

SIMULASI DAMPAK PERUBAHAN TUTUPAN LAHAN TERHADAP DEBIT DAN SEDIMEN DI DAS MERAWU

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INTISARI

DAS Merawu merupakan bagian hulu dari DAS Serayu yang outletnya berada di Waduk Mrica, Kabupaten Banjarnegara. Berdasarkan informasi dari pengelola waduk, kapasitas waduk Mrica terus mengalami peningkatan sedimentasi dari tahun ketahun yang menyebabkan penurunan kapasitas tampungan air waduk. Salah satu penyebab utamanya adalah tingginya erosi dari DAS Merawu. Penelitian ini bertujuan untuk mengetahui pengaruh perubahan penutupan lahan terhadap debit dan sedimen di DAS Merawu.

Perubahan penutupan lahan dianalisis secara historis dari peta tahun 2006 dan 2022 yang bersumber dari Kementerian Lingkungan Hidup dan Kehutanan dengan skala 1:250.000. Pengumpulan data karakteristik tanah dilakukan dengan observasi lapangan, analisis dengan software *Soil Plant Atmosphere Water* (SPAW), serta analisis di laboratorium. Model hidrologi DAS Merawu dibangun dengan menggunakan model *Soil and Water Assessment Tools* (SWAT) dan dikalibrasi dengan menggunakan algoritma *Sequential Uncertainty Fitting 2* (SUFI-2). Pengaruh perubahan tutupan lahan terhadap debit dan sedimen dihitung dengan membandingkan hasil simulasi dari model SWAT yang sudah terkalibrasi dengan data tutupan lahan tahun 2006 dan 2022.

Hasil analisis perubahan penutupan lahan menunjukkan selama periode 2006 hingga 2022, DAS Merawu mengalami penurunan luas hutan sekunder dan lahan budidaya, yang disebabkan oleh meningkatnya luas hutan tanaman, lahan tidak produktif, lahan terbangun, dan sawah. Model SWAT yang dibangun menghasilkan nilai koefisien determinasi (R^2) sebesar 0,6 dan *Nash-Sutcliffe Efficiency* (NSE) sebesar 0,55 untuk kalibrasi dan menunjukkan nilai R^2 sebesar 0,71 dan NSE sebesar 0,69 saat validasi. Dari hasil simulasi dengan model yang telah terkalibrasi diperoleh informasi bahwa perubahan tutupan lahan yang terjadi selama periode 2006–2022 berdampak terhadap kenaikan rata-rata debit harian sebesar 294,82% dan rata-rata sedimen harian sebesar 662,47%. Kondisi ini menunjukkan bahwa perubahan tutupan lahan berupa berkurangnya tutupan vegetasi berpengaruh pada kenaikan debit dan sedimen di DAS Merawu.

Kata Kunci: SWAT, model, hidrologi, tutupan lahan, DAS

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*SIMULATION OF THE IMPACT OF LAND COVER CHANGE ON
DISCHARGE AND SEDIMENT IN MERAWU WATERSHED*

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ABSTRACT

Merawu Watershed is the upstream part of Serayu Watershed whose outlet is in Mrica Reservoir, Banjarnegara Regency. Based on information from the reservoir manager, the capacity of Mrica reservoir continues to experience an increase in sedimentation from year to year which causes a decrease in the capacity of the water reservoir. One of the main causes is the high erosion in Merawu Watershed. This study aims to determine the effect of changes in land cover on discharge and sediment in Merawu Watershed.

Land cover changes were analyzed historically from maps from 2006 and 2022 sourced from the Ministry of Environment and Forestry with a scale of 1:250,000. Soil characteristic data collection was carried out through field observations, analysis with Soil Plant Atmosphere Water (SPAW) software, and laboratory analysis. The Merawu watershed hydrological model was built using the Soil and Water Assessment Tools (SWAT) model and calibrated using the Sequential Uncertainty Fitting 2 (SUF2) algorithm. The effect of land cover changes on discharge and sediment was calculated by comparing the simulation results from the calibrated SWAT model with land cover data from 2006 and 2022.

The results of the analysis of land cover changes show that during the period 2006 to 2022, the Merawu Watershed experienced a decrease in secondary forest and cultivated land, which was caused by an increase in plantation forests, unproductive land, built-up land, and rice fields. The SWAT model that was built produced a coefficient of determination (R²) value of 0.6 and a Nash-Sutcliffe Efficiency (NSE) of 0.55 for calibration and showed an R² value of 0.71 and an NSE of 0.69 during validation. From the simulation results with the calibrated model, information was obtained that changes in land cover that occurred during the period 2006–2022 had an impact on an increase in the average daily discharge of 294.82% and an average daily sediment of 662.47%. This condition shows that changes in land cover in the form of reduced vegetation cover influence increasing discharge and sediment in the Merawu Watershed.

Keywords: SWAT, Model, Hydrology, Land cover, Watershed

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