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Assessing erosion hazard using revised Morgan Morgan and Finney (MMF) erosion model and microtopographic features : A case study in river Oyo sub catchment

Andi Sukman, Prof. Dr. Suratman, M.Sc.; Dr. Dhruvu P. Shrestha

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Degradasi lahan merupakan masalah yang serius di seluruh dunia, dimana erosi merupakan salah satu bentuk degradasi lahan. Penilaian erosi merupakan faktor penting dalam membuat rencana dan strategi konservasi tanah. Penelitian ini bertujuan untuk menilai bahaya erosi menggunakan model erosi Revised Morgan Morgan dan Finney (RMMF) dan microtopographic features di sebuah sub-DAS Sungai Oyo. Model erosi RMMF dipilih karena model tersebut tidak membutuhkan banyak data dan microtopographic features dipilih karena mudah diaplikasikan serta dapat menentukan teknik konservasi tanah terbaik di lokasi penelitian. Peta penggunaan lahan dan bentuk lahan dibuat berdasarkan interpretasi photo udara. Kedua peta tersebut digunakan sebagai arahan pengumpulan data di lapangan untuk menjalankan model RMMF. Pengumpulan data microtopographic features berdasarkan penggunaan lahan, teknik konservasi yang digunakan dan jenis tanaman. Analisa korelasi antara hasil model RMMF dan microtopographic features menggunakan analisa statistik korelasi Spearman Rank. Untuk menentukan teknik konservasi tanah terbaik digunakan uji hipotesis dari data indeks intensitas erosi yang dihasilkan dari metode microtopographic features.

Hasil dari model RMMF menunjukkan bahwa tegalan memiliki laju kehilangan tanah tertinggi (10.3 t/ha/th), sedangkan hutan tanaman sebagai lahan bervegetasi memiliki laju kehilangan tanah terendah (0 t/ha/th). Secara umum, rata-rata laju kehilangan tanah di lokasi penelitian sebesar 3.9 t/ha/th. Proses erosi ditentukan oleh kapasitas angkut dari aliran permukaan. Curah hujan tahunan merupakan faktor paling menentukan terhadap laju kehilangan tanah. Hasil dari model RMMF berbeda dengan microtopographic features. Index intensitas erosi dari kebun campur lebih tinggi dari tegalan. Pada lahan tegalan, kacang tanah yang ditanam pada teras bangku dengan kelerengan teras 8° memiliki indeks intensitas erosi terendah dan kacang tanah yang ditanam pada teras bangku dengan kelerengan teras 8 – 14° memiliki indeks intensitas erosi tertinggi. Koefisien korelasi antara RMMF model dan microtopographic features adalah -0.328 dengan signifikansi 0.274. Model RMMF mengestimasi tegalan memiliki laju kehilangan tanah yang tinggi sedangkan hutan tanaman memberikan perlindungan terbaik terhadap laju kehilangan tanah. Kacang tanah yang ditanam pada teras bangku dengan kelerengan teras 8° merupakan teknik konservasi tanah terbaik di lahan tegalan. Microtopographic features tidak dapat digunakan untuk memvalidasi model RMMF pada penelitian ini karena tidak memiliki korelasi yang signifikan. Hubungan yang tidak signifikan antara model RMMF dan microtopographic features kemungkinan disebabkan oleh curah hujan yang kurang erosi selama penelitian atau kesalahan pengukuran pada metode microtopographic features.

Kata Kunci : penilaian erosi tanah, modeling erosi, RMMF, microtopographic features



Land degradation is a serious problem in the world. Erosion is one form of land degradation. Although erosion is a natural process that creates land surface, human activities can accelerate the process when the land is utilized not properly and over its capability. Erosion assessment is very important to make a planning and strategies of soil conservation. Since the erosion plots are expensive and time consuming, erosion model is often used to quantitatively assess soil loss. Another method is qualitative method which result erosion intensity index or degree of erosion hazard.

This research aims to assess erosion hazard using Revised Morgan Morgan and Finney (RMMF) erosion model and microtopographic features in a sub-catchment of river Oyo. RMMF model was selected since it is not demanding data and microtopographic features was used since it is simple and it can determine the best soil conservation practices. Aerial photo interpretation was used to generate land use map and landform map. Collecting field data for running RMMF model was based on those maps. Collecting microtopographic features data was based on land use, soil conservation practice and crop type. Analyzing correlation between RMMF model and microtopographic features used statistical analysis of Spearman rank correlation. To select the best soil conservation practice, statistical analysis of hypothesis test of erosion intensity index data generated by microtopographic features was used.

The result of RMMF shows that field crops land use has the highest soil loss (10.3 t/ha/yr), the forest plantation as vegetated land use has the lowest soil loss (0 t/ha/yr). In general, average annual soil loss in the study area is 3.9 t/ha/yr. Erosion process is determined by transport capacity of runoff. Annual rainfall is the most determining factor to soil loss. The result of RMMF model is different to microtopographic features. The erosion intensity index of mixed garden is higher than field crops. The result of microtopographic features in field crops land use is that groundnut on 8° outward bench terrace has the lowest erosion intensity index and groundnut on 8 - 14° outward bench terrace has the highest erosion index. Correlation coefficient between RMMF model and microtopographic features is -0.328 with significance probability 0.274.

RMMF estimate the field crops land use has severe soil loss and forest plantation give the best protection to soil loss. Groundnut on 8° outward bench terrace in field crops gives the best soil conservation practice. Microtopographic features can not be used to validate RMMF model in this study since there is no significant correlation between model result and microtopographic features. It is probably caused by not erosive rain intensity during study or error measurement of microtopographic features.

Keywords : soil erosion assessment, erosion modelling, RMMF, microtopographic features