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Flow resistance of woody vegetation and velocity estimation for flow over wooded floodplains using dilution gauging and dye tracing

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With increasing interest in improving the conservation value of floodplains by restoring them to their natural habitat such as woodland, it is important to understand interactions between flow and vegetation. Naturally vegetated floodplains tend to retain floodwater on the floodplain for longer periods, and at greater depths due to reduced over-bank flow velocities. Therefore it is necessary to improve our understanding of the flow resistance caused by vegetation on floodplains. .

Examination of velocity profiles within an array of vegetation reveal a complex spatial variation in velocity indicating that it is difficult to quantify mean flow velocity from point measurements of velocity within vegetated zones such as natural floodplains. Therefore this paper presents a method using conductivity and dye tracing techniques developed for measuring mean flow velocity and examining flow patterns on vegetated floodplains where access during flood conditions may be difficult. Additional data on velocity profiles in multi-cylinder arrays in flume experiments assist in the interpretation of the field data.

Video analysis of the dye plume advection and dispersion enables estimation of an approximate surface velocity and shows that the general surface flow tends to migrate towards the edge of the floodplain furthest from the main stream. Analysis of the conductivity traces of the passage of a plume of saline solution past an array of conductivity sensors on the floodplain allows calculation of sub-surface velocities and indicates that the sub-surface flow tends to migrate down the floodplain towards the main channel.

A comparison of the analysis from the dye and conductivity traces shows that the

velocity increases from the bed to the surface, and also suggests a circulatory motion within the floodplain flow from the main channel towards the floodplain at the surface and returning to the main channel closer to the bed.

With knowledge of the flow velocity, and a survey of the vegetation present at the field site, estimation of flow resistance parameters can be reviewed and improved.