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The impact of aquatic animals on sediment transport in gravel-bed rivers

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Invertebrate animals have an important and complex role in altering the physical and biochemical environment of marine and freshwater sediments. A database has been compiled which aims to include all published articles that consider how macroinvertebrates alter aquatic systems. The database contains 2300 entries spanning over 120 years of study and representing 800 species. However, only 24 studies focus on invertebrate animals altering geomorphic processes in streams. This is despite the fact that invertebrates are ubiquitous in temperate and tropical rivers; they regularly occur in high densities; and are known to interact with substrates in a multitude of ways; for example when burrowing, moving and foraging for food.

Here, we present two examples that demonstrate the potential biogeomorphic significance of invertebrates in rivers. First, the activity of signal crayfish (*Pacifastacus leniusculus*), a globally widespread invasive crustacean, altered the structure and topography of fluvial substrates in flume experiments. As a result of crayfish destroying grain-scale structures, twice as much material was entrained from disturbed gravel substrates in comparison to control surfaces that had not been exposed to crayfish. Second, Hydropsychid caddisfly larvae bind grains together with silk, which is spun for a variety of purposes including the creation of nets to catch organic matter from the flow. Fine gravels (2–6 mm) that were colonised by natural densities of caddisfly, required significantly greater shear stresses to be mobilised in comparison to uncolonised, control gravels.

Whilst these examples demonstrate the potential for invertebrates to alter sediment transport in rivers, their impacts need to be assessed in field environments and at larger scales in order to fully appreciate their significance. Long-term monitoring of radio-tagged crayfish and suspended sediment transport in the Brampton arm of the River Nene suggests that signal crayfish are important at catchment-scales, with crayfish contributing 45% to the total baseflow suspended sediment load over the monitoring period.

These findings highlight the need for more research on the biogeomorphic impacts of invertebrates in rivers and, in particular, work that assesses animal impacts in field environments, in the context of ecological and sedimentary complexity and in comparison to the hydraulic processes that bring about sediment transport.