

AHW026-P11

Room:Convention Hall

Time:May 27 09:00-10:45

Phosphorus dynamics in ponded shallow reservoir

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Phosphorus rock which is material of fertilizer faces to depletion in this century due to food demand behind human population increasing. Prevention of loss of phosphorus from farmland and reuse the material which includes phosphorus are strongly desired in agriculture because Japan obtains all of phosphate rock from import. Therefore it is important to look for the location of accumulation of phosphorus and to evaluate amount of loosed phosphorus.

The objective of this study is to clarify the mechanism of long-term variation for nutrient discharge in the Seto Inland Sea. Especially, we evaluate nutrient retention efficiency by small weirs on the stream using hydrodynamic ecological model.

The result of simulation for nutrient dynamics in the small reservoir using an eco-hydrodynamics model indicates that phosphorus overflows from water column to downstream in flood event while phosphorus circulates with sedimentation-resuspension inside the reservoir in ordinary condition. The net flux of phosphorus was estimated that 23% of total inflow is trapped in the reservoir and the residue is overflowed toward downstream. On the other hands, the net flux of nitrogen was estimated that 15% of total inflow is trapped as sedimentation, 26% is attenuated by denitrification and the residue is overflowed. These results suggest that the small reservoir has a capability of nutrient retention. The total sediment in the reservoir was estimated 62352 ton include with 42.4 ton of phosphorus. The result was equal to an accumulation of 15 years of estimated sediment. The result suggests that there is a possibility to be resource of phosphorus because the pore water was actually higher concentration than that in the water column. For fertilizer usage, it is an easy way to recycle of phosphorus from extraction of sediment than other material such as steel slag and sewage sludge.

Keywords: Phosphorus, Retention, Agricultural reservoir, Hydro-eco reservoir model, Takaya River