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Influence of Wood Density on Backwater Rise due to Large Wood Accumulations

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The backwater caused by the accumulation of wood and large logs in rivers surrounded by tropical forests is determined by the characteristics of the floating material and the approaching flow. Density, as a characteristic of wood logs, determines their buoyancy and depends on the tree species, age, state of decomposition and water content, reaching values between 250 kg/m^3 and over 900 kg/m^3. Despite this apparent relationship, flood hazard studies in rivers with log transport usually do not consider the influence of density.

In the present study, the effect of wood density on the increase in backwater and the shape of the accumulation is evaluated by means of laboratory-scale simulation with pieces of artificial logs for different Froude numbers and approach flow heights. The pieces were manufactured on 3D printers to obtain certain density ranges (400 ±30, 600 ±30, 800 ±30 and 950 ±30 kg/m^3), reduce the possible variation in the moisture content of the wood and facilitate its reuse. Backwater formation was forced by installing vertical steel rack in a control section installed downstream of the test channel. The results of the evaluation show a marked tendency in the increase of the backwater height with the increase of the density of the wood for each approach flow condition evaluated. Regarding the shape of the accumulations, the presence of a carpet form was observed only for the tests with subcritical approach flows, for the tests with supercritical flow, wedge or box shapes were observed for low densities and higher densities, respectively. Likewise, it was observed that the length of the carpet form decreases as the Froude number of the approach flow increases. On the other hand, it was observed that the percentage of retention of pieces of logs in the grid decreases when the density of the logs increases under subcritical flow conditions. The findings of the present investigation demonstrated the interaction between the density of the wood and the different forms of accumulations of logs and the relationship of the density of the wood with the increase in backwater.