

Calculation of TN and TP concentration coefficients of river water for each land use by a simple watershed model.

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Water quality deterioration of rivers caused by leakage of fertilizer components such as nitrogen and phosphorus from paddy and upland fields is an environmental problem. Also, runoff of fertilizer components are expected to increase with the accelerated water and sediment runoff by intensification and localization of rainfall caused by climate change. Although it is difficult to predict the place and extent of heavy-rainfall-related disasters, we firstly grasp the average concentrations of nitrogen and phosphorus and predict increase and decrease in those concentrations when the way of rain changes. Nitrogen and phosphorus runoff is dependent on land use and land cover, conservative measures, topography, climate condition mainly rainfall etc.. Among them, the land use and land cover is expected to be a main factor in normal climate conditions. In order to contribute to the prediction of heavy-rain related disasters in the future, coefficients that indicate the total nitrogen (TN) and total phosphorus (TP) load intensity to rivers of each land use for the river watersheds across the country are calculated using a simple watershed land use model. Watersheds whose lower ends are observation points of water quality, and whose land use ratios were determined by GIS technique using published database of DEM (GSI, 10B) and LULC mesh data (JAXA, ALOS AVNIR-2). The TN and TP concentration coefficients of paddy, upland, forest, and urban were calculated by applying the below multiple regression equation using the land use ratios and published TN and TP data (Ministry of Environment).

$$C = a_1 x_1 + a_2 x_2 + a_3 x_3 + a_4 x_4$$

C: TN or TP concentration (mg L⁻¹) a_i : TN or TP concentration coefficient for land use i , x_i : ratio of land use i , Land use: 1;paddy, 2;upland fields, 3;forest, 4;urban

TN concentration coefficient across Japan is 1.67 (from lower limit 95% value 1.34 to upper limit 95% value 2.01), 4.08 (from 3.64 to 4.51), 0.76 (from 0.67 to 0.90), 3.57 (from 3.38 to 3.76) for paddy fields, upland fields, forests and urban areas respectively (n=3256). The TP concentration coefficient is 0.146 (lower limit 95% value 0.119 to upper limit 95% value 0.172), 0.172 (0.138 to 0.206), 0.044 (0.033 to 0.055), 0.267 (0.253 to 0.282) for paddy fields, upland fields, forests and urban areas respectively (n=3256). Prefectural TN and TP concentration coefficients for paddy and upland fields related only loosely to prefectural surplus N and surplus P. On the other hand, prefectural TN and TP concentration coefficients for forests and urban related to prefectural population densities by logarithmic functions with determination coefficients R^2 from 0.45 to 0.48.

Keywords: watershed land-use model, TN, TP, concentration coefficient