

Soil erosion on agricultural land and sediment management for agricultural watershed in Okinawa, Japan



Kazutoshi Osawa, Ph.D.
Assoc. Prof. of Faculty of Agriculture
Dept. of Environmental Engineering
Utsunomiya University, Tochigi pref., Japan



Soil erosion and runoff have led to agricultural and environmental problems throughout the world. Especially in tropical or subtropical region, the corals have been damaged due to oversupply of sediment and nutrients from the river basin including agricultural zones (Fig.1). Therefore effective measures which can reduce sediment yield in the farmland are necessary. For the purpose, advanced sediment management technique is required.

We carried out long-term continuous and multi-points observations at four test plots in sugarcane fields in Ishigaki Island to compare the amounts of soil loss depending on the difference of agricultural management at each plot. From the observation, zero-tillage perennial farming is found to reduce sediment effectively. Consequently, the Water Erosion Prediction Project (WEPP) model developed by USDA was applied to these test plots in predicting sediment yield at farmland. The WEPP is a physically-based model which can predict sediment detachment, deposition, transports on hillslopes. The results have revealed that the WEPP model is effective to estimate the soil loss at farmlands affected by various agricultural management conditions (Fig.2).

Multi-points observation was carried out at six points in Nagura-river watershed, Ishigaki Island. The time series of water discharge, suspended sediment concentration, and nutrients concentrations were measured for several rainfall events. In the present application to the watershed sediment management, we carried out some case studies to choose proper combination of sediment yield reduction measures. The calculation has shown that sediment runoff at outlet of the watershed can be reduced by 10% if the measures about land deformation are taken into consideration. Another calculation has shown that sediment runoff can be reduced by 74% if the combination of measures about land deformation and about farming program is properly chosen (Fig.3).

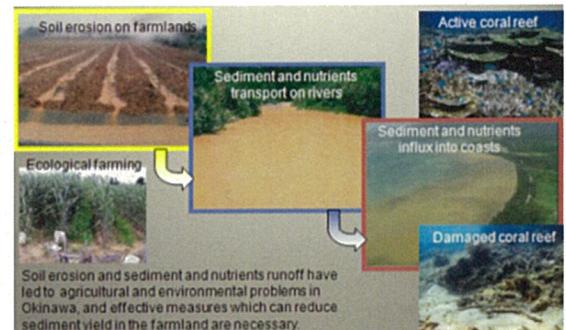


Fig.1 Soil and nutrients runoff problems in Okinawa

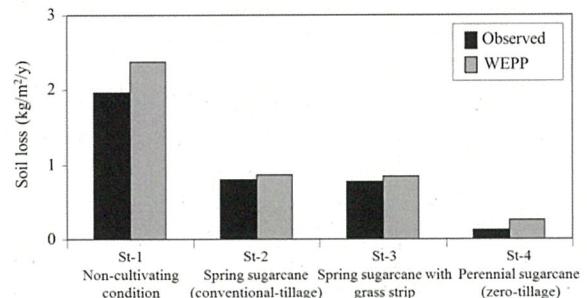


Fig.2 WEPP model verification

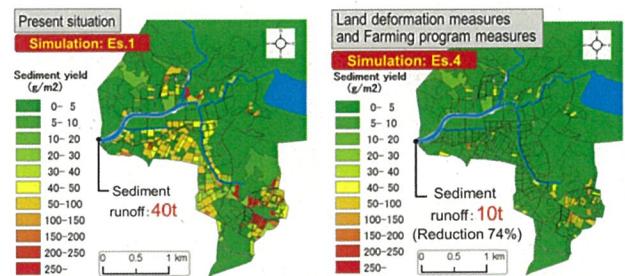


Fig.3 Numerical simulation for sediment management