# 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.

**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**

**By Angelos Alamanos**

General comment:

The study provides the prediction of land use maps by relating ecosystem services to evaluate flood risks and associated economic losses. The study has demonstrated how a combination of different approaches - cellular automata model (CAM), ecosystem service valuation (ESV), HEC-HMS, and HECRAS models - enables exploration of the impact of future land uses on flood risks and ecosystem services with limited data. The manuscript contributes to the wide readership of the scientific community in hydrology and spatial land use planning, enabling them to adapt the methods in regions with limited data situations. The flood risks are usually associated with the probability of occurrence of flood events. The author did not provide reasons why limited to a 50-year return period for analyzing floods. Why not a 100-year or 500-year return period?

What are the assumptions in CAM to predict land use maps? How did you calibrate/validate the CAM? What are the parameters embedded in the CAM? What were the assumptions for using climate data/information in the analysis? The manuscript could be improved by including the effect of future climate in the analysis. The change from wetlands to built-up areas, deforestation to agricultural land use, or barren land needs clear assumptions about the economic analyses in line with future government policies to set prices for ecosystem services. The introduction fails to provide information on the existing ecosystem services, flood risks, and associated economic losses based on the reference land use maps.

In general, the manuscript lacks clarity on how the flood outcomes are related to the ecosystem valuation outputs. Moreover, the scope of the study should be indicated in the manuscript. The manuscript could be accepted after incorporating the general and specific comments and suggestions provided in the review.

Specific comments:

The manuscript is submitted without providing numbers to identify sentences in each line and page. Thus, it is difficult to show exactly where changes are required in the manuscript.

Abstract

The abstract needs rewriting. The main outcomes concerning flood magnitude, extent, depth, and associated risks should be briefly described in the abstract.

-In line 13 of the abstract, delete**int** integrated character…

-Limit the keywords to 4 to 5 words.

**1. Introduction**

-Replace (Corner et al., 2013) with Corner et al., 2014. (Islam and Ahmed, 2012) 2011? Please cross-check the citations and complete the listing in the reference section.

-However, the impact of land cover changes**in** potential flood risks is still poorly understood (Rogger et al.,2017),----------
-Please paraphrase the sentence again.---- Replace the preposition in with on.

**2. Study area**

In this section, information about the topography, land use rate, and magnitude of changes in the existing land use maps described in Figure 1 is missing. Besides, salient features of the streamflow inter and intra-annual variations, and extremes should be described to compare the outcomes due to projection of land use maps.

**3. Methods**

-Improve the readability of texts in Figure 2 and all figures in the manuscript.

-It is not clear why the HEC-HMS model is used in this study. The basis for the two models HEC-HMS and HEC-RAS should be provided. Equations related to rainfall-runoff transformation in HEC-HMS, and the Saint-Venant equations (conservation of mass and momentum) need to be described. How did you calibrate and validate the HEC-RAS model?

-Performance measures for hydrologic and hydraulic models should be provided. Describe the upstream and downstream boundary conditions implemented in the HEC-RAS model.

-In Table 2, how will you set the ESV Coefficient (2022 USD/ha/yr) /what are the assumptions to use ESV in future projected land uses?

**4. Results and Discussion**

-In **Figure 4.** The predicted land use areas as number of pixels predicted by the CAM model for CCW.------- The predicted land use maps for different years seem constant. Please provide the predicted rate and magnitude of land use changes in

a tabular form. Why barren land use is missing in Figure 4?

The hydraulic model was formulated in HEC-RAS and the necessary data preprocessing was performed in HEC-HMS, which is often combined with other tools for hydrological data analysis and hydraulic modelling (Pathak and Kalra, 2015; Alamanos and Papaioannou, 2022). The rain-on-grid simulation run with the Full Momentum method, which is more detailed compared to the Diffusion Wave method. The Full Momentum method takes into account the conservation of both momentum and energy as water flows through the channels, while it considers the influence of all the other input factors such as channel shape, roughness, and slope. ----------***This paragraph is a method and it should not appear in the results section. Please avoid mixing methods with results.***

-In **Figure 5.** Maximum water depth and flood extent for each predicted land use simulation for the period 2026 to

2051.----------***Please provide the scale of the flood extent in meters. Discuss the temporal distribution of the flood depths.***

- The simulation results are presented in Figure 5, and the zonal statistics for each case are shown in Figure 5.----------***Please correct it; where are the zonal statistics?***

- **Figure 6.** Flooded area (km2) and flood depth (m) under the predicted land use. ---------***Explain why flood depths are not significant from the years 2036-2051. What is the duration of the presented flood extent? I suggest providing flood extent with a combination of different storm durations for a return period of 50 years and a 100-year return period in one plot.***