

Impacts of land use changes on rainfall-runoff relationships in Yasu River basin

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1. Introduction

The Yasu River basin has a catchments area of about 400 sq. km and is located at the head waters of Lake Biwa in Shiga prefecture, Honshu Island, Japan. The rainfall tends to occur in summer from June to September and annual precipitation is about 1600mm. The lower part of the basin is very flat and consists of paddy fields and urban settlements while the upper part has a hilly terrain and is covered mainly by forests. Several townships are located within the basin with a total population of 220,000.

2. Land use changes

Two land use data sets in 1976 and 1997 were used to determine the spatial pattern of landuse changes over the last 20 years. The main landuse classes identified were forest, paddy field, agricultural land, water bodies and golf courses.

The most visible change between the two periods is the conversion of forest areas into golf courses. This shift of land use has contributed mostly to the decrease of the percentage of basin covered by forests which amounts to 2.5%. The golf courses cover 2.3% of the basin area in 1997. The area covered by paddy fields decreased by 1.4% while the built up area coverage increased by 2%. The expansion of the urban area took place in the lower part of the basin downstream of Kashiki and Ukawa gauging stations. There in only a slight effect of urbanization on the forested area where urbanization accounts for 12% of the change between 1976 and 1997.

3. Effects on rainfall runoff

To investigate the effects of the landuse changes on rainfall runoff relationship in the basin a distributed rainfall runoff model was used to simulate flood peaks using landuse data of 1976 and 1997. The land use data for the two years

was used to assign spatially variable roughness coefficient used to simulate the overland flow by kinematic wave model. The results indicate that flood peaks in 1997 are higher and faster as compared to 1976 due to landuse change within this period.

Table 1 Land use changes in Yasu basin 1976-1997.

Land use	(%) Coverage in 1976	(%) Coverage in 1997
Forests	63.4	60.9
Paddy field	18.7	17.3
Buildings (built up area)	4.4	6.4
Water bodies	3.6	3.8
Other land uses	4.2	3.4
Agric. Land	2.6	2.8
Golf courses	0	2.3

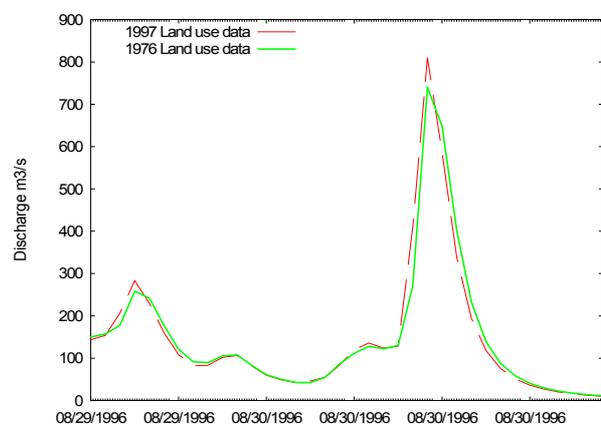


Figure 1 Simulated hydrograph using 1976 and 1997 landuse data in Yasu River Basin.