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Probabilistic Evaluation of Anthropogenic Regulations In a Vegetated River Channel Using a Vegetation Dynamics Modeling

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Vegetation overgrowth in fluvial floodplains, gravel beds, and sand bars has been a serious engineering problem for riparian management in Japan. From the viewpoints of flood control and ecological conservation, it would be necessary to predict the vegetation dynamics accurately for long-term duration.
In this research, we have developed a stochastic model for predicting the vegetation dynamics in fluvial floodplains with emphasis on the interaction with flood impacts. The model consists of the following four components: (i) long-term stochastic behavior of flow discharge, (ii) hydrodynamics in a channel with floodplain vegetation, (iii) variation of riverbed topography, and (iv) vegetation dynamics on floodplains. In the vegetation dynamics model, the flood discharge (i) is stochastically simulated using a filtered Poisson process, one of the conventional approaches in hydrological time-series generation. The component for vegetation dynamics (iv) includes the effects of tree growth, mortality by floods, and infant tree recruitment.
Vegetation condition has been observed mainly before and after floods since 2008 at a field site located between 23-24 km from the river mouth in Kako River, Japan. The Kako River has the catchment area of 1,730 km2 and the main channel length of 96 km. This site is one of the vegetation overgrowth sites in the Kako River floodplains. The predominant tree species are willows and bamboos. In the field survey, the position, trunk diameter and height of each tree as well as the riverbed materials were measured after several flood events to investigate their impacts on the floodplain vegetation community.
This presentation tries to examine effects of anthropogenic river regulations, i.e. thinning and cutting-down, in the vegetated channel in Kako River by using the vegetation dynamics model. Sensitivity of both the flood water level and the vegetation status in the channel is statistically evaluated in terms of the different cutting-down levels, timings and scales of the thinning, etc., by the Monte Carlo simulation of the model.