Applying Geomorphic Analysis and Plant Traits to Assess Success of the Little Thompson Restoration Site

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In September 2013, the Colorado Front Range experienced an extreme rainfall event that caused flooding and damage to roads and other infrastructure throughout the region. Consequently, many river reaches, including a reach of the Little Thompson River, were restored. We are developing a framework to assess restoration success of the Little Thompson River using an approach that integrates both ecological and geomorphic aspects of the project, with the ultimate goal of contributing to the knowledge of best practices in river restoration. Despite a process-based approach to channel restoration at the Little Thompson, we predict that typical flows (Q_2) will not connect to the floodplain. During restoration, various species of woody riparian vegetation were planted at the Little Thompson restoration site. Plant traits, such as stem density, flexibility, and basal diameter, exert some control on geomorphic processes. Following a functional traits framework, we investigated whether restoration practices influenced the distribution of traits such that a change in geomorphic response might be expected. Plant distribution and traits were collected for woody species at the restored and upstream reference reach. For five woody species, flexibility (a key control on hydraulic roughness) was measured. Using a linear statistical modeling approach and AIC criterion, the most likely model (F-statistic 44.48; R^2 = 0.64) predicting bending force (flexibility) includes diameter and site ($p < .05$ for all coefficients). Diameter exerted the strongest effect on bending force, displaying a power relationship. However, site had an additional effect with plants at the restored reach requiring more force to bend. Vegetation surveys indicate that, of the vegetation types planted, only willows are thriving, comprising 72% of present vegetation. In contrast, 5 years after project completion, 22% of living woody vegetation recruited naturally, consisting predominantly of cottonwoods that require flood disturbance for recruitment. Currently, the reference reach's plant community is denser and more diverse. We infer human intervention acted as a secondary disturbance, resulting in stilted plant community succession and more rigid plants at the restored reach compared to the reference. The long-term effects of this secondary disturbance on the coevolution of plant communities and geomorphic processes remain unclear.