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Riparian plant response and effect traits on alluvial bars

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Within riparian corridors, vegetation establishment is controlled by hydrogeomorphology which in turn is modulated by plant species acting as ecosystem engineers. The potential of different plant species to affect geomorphology according to their exposure to different level of mechanical stress was poorly considered. The comprehension of the variation of morphological and biomechanical response trait attributes of plants is crucial to better understand how pioneer riparian plants succeed in establishing on alluvial bars and affect fluvial geomorphology. We investigated the response of vegetation to hydrogeomorphic constraints and its engineering effect at two spatial scales within the dynamic Allier River, France. At the broader reach scale, we studied on sixteen alluvial bars the aptitude of three dominant pioneer riparian Salicaceae species (Populus nigra L., Salix purpurea L. and Salix alba L.) to establish and to act as ecosystem engineers by trapping fine sediment. At the finer bar scale, we quantified the relation between response trait attributes of young (1-2yrs) P. nigra plants and their exposure to three different levels of mechanical stress. Our results show (i) that the capacity of riparian plants to establish and act as ecosystem engineers depends of species ecology, the age of individuals and on their locations and (ii) that P. nigra plants develop different response traits depending on their exposure to mechanical stress. From a functional trait perspective, our results suggest that interspecific functional trait diversity and intraspecific plasticity of riparian engineer species plays an important role in vegetation resilience and resistance. Trait diversity and plasticity also control the overall capacity of plants to enhance fluvial landform construction at the scale of the alluvial bar.

Keywords: riparian Salicaceae species; fluvial landforms; ecosystem engineer; response and effect plant traits; multi-scale study