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Flow-vegetation-channel morphology feedbacks and coevolution in an alluvial stream.

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The dynamics of alluvial streams results from the feedbacks and coevolution of flow distribution, vegetation and channel morphology. Even though these processes interact on a variety of time and spatial scales, local detailed analysis can provide valuable insights on mechanisms and feedbacks that can affect the long-term evolution of the system. The three-dimensional, time varying flow distribution can be considered the main driving force, but is affected by the channel geometry as a result of stream curvature, stream width changes and in-stream topographic steering. In-stream vegetation also affects flow distribution in a similar way, either reinforcing or attenuating geometric forcing. But as these systems are the result of coevolution, flow patterns in turn affect sediment transport fluxes, erosion and deposition which eventually modify some aspects of the topography, sediment size distribution and vegetative cover. We present in this study a comprehensive set of flow and sediment fluxes obtained in an alluvial stream with different degrees of riparian vegetation establishment. We analyse the effects of curvature, width changes and bedform and vegetation steering on sediment transport and sorting and the resulting changes in flow patterns. We analyse the implications for the long-term coevolution of the different components of the system.