

Evaluasi tingkat kerentanan longsor dilakukan sebagai upaya mitigasi terhadap bencana gerakan tanah. Badan Penanggulangan Bencana (BPBD) Kabupaten Kulon Progo mencatat 429 kejadian longsor terjadi selama kurun waktu 2012-2021 di Kapanewon Girimulyo serta terancam bencana aliran debris. Salah satu kejadian longsor di Dusun Pringtali, Kelurahan Jatimulyo pada tanggal 2 Oktober 2022, berlokasi dekat dengan sungai. Hal ini akan meningkatkan kemungkinan terjadinya aliran debris apabila material berhasil masuk ke badan sungai. Aliran debris pada saluran sempit dan terjal dapat membawa material hingga berkilo meter. Studi ini dilakukan untuk memproyeksikan tingkat kerentanan bencana tanah longsor dan aliran debris dalam skala regional Kapanewon Girimulyo.

Penelitian menggunakan metode *Analytical Hierarchy Process* (AHP) yang mempertimbangkan faktor kemiringan lereng, jenis batuan, curah hujan, sifat geoteknik, struktur geologi, ketebalan tanah, kedalaman muka air tanah, dan tata guna lahan. Data primer didapatkan dari survei geomorfologi dan uji laboratorium, serta data sekunder berupa riwayat data longsor, *Digital Elevation Model*, peta geologi, peta batas administrasi, data curah hujan, dan citra satelit. Metode *Analytical Hierarchy Process* (AHP) dilakukan untuk mengetahui bobot keterpengaruhannya tiap parameter untuk membentuk peta kerentanan longsor awal (*landslide preliminary susceptibility map*). Daerah dengan tingkat kerentanan longsor tinggi hingga sangat tinggi dari hasil analisis AHP digunakan sebagai variabel *source area* dalam perangkat lunak Flow-R bersama dengan data DEM. Pemodelan oleh Flow-R berdasar pada probabilitas dan algoritma energi untuk menilai sebaran aliran dan jarak jangkauan aliran debris sehingga terbentuk peta kerentanan aliran debris.

Penilaian kerentanan longsor menggunakan AHP menunjukkan faktor kemiringan lereng, jenis tanah, dan ketebalan tanah memiliki pengaruh dominan terhadap kejadian longsor dengan bobot 24%, 22%, dan 19%. Peta tingkat kerentanan longsor hasil AHP menghasilkan nilai akurasi 71% berdasarkan metode *overall accuracy*. Analisis penyebaran aliran debris menggunakan Flow-R menghasilkan tingkat kerentanan aliran debris rendah, sedang, dan tinggi yang dipengaruhi oleh faktor topografi dengan area seluas 1.631,05 Ha berpotensi terdampak aliran debris. Akurasi peta kerentanan aliran debris mencapai 81%.

Kedua peta kerentanan hasil metode AHP dan Flow-R dapat digunakan untuk mitigasi tipe longsor yang berbeda. Peta kerentanan longsor hasil analisis AHP dapat digunakan sebagai upaya mitigasi bencana longsor tipe longsor jatuhnya, robohan, gelinciran, dan sebaran karena hanya mempertimbangkan faktor penyebab dan pemicu longsor. Sedangkan, longsor tipe aliran debris dapat diketahui potensi kerentanannya berdasarkan peta kerentanan aliran debris hasil analisis perangkat lunak Flow-R karena telah mempertimbangkan jangkauan dan arah aliran debris.

**Kata kunci:** Longsor, Peta Kerentanan Longsor, AHP, Aliran Debris, Flow-R

The evaluation of landslide is an essential term in mitigation soil movement disasters. The Disaster Management Council (BPBD) of Kulon Progo Regency has recorded 429 landslide incidents that occurred during 2012-2021 in the Girimulyo Subdistrict, along with the potential threat of debris flow. One of the landslide events took place in Pringtali Hamlet, Jatimulyo Village, on October 2, 2022, located near by the river. This situation increases the possibility of debris flow if materials manage to enter the river. Debris flow in narrow and steep channels can transport materials for kilometers. This study was conducted to project the level of landslide and debris flow susceptibility in the regional scale of Girimulyo Subdistrict.

The research utilized the Analytical Hierarchy Process (AHP) method, considering factors such as slope, rock type, rainfall, geotechnical properties, geological structure, soil depth, groundwater depth, and land use. Primary data is obtained from geomorphological surveys and laboratory tests, while secondary data includes historical landslide data, Digital Elevation Models, geological maps, administrative boundary maps, rainfall, and satellite imagery. The Analytical Hierarchy Process (AHP) method is used to determine the influence weights of each parameter to create an initial landslide susceptibility map. Regions identified as having a high to very high landslide susceptibility from the AHP analysis are used as source area variables in the Flow-R software along with DEM data. Flow-R modeling is based on probabilistic and energy algorithms to assess the distribution and runoff of debris flow, resulting in a debris flow susceptibility map.

The landslide susceptibility map assessment using AHP indicates that factors such as slope, soil type, and soil thickness have significant influences on landslide occurrences, with weightings of 24%, 22%, and 19%, respectively. The landslide susceptibility map generated from AHP analysis achieves an accuracy rate of 71% based on the overall accuracy method. The analysis of debris flow distribution using Flow-R reveals low, medium, and high levels of debris flow susceptibility map, influenced by topographic factors. This covering an area of 1,631.05 hectares with potential debris flow impacts. The accuracy of the debris flow susceptibility map reaches 81%.

Both susceptibility maps resulting from the AHP method and Flow-R can be used for mitigating different types of landslides. The landslide susceptibility map generated from the AHP analysis can be applied for landslide disaster mitigation, addressing various types of landslides such as falls, topples, slides, and spreads, as it considers only the causal and triggering factors of landslides. On the other hand, the susceptibility of debris flow, can be determined based on the debris flow susceptibility map, result of the Flow-R software analysis, as it considers the extent and direction of debris flow.

**Keywords:** Landslide, Susceptibility Map, AHP, Debris Flow, Flow-R