Study of the bedload transport in gravel bed rivers (Ardenne, Belgium)

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Bedload transport has been studied in Ardenne rivers using different methods. Experiments with marked pebbles were carried out on gravel bed rivers in order to determine critical parameters of mobilisation. The tracking of more than 1000 elements marked with PIT-tags (Passive Integrated Transponder) has been performed on different sized rivers during three hydrological seasons. These surveys allowed us to determine the initial motion of bed material, to measure the distance of particle travel from flood to flood, to reconstruct the trajectories of pebbles, to analyze the burying of particles into the subsurface layer and to identify the trapping sites and their effects on the bedload progression.

On the same rivers, the thickness of the active bed layer has been measured using scour chains. It appears that the mobilised layer thickness increases with specific stream power. Bedload discharge of several floods has also been estimated crossing the active layer thickness and the mean progression distance of marked pebbles.

Pits have been dug across the bed of a gravel bed stream (catchment area of 12 km²) in order to trap all particles moving on the bed. Volume of sediments trapped has been measured after each flood event and the largest elements mobilised have been measured. These observations show that bedload trapped is clearly more important that bedload discharge estimated by the method of scour chains and marked pebbles. This difference is for the most part explained by the trapping of sandy matrix from the subsurface layer, which is also moving on the bed. In this headwater stream (forested floodplain), the specific bedload discharge is only 0.4 $t.km^{-1}.year^{-1}$. Such a value is relatively low in comparison with other Ardenne rivers (up to 2,5 $t.km^{-1}.year^{-1}$), but may be partly explained by numerous vegetation logjams, which slow down bedload progression and increase bed roughness.