# VELOCITY DISTRIBUTION IN COMPOUND CHANNELS WITH VEGETATED FLOODPLAIN

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In natural rivers with floodplains, there are many kinds of vegetation on the floodplains. The vegetation on the floodplain strongly affects the resistance of flow. Understanding the hydraulics of flow in a compound channel with vegetated floodplain is very important for determining the stage-discharge curve and for supporting the management of fluvial processes. Otherwise, the hydraulic behavior of overbank flow in compound channels with vegetated floodplains is more complex than that with non-vegetated floodplains. Some authors such as Naot etc.(1996) have drawn attention to the influence of vegetation of the floodplain on the flow behavior. The hydraulic behavior of overbank flow in compound channels with vegetated floodplains is more complex than that with non-vegetated floodplains. How do different types of floodplain vegetation, such as tree, shrub and grass, affect the velocity distribution of overbank flow? All these issues will be discussed in this paper, based on by experimental evidence.

The author carried out 26 groups of preliminary laboratory experiments in a flume of 16 m long and 0.3 m wide at Sichuan University in order that he could investigate the effect of different types of vegetation on the floodplain on the velocity distribution. For vegetation on the floodplain, the author chose plastics grass, duck feathers and plastic straws as model grass, model shrubs and model trees, respectively. Model vegetation was planted on the floodplain over a length of 3 m, between 8.2 m and 11.2 m from the beginning of the compound channel. While the measuring cross-section was located 9.6 m from the beginning of the compound channel. For the measured cross section comprising a main channel and a floodplain, 8 cm and 13 cm wide respectively, with a main channel side slope, s, of 1.5, the author arranged ten verticals. To consider the effect of bed slope, $S_0$, two slopes were used, i.e. 1.25‰ and 0.1785‰. Under the condition of the same bed slope, for every vegetation at least three discharges were considered, 10.95, 14.11 and 17.72 l/s. But for certain cases, a discharge of 22.21 l/s, was also used. For comparisons, the experiments for non-vegetated case were undertaken. ADV was used to measure the local flow velocities

All measured streamwise velocities followed the logarithmic distribution for the case of non-vegetated floodplain, but for vegetated floodplains followed an S- shaped profile, exhibiting three-zones, shown in Fig. 1-2. The resistances to the flow offered by the different types of vegetation were different. In general, the long grass retards the flow the most. After the floodplain was vegetated, the lateral gradient of streamwise velocity increased and the lateral velocity varied complexly. As a result, the apparent shear stress on the main channel/floodplain interface correspondingly increased. As the bed slope decreased, the velocity decreased for a given location, shown in Fig. 2. For all the cases of vegetated floodplain, the influence of bed slope on the velocity distribution was distinct. Even though the bed slope was different, the velocity followed an S-shaped distribution.

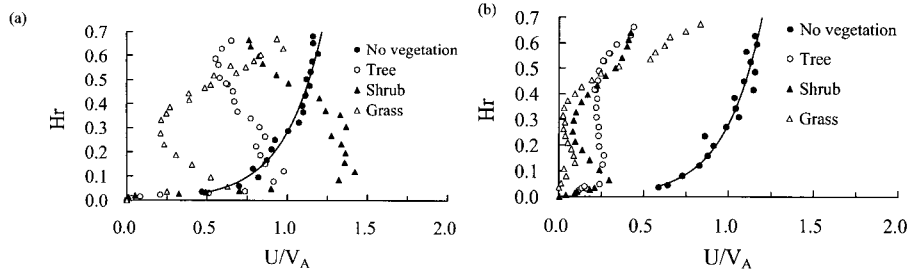


Fig. 1 Vertical distribution of point velocity at different locations, with $S_0$=1.25‰ and Q=17.72 l/s. (a) at the beginning of floodplain (b) near the central line of the floodplain

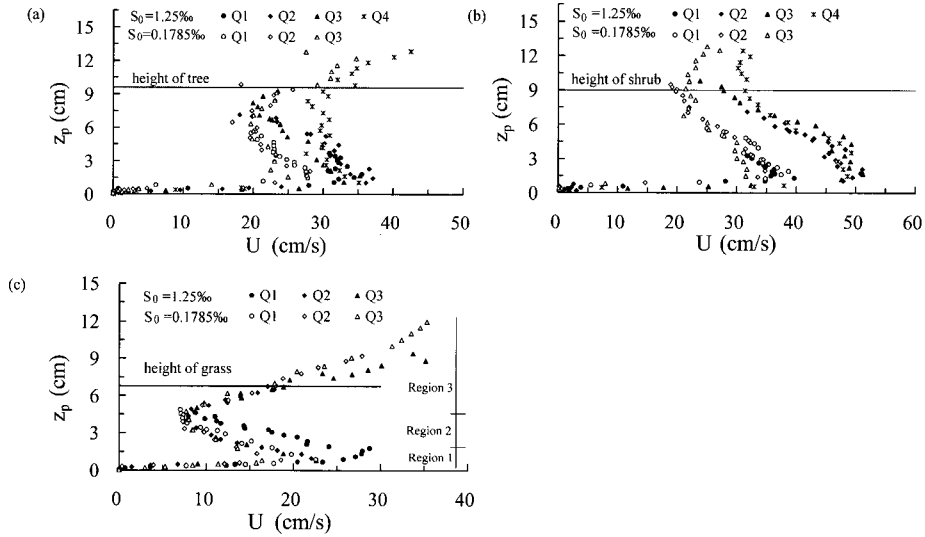


Fig. 2 Vertical distribution of point velocity for different types of vegetation, at the beginning of floodplain.
(a) for tree (b) for shrub (c) for grass. Q1, Q2, Q3 and Q4 refer to 10.95, 14.11, 17.72 and 22.21 l/s, respectively.

## REFERENCES

Naot, D., Nezu, I., Nakagawa, H., 1996. Hydrodynamic behavior of partly vegetated open channels. Journal of Hydraulic Engineering, ASCE, 122(11), pp. 625-633.