Kajian Multi Bencana Lahan Pertanian di Kabupaten Magelang = Multi-Disaster Study of Agricultural Land in Magelang Regency

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Abstrak

Penelitian ini mengembangkan model prediktif berbasis Spatial Machine Learning (SML) untuk menganalisis kerentanan multi-bencana pada lahan pertanian di Kabupaten Magelang. Metodologi penelitian mengintegrasikan lima algoritma machine learning yaitu Decision Tree, Random Forest, Support Vector Machine, Artificial Neural Network, dan Gradient Boosting Machine dengan. Model Random Forest menunjukkan performa terbaik dengan nilai AUC 0.81-0.96 untuk semua jenis bencana, dengan akurasi di atas 0.77 dan nilai kappa 0.53-0.79. Hasil analisis mengidentifikasi bahwa 11.11% wilayah (12,522.75 hektar) memiliki potensi bencana kebakaran hutan dan lahan, sementara 22.90% wilayah (25,811.38 hektar) berisiko mengalami kombinasi kekeringan, kebakaran hutan dan lahan, serta banjir. Kecamatan Ngablak dan Pakis teridentifikasi sebagai area dengan kerentanan tertinggi, masing-masing mencatatkan area kerentanan tinggi seluas 507.25 Ha dan 779.51 Ha. Analisis frequency ratio menunjukkan bahwa kemiringan lereng (frequency ratio 1.99-2.0) dan litologi (frequency ratio 1.82-2.0) memiliki pengaruh paling signifikan terhadap kejadian bencana, diikuti oleh faktor curah hujan dan penggunaan lahan yang bervariasi untuk setiap jenis bencana. Model yang dikembangkan berhasil mengintegrasikan analisis multi-bencana dan memberikan pendekatan sistematis dalam menganalisis pola spasial kerentanan bencana pada lahan pertanian.

.....This research develops a Spatial Machine Learning (SML)-based predictive model to analyze multi-hazard vulnerability in agricultural lands in Magelang Regency. The research methodology integrates five machine learning algorithms: Decision Tree, Random Forest, Support Vector Machine, Artificial Neural Network, and Gradient Boosting Machine. The Random Forest model shows the best performance with AUC values of 0.81-0.96 for all types of hazards, with accuracy above 0.77 and kappa values of 0.53-0.79. The analysis results identify that 11.11% of the area (12,522.75 hectares) has potential for forest and land fires, while 22.90% of the area (25,811.38 hectares) is at risk of experiencing a combination of drought, forest and land fires, and floods. Ngablak and Pakis Districts are identified as areas with the highest vulnerability, recording high vulnerability areas of 507.25 Ha and 779.51 Ha respectively. Frequency ratio analysis shows that slope (frequency ratio 1.99-2.0) and lithology (frequency ratio 1.82-2.0) have the most significant influence on disaster occurrence, followed by rainfall and land use factors that vary for each type of disaster. The developed model successfully integrates multi-hazard analysis and provides a systematic approach to analyzing spatial patterns of disaster vulnerability in agricultural lands.