Process-Based Stream Restoration Effectively Alters Riparian Plant Functional Composition and Diversity

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Process-based stream restoration aims to reestablish natural rates and magnitudes of hydrogeomorphic processes. Successful treatments alter the dominant environmental filters through which riparian plant communities assemble: water availability and fluvial disturbance. Life history strategies and functional traits of streamside vegetation can be used to gauge treatment efficacy. We used plant functional traits, shifts in vegetative reproductive strategies, before-after-control-impact monitoring, and Bayesian statistical analysis to determine whether process-based treatments, including beaver dam analogs and plug and ponds, effectively altered environmental conditions and achieved restoration targets. Changes in community-level functional traits and vegetative reproductive strategies provided information on whether process-based stream restoration successfully raised water tables or increased overbank flooding, and how riparian plant communities responded to ecosystem alterations. Shifts in functional traits and reproductive strategies have implications for ecosystem services including nutrient cycling, carbon storage, wetland habitat quality. They also guide whether seeding or sodding is optimal in restoring riparian zones. Bayesian analysis of BACI functional composition data provides an estimate of the probability of achieving a specific desired effect size (e.g., ≥20% in cover of obligate wetland plants). As process-based treatments become more common, our approach helps evaluate their effectiveness, aiding decision-makers and managers in balancing costs and conservation of riparian ecosystems.

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