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Landslide Susceptibility Mapping Using Soft Computing in Amhara Saint

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Abstract : Frequency ratio (FR) and analytical hierarchy process (AHP) methods are developed based on past landslide failure points to identify the landslide susceptibility mapping because landslides can seriously harm both the environment and society. However, it is still difficult to select the most efficient method and correctly identify the main driving factors for particular regions. In this study, we used fourteen landslide conditioning factors (LCFs) and five soft computing algorithms, including Random Forest (RF), Support Vector Machine (SVM), Logistic Regression (LR), Artificial Neural Network (ANN), and Naïve Bayes (NB), to predict the landslide susceptibility at 12.5 m spatial scale. The performance of the RF (F1-score: 0.88, AUC: 0.94), ANN (F1-score: 0.85, AUC: 0.92), and SVM (F1-score: 0.82, AUC: 0.86) methods was significantly better than the LR (F1-score: 0.75, AUC: 0.76) and NB (F1-score: 0.73, AUC: 0.75) method, according to the classification results based on inventory landslide points. The findings also showed that around 35% of the study region was made up of places with high and very high landslide risk (susceptibility greater than 0.5). The very high-risk locations were primarily found in the western and southeastern regions, and all five models showed good agreement and similar geographic distribution patterns in landslide susceptibility. The towns with the highest landslide risk include Amhara Saint Town's western part, the Northern part, and St. Gebreal Church villages, with mean susceptibility values greater than 0.5. However, rainfall, distance to road, and slope were typically among the top leading factors for most villages. The primary contributing factors to landslide vulnerability were slightly varied for the five models. Decision-makers and policy planners can use the information from our study to make informed decisions and establish policies. It also suggests that various places should take different safeguards to reduce or prevent serious damage from landslide events.

Keywords : artificial neural network, logistic regression, landslide susceptibility, naïve Bayes, random forest, support vector machine
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