

A method for estimating large scale groundwater recharge depending on forest management practice.

*Sean Hudson¹, Yuichi Onda², Takashi Gomi³, Chen-wei Chiu³, Yosuke Adachi¹

1. University of Tsukuba, Faculty of Life and Environmental Sciences, 2. University of Tsukuba, Center for Research in Isotopes and Environmental Dynamics, 3. Tokyo University of Agriculture and Technology, Graduate School of Agriculture, Department of International Environmental and Agricultural Sciences

The management of abandoned forest plantations in Japan has received significant attention in the past decade, specifically relating to increasing discharge from headwaters catchments through the reduction of evapotranspiration loss (Komatsu et al 2019). While the surface water balance and its associated processes are understood in these catchments, the responses to thinning, especially the response of groundwater recharge has not received enough attention. Additionally, the difficulty and cost in acquiring field measurements of evapotranspiration and runoff makes large spatial-scale forecasts of groundwater availability and recharge difficult. Further, where individual catchments are monitored, the spatial scale is often too small for water resource managers to effectively use in groundwater storage and recharge estimates. Here, we present a model that describes the effects of forest thinning on groundwater recharge rates calculated from stand density and accepted empirically derived models of evapotranspiration components and climate data. Data used in the model include forest inventory data and Japan meteorological agency climate station data. Model inputs are tree height and age, precipitation, and daily received solar radiation. The model output is mapped as a 250m² grid cell to make a GIS database of potential groundwater recharge rates. A simple model using widely available data and able to resolve a large spatial scale models such as this is of great importance to water resource managers especially in areas dependent on surface water who are looking to ground water as stream discharges vary due to climate change. The development of this model represents an interdisciplinary approach to problem solving as forest hydrologists and geomorphologist can share discipline specific knowledge of forest hydrologic processes to engineers, water resource managers and other stakeholders allowing them to make sustainable management decisions of plantation lands and water resources.

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