

Prediksi Ketersediaan Air Das Citanduy Hulu Dalam Kondisi Perubahan Iklim

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ABSTRAK

Perubahan iklim yang ditandai dengan perubahan pola curah hujan dan peningkatan suhu udara berdampak terhadap ketidakpastian ketersediaan air di daerah aliran sungai (DAS). DAS Citanduy Hulu sebagai daerah tangkapan air utama memiliki peran penting dalam menjaga kontinuitas pasokan air bagi berbagai sektor. Penelitian ini bertujuan mengidentifikasi karakteristik DAS Citanduy Hulu berdasarkan parameter tata guna lahan, jenis tanah, dan kemiringan lereng melalui pembentukan *Hydrologic Response Unit* (HRU), menganalisis tren perubahan parameter klimatologi selama periode 2005–2024 menggunakan uji Mann-Kendall dan Sen's Slope, serta menganalisis ketersediaan air andalan (Q80) berdasarkan hasil simulasi model *Soil and Water Assessment Tool* (SWAT). Pemodelan hidrologi dilakukan menggunakan SWAT dengan data klimatologi ERA5-Land, data spasial, dan data debit observasi, sedangkan analisis debit andalan dilakukan menggunakan Kurva Durasi Aliran (*Flow Duration Curve*) berdasarkan Persamaan Weibull. Hasil penelitian menunjukkan bahwa DAS Citanduy Hulu memiliki luas 65.248,47 ha yang terbagi menjadi 9 Sub-DAS dengan karakteristik tutupan lahan, jenis tanah, dan kelas lereng yang berhasil membentuk HRU sebagai representasi kondisi biofisik DAS. Evaluasi model SWAT menunjukkan peningkatan kinerja setelah dilakukan penyaringan data debit observasi, dengan nilai koefisien determinasi (R^2) meningkat dari 0,05 menjadi 0,47. Analisis Kurva Durasi Aliran menghasilkan debit andalan (Q80) sebesar 13,6 m³/detik, yang menunjukkan debit tersebut memiliki peluang terpenuhi sebesar 80% sepanjang tahun. Dengan demikian, DAS Citanduy Hulu masih memiliki ketersediaan air andalan yang dapat dimanfaatkan secara berkelanjutan, meskipun perubahan iklim telah memengaruhi dinamika hidrologinya, sehingga hasil penelitian ini dapat menjadi dasar ilmiah dalam pengelolaan sumber daya air dan perencanaan adaptasi perubahan iklim di wilayah DAS Citanduy Hulu.

Kata Kunci: perubahan iklim, DAS Citanduy Hulu, SWAT, HRU, Mann-Kendall, debit andalan, Q80

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PREDICTION OF WATER AVAILABILITY IN THE UPPER CITANDUY DAS UNDER CLIMATE CHANGE CONDITIONS

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ABSTRACT

Climate change, characterized by shifts in rainfall patterns and rising air temperatures, has led to uncertainty regarding water availability in watersheds. The Upper Citanduy Watershed, as a major water catchment area, plays a crucial role in ensuring a continuous water supply for various sectors. This study aims to identify the characteristics of the Upper Citanduy Watershed based on land-use parameters, soil types, and slope gradients through the establishment of Hydrologic Response Units (HRUs), to analyze trends in climatological parameters during the 2005–2024 period using the Mann-Kendall and Sen's Slope tests, and to analyze reliable water availability (Q80) based on simulation results from the Soil and Water Assessment Tool (SWAT) model. Hydrologic modeling was performed using SWAT with ERA5-Land climatological data, spatial data, and observed discharge data, while the analysis of reliable discharge was conducted using the Flow Duration Curve based on the Weibull Equation. The results of the study show that the Upper Citanduy Watershed covers an area of 65,248.47 ha, divided into 9 sub-watersheds with characteristics of land cover, soil type, and slope class that successfully formed HRUs as a representation of the watershed's biophysical conditions. An evaluation of the SWAT model showed improved performance after filtering the observed discharge data, with the coefficient of determination (R^2) increasing from 0.05 to 0.47. Analysis of the Flow Duration Curve yielded a reliable discharge (Q80) of 13.6 m³/second, indicating that this discharge has an 80% probability of occurring throughout the year. Thus, the Upper Citanduy Watershed still has a reliable water supply that can be utilized sustainably, even though climate change has affected its hydrological dynamics; therefore, the results of this study can serve as a scientific basis for water resource management and climate change adaptation planning in the Upper Citanduy Watershed

Keywords: climate change, Upper Citanduy Watershed, SWAT, Hydrologic Response Unit (HRU), Mann-Kendall test, dependable flow, Q80

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