Thank you.