IGNITE TALK

Comparative Analysis of Baseline and Advanced Boosting Models for Flood-Prone Area Prediction and Model Explainability: A Case Study from the Upper Draa Basin, Morocco

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Historic floods in the Sahara Desert
A year's worth of rain in 48 hours
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global flood partnership
source : AP

INTRODUCTION

Research Gaps

- Few comparative studies on multiple boosting models
- Low focus on explainability — most studies prioritize accuracy over understanding variable roles.

Role of Machine Learning

AI/ML techniques (e.g., ANN, DT) offer a promising solution:

- Handle complex, non-linear relationships
- Improve predictive accuracy
- Support rapid, non-destructive assessments

Background

In the Upper Drâa Basin, irregular and intense rainfall events in semi-arid regions greatly increase flood vulnerability.

Floods cause major socio-economic and environmental losses, justifying the need to improve flood susceptibility mapping.

Integrating machine learning (ML) with GIS and remote sensing enhances flood prediction and mapping capabilities.

OBJECTIVES

Data Building

Compile geospatial factors

Model Evaluation

Compare boosting models

Robust Validation

Accuracy · F1 · AUC · Cross-val

Decision Support

maps for planning & mitigation

METHODOLOGY

Multi-source data compilation:

Flood inventory

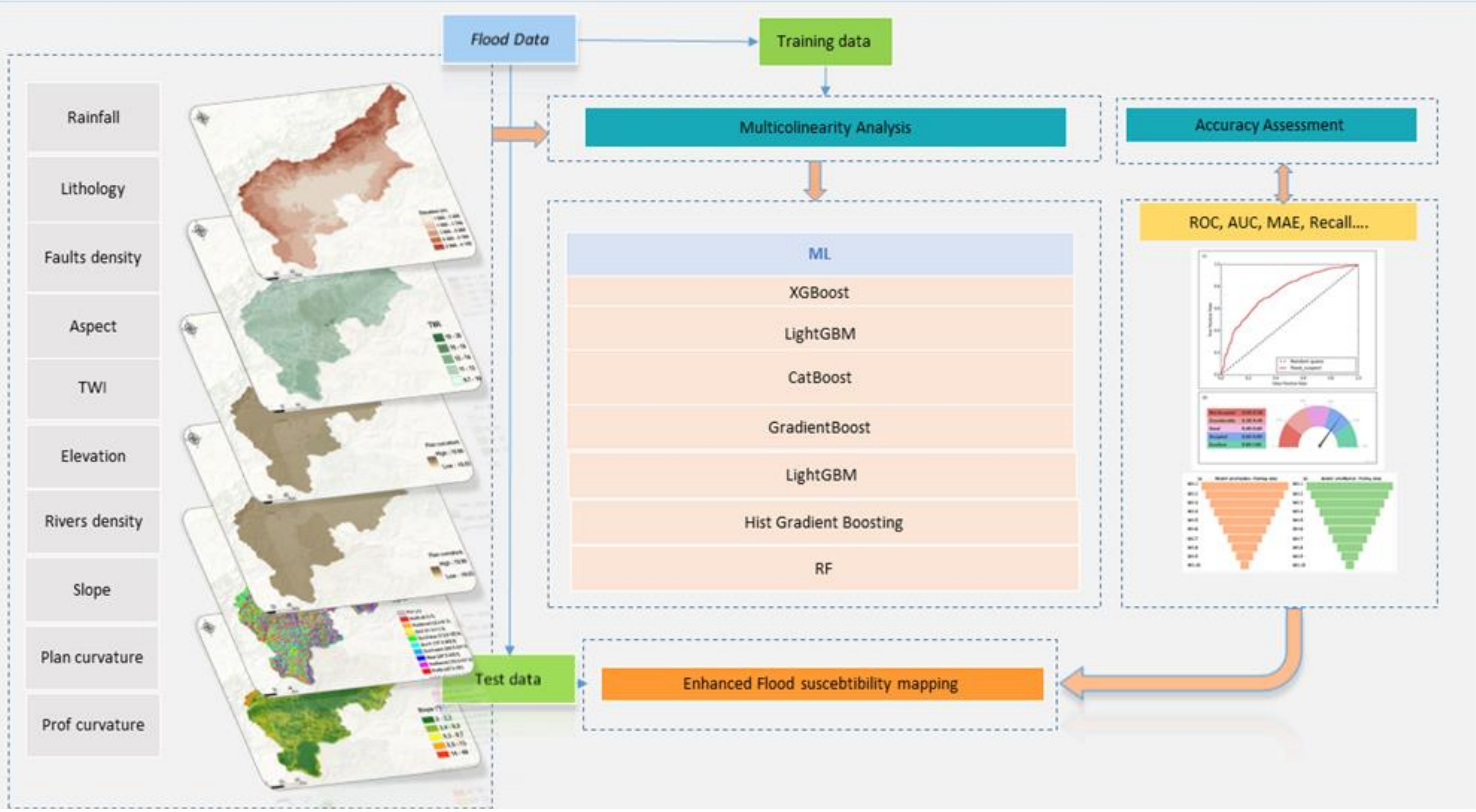
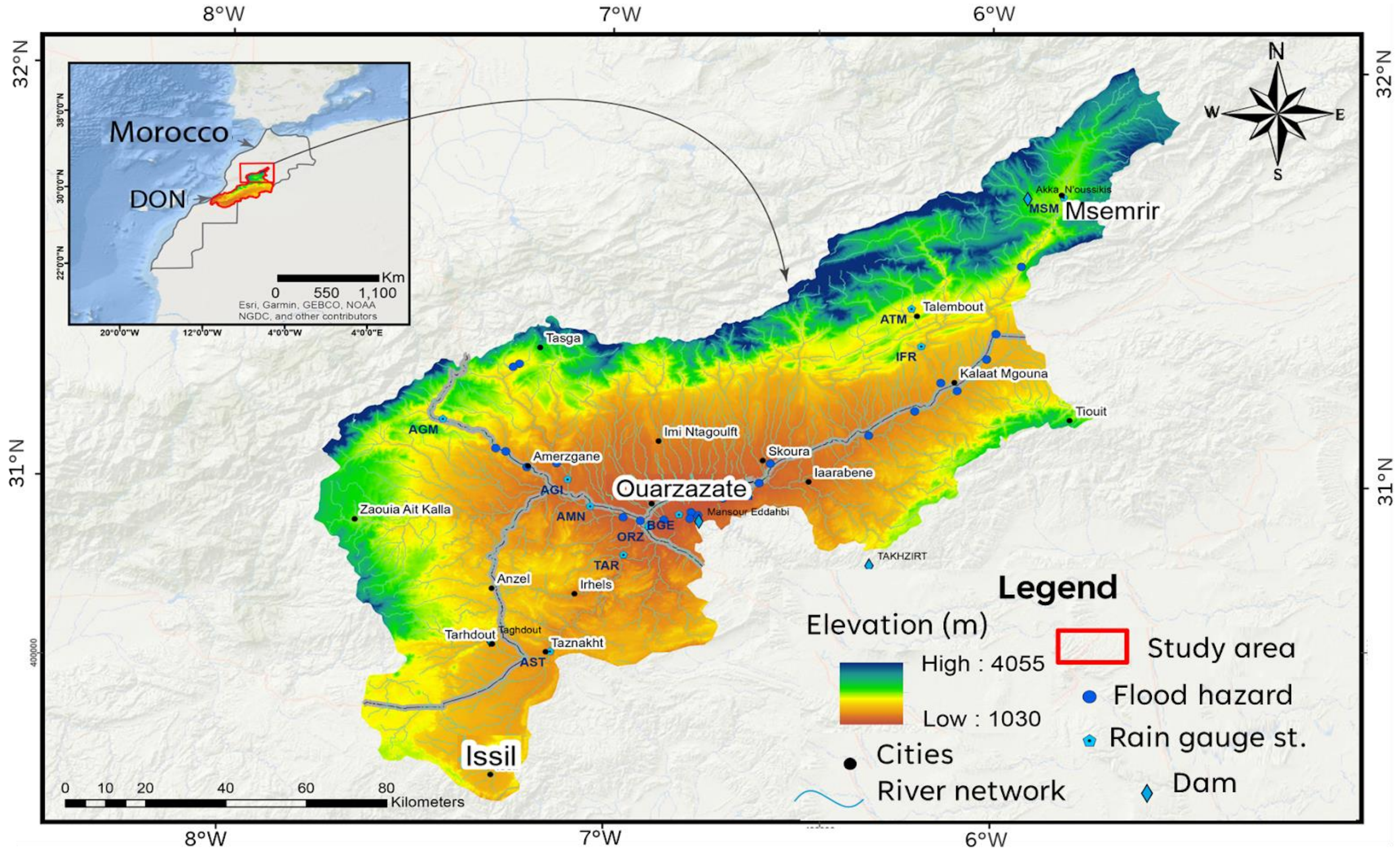


Figure 1. Flow chart of the methodological framework implemented in this study.

Ten conditioning factors were standardized for balanced model training, while the flood inventory from the basin agency and our field visits ensured the spatial reliability of events used for model calibration and validation.

METHODOLOGY

Localization of our basin



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RESULTS

MODEL EVALUATION

$$\text{RMSE}=\sqrt{\frac{\sum_{i=1}^{n}(pi-qi)^2}{n}}$$

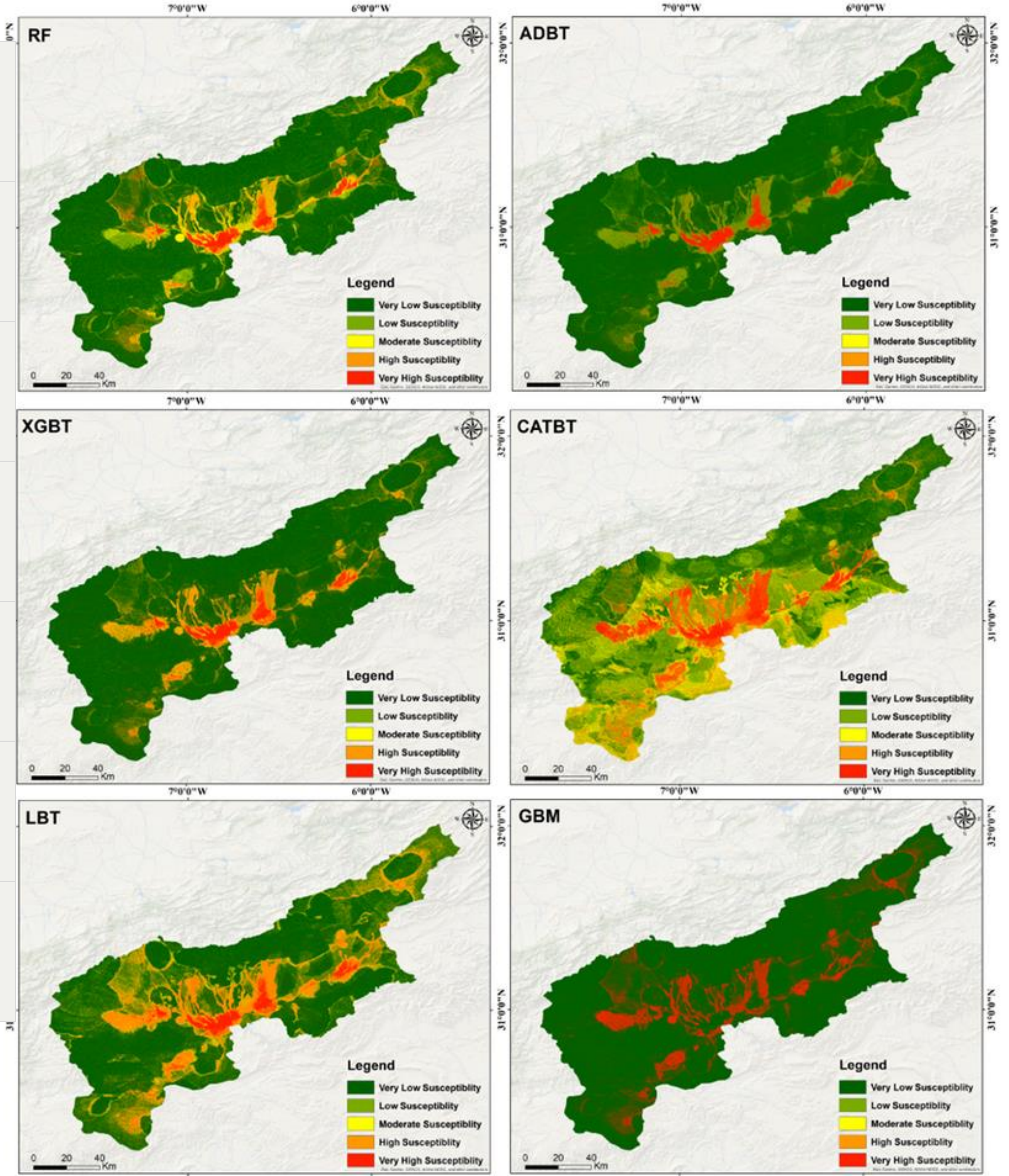
$$\text{MAPE}=\frac{1}{n}\sum_{i=1}^{n}\left|\frac{qi-pi}{qi}\right|\times 100$$

$$\text{MAE}=\frac{\sum_{i=1}^{n}|pi-qi|}{n}$$

Table 1 Performance of the Tested Boosting Models

Model ML	MSE	RMSE	Exactitude (%)	F1-score	AUC
(XGBT)	≈0.09	≈0.30	≈90	≈0.76	≈0.80
(LBT)	≈0.09	≈0.30	≈90	≈0.75	≈0.80
(CATBT)	>0.10	>0.31	<88	≈0.70	≈0.78
(HGBT)	**0.068**	**0.262**	**93.1**	**0.8**	**0.833**
(RF)	>0.11	>0.33	<85	≈0.65	≈0.75
(ADBT)	>0.11	>0.33	<85	≈0.65	≈0.75

Histogram-Based Gradient Boosting



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RESULTS

- High-risk zones: Taznakht, Skoura, Ouarzazate (agricultural & urban areas
- Best models: XGBoost, LightGBM, HistGB (high accuracy & generalization)
- Key factors: River density, TWI, slope, rainfall

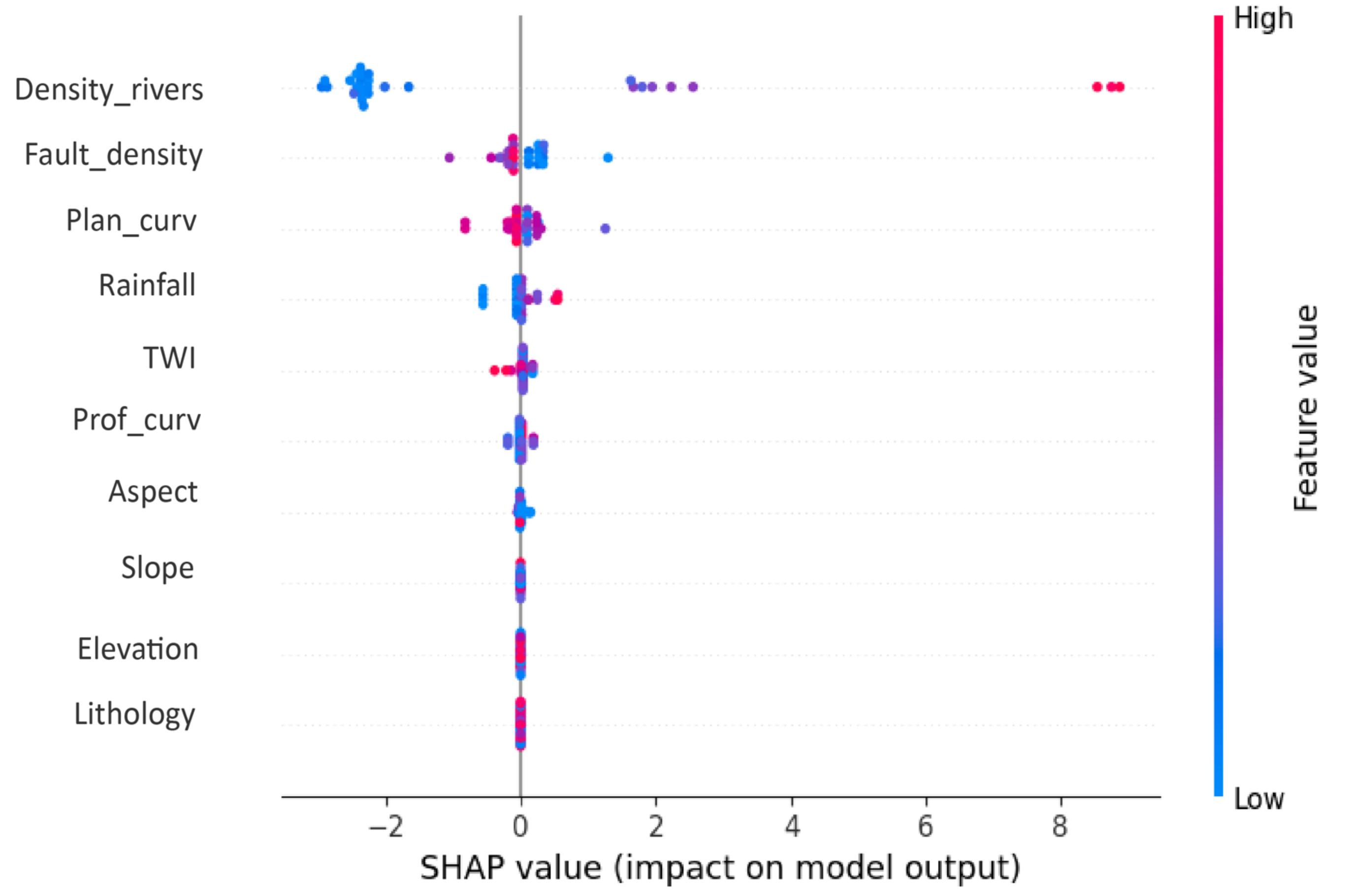

Figure 3. HistGBoost Explainability issued from Shapley Explainability model

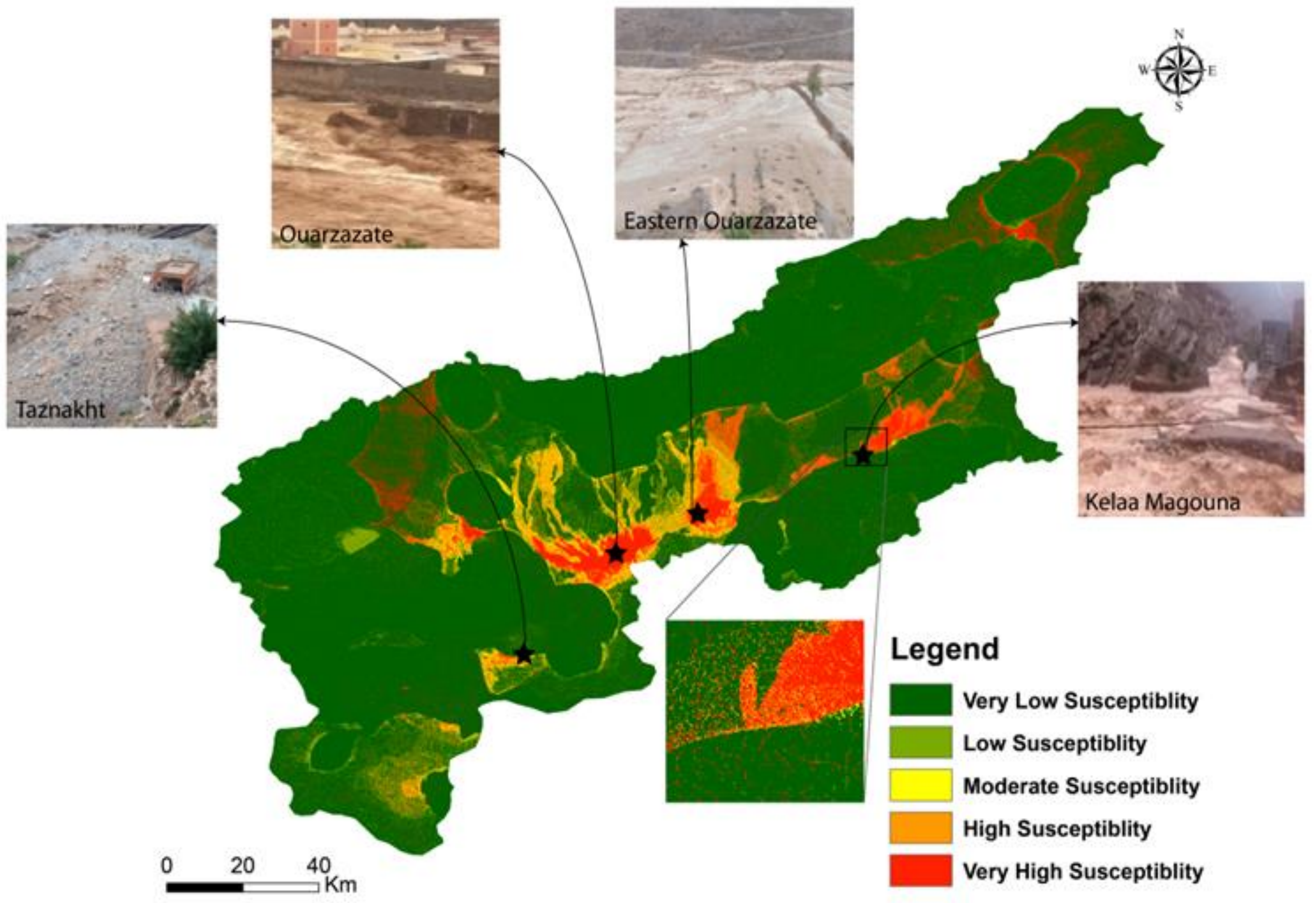

Figure 2. Flood susceptibility mapping in the Upper Draa Basin using the HGBT model, validated by field observations.

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Our contribution
& Reference bibliographies

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Article

Analysis of Baseline and Novel Boosting Models for Flood-Prone Prediction and Explainability: Case from the Upper Drâa Basin (Morocco)

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Integrating geospatial data and analytic hierarchy process for flood-prone zones mapping in the Upper Draa basin, Morocco

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A Comparative Analysis of Analytical Hierarchy Process and Fuzzy Logic Modeling in Flood Susceptibility Mapping in the Assaka Watershed, Morocco

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THANK YOU

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