NANA MULYANA  Analysis of Forested Cover Area to Green Water and Blue Water Availability in Gumbasa and Cisadane Sub Watershed by Applied SWAT Model supervised by CECEP KUSMANA, KAMARUDDIN ABDULAH and LILIK B. PRASETYO

The relationship between forested area and water yield in a watershed is still uncertain and has been a subject to prolonged debates among foresters. To clarify this problem, in this study a modeling approach has been adopted and tested with collected data from Cisadane sub watershed (1,811.6 ha) in West Java and Gumbasa sub watershed (120,292.3 ha) in Central Sulawesi. The objectives of this study were: a). To determine suitable software which could validate the positive relation between forest cover and the water yield of the forest. b). To determine optimum forest cover in the two sub-watersheds under study and c) To determine the distribution of green and blue waters in the two sub-watersheds. To achieve these objectives, the study has been conducted by first to test several available models for analysis and finally, selecting the most appropriate hydrologic model which could serve the purpose of this study. The SWAT model was selected for further use in this study due to its effectiveness in studying the complex nature of water availability in a watershed, water balance, run-off, evaporation, sedimentation and water quality in a watershed. In order to ensure the suitability of the SWAT model to study the current problem, it was first tested following three steps of model test, namely, the verification and conducted calibration stage in 2007, the validation stage, comparing the results of analysis using SWAT model and observed data in 2008 and finally the simulation stage, resulting in ten probable scenarios determining the relations between forest area and water yields. The results of SWAT model calibration have indicated that the obtained value of $R^2$ was equal to 0.881 and NSE, 0.88. After the validation process the $R^2$ was reduced to 0.72 and NSE 0.7. Using the validated SWAT model, it was found that an increase in forest area would result in the decreasing trend in run-off. In other words that forested area could be used as an effective means to reduce run-off. SWAT analysis for Cisadane upper-catchment had indicated that optimum water availability could be obtained if 44.1% of the area or 799 ha could be covered by forest. Share of green waters availability in Cisadane was 28.13 % and blue waters, 71.87 %, respectively, indicating that this sub-watershed is dominated by the blue waters. The validation test results of SWAT model in Gumbasa sub watershed has given the best correlation between computed results and the observed data where $R^2$ was 0.74 and the NSE, value of 0.79. From the model test it was found that soil moisture content, slope factor and the factor of evaporation from the soil play important roles in controlling water availability in the Gumbasa. The optimum forest cover area in Gumbasa was found to be 53% (63,760 ha), while the distribution of green water in Gumbasa was 51.64% and 48.36 % for blue water, respectively. The optimum of water yield if the forest cover caused balance between run off and recharge. The water yield (WYLD) would optimally be achieved in an increase of run off (Qsurf) offset by rising ground water (Qgw).

Keyword: SWAT Model, Water Yield, Blue Water, Green Water, Cisadane Hulu, Gumbasa