Geophysical Research Abstracts
Vol. 19, EGU2017-304, 2017
EGU General Assembly 2017

Measuring the connections between hydrology and bedload transport to manage nuisance periphyton: a case study from the Pohangina River, New Zealand

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Physical habitat in riverine systems is shaped by erosion and deposition processes which are driven by connectivity between hydrological and sediment regimes. Construction of dams is a major disruption to connectivity in riverine systems. A dramatic increase in periphyton biomass often occurs downstream of dams as a result of increased substrate embeddedness, leading to degraded ecological health for in-stream biota. Flushing flows are often implemented in an attempt to replicate the natural hydrological regime with the aim to scour periphyton during high flows. However, such flushing flows are often not effective. Bed substrate may act as refugia for periphyton during these flushes allowing periphyton biomass to recover within 2 weeks. Flushing flows which do not scour periphyton may increase biomass by increasing nutrient supply. Releasing flushing flows which are capable of turning over substrate may offer a solution by exposing the total periphyton biomass to scouring and abrasion forces.

In order to achieve substrate turn-over, thresholds for incipient motion need to be exceeded. Incipient motion is the result of complex interactions between hydrology and sediment. Conventional entrainment studies have been limited by the difficulty of measuring hydrological connectivity and sediment dynamics in the field, with many studies conducted in flumes. Key entrainment formulae have been derived from these flume experiments. However, the dynamic hydrological conductivity found in natural channels is poorly replicated in many flume studies, resulting in a failure to take hydrological connectivity into account in entrainment formulae.

This paper highlights the need for considering hydrological connectivity in bedload transport studies and how this consideration may help improve the management of aquatic ecosystems. A case study measuring hydrological connectivity and bedload transport in the Pohangina River, New Zealand is provided. The paper also proposes how similar case studies may be used to manage nuisance periphyton.