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The annual invasive plant, Impatiens glandulifera (Himalayan Balsam) as a trigger for high-magnitude soil erosion in temperate river systems

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The invasive plant, Impatiens glandulifera (common English name: Himalayan Balsam), is now found in most temperate European countries, as well as across large parts of North America and on some Australasian islands. As a ruderal species, it favours damp, fertile soils that experience frequent disturbance. Riverbanks and the riparian zone thus represent prime habitat. Its ability to out-compete most perennial vegetation yet tendency to suddenly die during seasonally cold weather has led to claims that it may promote soil erosion, particularly along inland watercourses. Despite the strong implication, this was only recently proven during an investigation conducted over one dieback and regrowth cycle in 2012/13 along a watercourse in northwest Switzerland. Here we reinterpret those initial findings and also present additional data from the same watercourse which now covers three die-off and regrowth cycles, as well as data over two die-off and regrowth cycles from a river system in southwest UK. Results from all monitoring campaigns strongly support the original conclusion that I. glandulifera promotes significant soil erosion along contaminated sections of riverbank and riparian zone. More specifically, however, approximately one third of the total number of contaminated locations monitored (n=41) recorded net ground surface retreat that exceeded, by at least one order of magnitude, equivalent annual erosion rates documented on cultivated hillslopes in temperate regions. Not only does I. glandulifera induce repeat cycles of colonization and die-off, therefore, but collectively, the results generated so far strongly infer that under certain circumstances, this cycle of events can commonly trigger severe or even extreme erosion. Seasonally induced soil loss of this magnitude, particularly along short sections of watercourses, is unsustainable in the long-term and may lead to key fluvial features undergoing profound morphological and structural changes. Such an effect could reduce the stability, and hence the ability, of riverbanks to offer natural, sustainable flood protection, as well as hamper the capacity of riparian zones to buffer and retain sediment and contaminants during their passage from terrestrial to aquatic environments. Aside from the deleterious effect of large amounts of fine-sediment entering receiving watercourses, a failure of those key geomorphic components to fulfil those fundamental ecosystem services could lead to an eventual breakdown in the hydrogeomorphic functioning of whole river systems. This could make the delivery of effective sediment reduction strategies extremely challenging in the future.