

Supplementary Materials

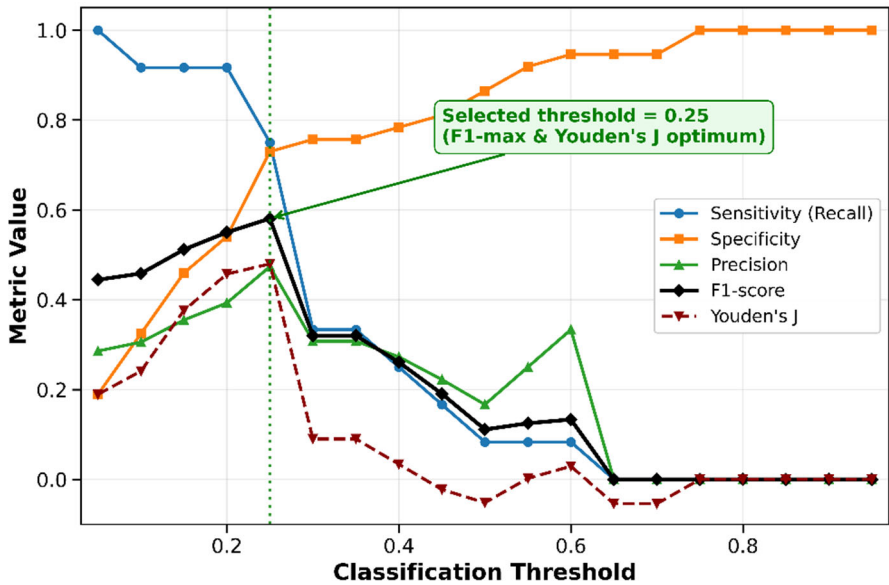
for

Segment-Based Landslide Susceptibility Along Mountainous Road Corridors: Validating Random Forest Model with SLAM LiDAR in Northeastern Iraq

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Supplementary Table S1. Variance Inflation Factor (VIF) values for the ten conditioning factors used in the RF model.

Rank	Conditioning Factor	VIF
1	Mean slope	16.95
2	Relief	14.55
3	Mean elevation	11.42
4	Mean TWI	9.32
5	Minimum distance to drainage	4.28
6	Maximum slope	3.88
7	Mean NDVI	2.21
8	LULC	1.47
9	Minimum distance to road	1.16
10	Mean curvature	1.12



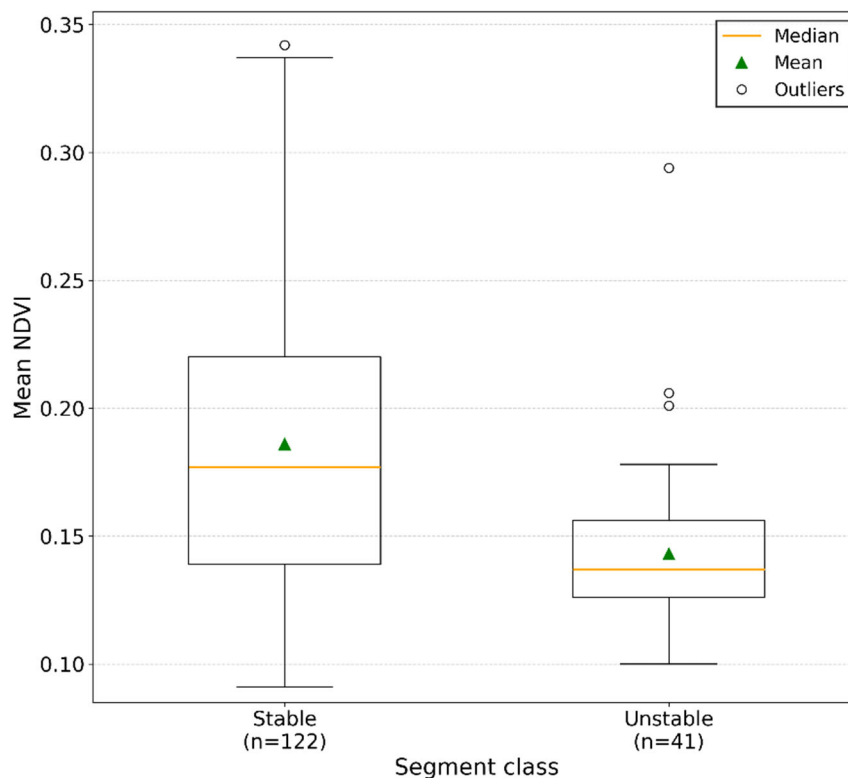
Supplementary Figure S1. Threshold sweep analysis showing the variation in Sensitivity, Specificity, Precision, F1-score, and Youden's J statistic across candidate probability thresholds (0.05–0.95, step = 0.05) evaluated on the independent test dataset. The selected threshold (0.25) corresponds to the highest F1-score and Youden's J statistic among the evaluated thresholds.

Supplementary Table S2. Jenks natural break boundaries used for RF probability and LiDAR–AHP susceptibility classifications in the comparison of the 18 overlapping segments within the 2 km LiDAR subsection.

Susceptibility Class	RF Probability Range	LiDAR–AHP Range
Very low	0.0000 – 0.1405	0.0000 – 4.53175
Low	0.1406 – 0.3282	4.53176 – 5.08247
Moderate	0.3283 – 0.6032	5.08248 – 5.38019
High	0.6033 – 0.9137	5.38020 – 5.88213

Supplementary Table S3. Summary statistics of the Monte Carlo cross-validation (MCCV) analysis (500 repeated stratified train/test splits), showing the mean, standard deviation (SD), and 95% empirical percentile interval for each performance metric.

Performance metric	Mean	SD	95% empirical percentile interval
Accuracy	0.669	0.062	0.551 – 0.786
AUC	0.777	0.069	0.631 – 0.905
Precision	0.418	0.058	0.308 – 0.542
Recall	0.849	0.122	0.583 – 1.000
F1-score	0.557	0.066	0.412 – 0.677
Specificity	0.61	0.084	0.459 – 0.784
Cohen's Kappa	0.341	0.101	0.129 – 0.537



Supplementary Figure S2. Box plot comparing Mean NDVI distributions between stable (n = 122) and unstable (n = 41) segments. Boxes represent the interquartile range, the central line indicates the median, whiskers denote data dispersion, and circles represent outliers.