Japan Geoscience Union Meeting 2011
(May 22-27 2011 at Makuhari, Chiba, Japan)

AHW027-P03 Room:Convention Hall Time:May 23 16:15-18:45

Runoff change in a catchment of decisuous forest without any treatment for sixty years

Makoto Tani[1*], Ikuhiro Hosoda[2]

[1]Grad. School. Agric., Kyoto University, [2]Kansai Br., For. & For. Prod. Res. Inst.

In many hilly moutains in Japan (satoyama) that people collected firewood and muck for hundreds of years, vegetation has been grown up naturally without uses and treatments after the energy revolution around 1960. Its effects on rainfall-runoff responses is widely interested from a view-point of flood control and water resources management. Long-term observations in small catchments with such a vegetation process since early 20th Century can be analyzed for evaluating these effects.

This sdudy tried to assess a data set obtianed from a 60-year observation in Tatsunokuchi-yama Kitatani catchment(17.3 ha, Paleozoic formation) near Okayama City. The annual precipitation and air tempearture were 1236 mm and 13.5 degC.

The annual water balance showed an obvious change in the annual-unit water storage, and the annual evapotranspiration (ET) was controlled by annual air temperature. An intereting finding for ET was an additional increase to this tempearture effect in recent years after 1990.

Using monthly ET estimated from Hamon's Equation (Tani and Abe, Bul. FFPRI 1987) and the annual ET obtained above, a simulation of rainfall-runoff response for the 60 years in this catchment was attempted by a runoff model (HYCYMODEL)(Tani et al., Hydrological Processes in press). Although an additional analysis by a high-resolution data set is needed, our simulation using the daily-data set found no drastic change in the buffering effect of runoff. Revegetation work operated for a bare land in granite mountains can convert ground-surface flow into subsurface flow, providing an obvious buffering effect. However, we can suppose that the period of 60 years was too short for a development of soil producing an increase of the buffering effect.

Our previous study on storm runoff responses in this catchment (Tani., J. Hydrology 1997) demonstrated that the storm runoff volume approached the rainfall volume after the wettest condition for a large storm event of the total rainfall over 300 mm. A HYCYMODEL simulation using the hourly data for one of these large storm evants suggested that runoff buffering potential (Tani, J. Hydrology 2008) still remained valid for this condition.

We can summarize that forest cutting may be desirable for the water use under a dry condition compared to humid climate in Japan because the minimum annual precipitaion of 622 mm was recorded in 1939 and ET has increased in recent yeras after 1990. Nonetheless, a large-scale clear cutting should be avoided from a view point of soil conservation because of the runoff buffering potential mainteined during large storm events.

Keywords: Runoff response, Evapotranspiration, Deciduous forest, Long-term change, Water resource, Satoyama