# ABSTRACT

Tinalah watershed is situated in Kulon Progo Regency, Yogyakarta Special Province, Indonesia. Tinalah watershed is one of the areas in Kulon Progo Mountains which is susceptible to landslide, due to composing of the hilly morphology and weakness engineering properties of lithology condition. Moreover, it was found that the most landslides are induced by rainfall because of the heavy rainfall area. The landslide occurrences has impact on transportation and human living around the area. Therefore, landslide susceptibility maps are vital for disaster management and planning development activities in the hilly areas. In this research, landslide susceptibility mapping conducted using application of analytical hierarchy process (AHP), statistical index (SI), index of entropy (IOE) and logistic regression (LR).

At the first stage, a landslide inventory map was prepared by carry out field investigation. As a result, 114 landslide locations were mapped, and out of 86 landslides (75.44%) were randomly selected for landslide training model or building landslide susceptibility models, while the remaining 28 landslides (24.56%) were used for validating the models. To assess the landslide susceptibility effectiveness using GIS based on landslide conditioning and triggering factors, there are six factors involved in slope stability. These factors include, slope gradient, lithology, distance from fault, land use, distance from river and rainfall. In this case, the rainfall is one of the most important factors that is considered to produce the landslide susceptibility mapping without consideration of rainfall and with consideration of rainfall data. Each application built two of landslide susceptibility maps and also reclassified into low, moderate and high susceptibility zones. Subsequently, both landside susceptibility maps without consideration of rainfall and with consideration of rainfall derived from AHP, SI, IOE and LR which compared with the increasing of frequency ratio by low and high susceptibility zones. The result showed that frequency ratio of landslide susceptibility analysis with rainfall data is reasonable. Then, the result of frequency ratio with consideration of rainfall data showed that index of entropy and logistic regression were better than statistical index, analytical hierarchy process, respectively. In other hand, the landslide susceptibility map without rainfall and with rainfall by logistic regression model was compared with resulting of area under the curve (AUC) of predicted probability (87.40% and 88.10%).

Finally, the landside susceptibility maps with consideration of rainfall data were used to validate the best model and carried out using receiver operating characteristic curve (ROC) of area under the curve (AUC). The result showed that the area under of the curve was 0.784 (78.40%), 0.688 (68.80%), 0.827 (82.70%) and 0.834 (83.4%) for AHP, SI, IOE and LR, respectively. From the result of area under the curve (AUC), it was concluded that the logistic regression model showed the reasonably good accuracy in predicting the landslide susceptibility in the study area.

**Keywords**: *Landslide susceptibility map, analytical hierarchy process, statistical index, index of entropy, logistic regression, GIS, ROC and AUC.*

# INTISARI

Daerah Aliran Sungai (DAS) Tinalah terletak di Kabupaten Kulon Progo, Propinsi Daerah Istimewa Yogyakarta, Indonesia. DAS Tinalah merupakan salah satu daerah di Pegunungan Kulon Progo yang rentan terhadap tanah longsor, karena menyusun sifat morfologi dan kelemahan teknik litologi kondisi litologi. Lagi pula, ditemukan bahwa tanah longsor banyak disebabkan oleh curah hujan karena daerah curah hujan yang deras. Kejadian longsor berdampak pada transportasi dan kehidupan manusia di sekitar daerah tersebut. Oleh karena itu, peta kerentanan tanah longsor sangat penting untuk kegiatan pengembangan manajemen dan perencanaan bencana di daerah perbukitan. Dalam penelitian ini, pemetaan kepekaan longsor dilakukan dengan menggunakan aplikasi proses hierarki analitik (PHA), indeks statistik (IS), indeks entropi (IE) dan regresi logistik (RL).

Pada tahap pertama, peta persediaan tanah longsor disiapkan dengan melakukan penyelidikan lapangan. Akibatnya, 114 lokasi longsor dipetakan, dan dari 86 tanah longsor (75.44%) dipilih secara acak untuk model pelatihan longsor atau model kerentanan tanah longsor, sedangkan 28 longsor lainnya (24.56%) digunakan untuk memvalidasi model. Untuk menilai keefektifan kerentanan tanah longsor dengan menggunakan GIS berdasarkan pengkondisian tanah longsor dan faktor pemicu, ada enam faktor yang terlibat dalam stabilitas lereng. Faktor-faktor ini meliputi, kemiringan lereng, litologi, jarak dari kesalahan, penggunaan lahan, jarak dari sungai dan curah hujan. Dalam hal ini, curah hujan merupakan salah satu faktor terpenting yang dipertimbangkan untuk menghasilkan pemetaan kerentanan tanah longsor tanpa mempertimbangkan curah hujan dan dengan mempertimbangkan data curah hujan. Setiap aplikasi membangun dua peta kerentanan longsor dan juga direklasifikasi ke zona kerentanan rendah, sedang dan tinggi. Selanjutnya, kedua peta kerentanan lahan tanpa pertimbangan curah hujan dan dengan pertimbangan curah hujan berasal dari PHA, IS, IE dan RL yang dibandingkan dengan peningkatan rasio frekuensi oleh zona kerentanan rendah dan tinggi. Hasil penelitian menunjukkan bahwa rasio frekuensi analisis kerentanan longsor dengan data curah hujan masuk akal. Kemudian, hasil rasio frekuensi dengan data curah hujan menunjukkan bahwa indeks entropi dan regresi logistik lebih baik dari pada indeks statistik, proses hirarki analitis. Di sisi lain, peta kerentanan longsor tanpa curah hujan dan dengan curah hujan dengan model regresi logistik dibandingkan dengan luas area di bawah kurva (ABK) probabilitas prediksi (87.40% dan 88.10%).

Akhirnya, peta kerentanan lahan dengan pertimbangan data curah hujan digunakan untuk memvalidasi model terbaik dan dilakukan dengan menggunakan kurva karakteristik operasi penerima (KOP) area di bawah kurva (ABK). Hasil penelitian menunjukkan bahwa luas kurva di bawah 0.784 (78.40%), 0.688 (68.80%), 0.827 (82.70%) dan 0.834 (83.40%) untuk PHA, IS, IE dan RL. Dari hasil di bawah kurva (ABK), disimpulkan bahwa model regresi logistik menunjukkan akurasi yang cukup baik dalam memprediksi kerentanan tanah longsor di wilayah studi.

**Kata kunci**: *Peta kerentanan tanah longsor, proses hirarki analitik, indeks statistik, indeks entropi, regresi logistik, GIS, dan ABK.*