Soil bioengineering to restore riparian connectivity

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Résumé

In urbanised areas, rivers and riparian ecosystems are often the last ecological corridors available for wildlife movement. At the same time, riverbanks are often stabilised by civil engineering structures (dykes, riprap). This can lead to habitat degradation and loss of landscape connectivity. Soil water bioengineering structures like live toe fascines (tied bundles of willow) could be an alternative to riprap as they maintain the quality of natural ecosystems by using native plant species instead of rocks. Nevertheless, their potential positive impacts on landscape connectivity remain to be evaluated.

We proposed a landscape scale decision-making methodology for river managers to prioritize bank restoration by converting riprap into soil bioengineering to improve landscape connectivity. We applied our methodology to a case study of a 25 km stretch of the Arve River in France. We selected four target vertebrate species based on biological traits to cover a wide range of dispersal capacities: Eurasian beaver, common toad, common sandpiper and barred grass snake. For each species, we used landscape graphs and the Probability of Connectivity index PC to assess habitat connectivity under three contrasting riparian management scenarios. Scenarios included replacing all natural banks with ripraps, replacing all ripraps with fascines or replacing existing fascines with ripraps. In addition, we systematically tested the effect of replacing individual 100 or 500 m sections of riprap with fascines to identify where riparian restoration would maximise connectivity gains.

The four selected species responded very differently to the scenarios (up to +14% and +46% change in probability of connectivity (PC) for common toad and Eurasian beaver, respectively, 0% for common sandpiper and barred grass snake). Restoration of specific riparian sections could result in important gains in PC (up to +33% for a single section for one species), but no section maximised connectivity gains for all target species. These results highlight the fact that it can be difficult to improve landscape connectivity for taxa with different needs. In the context of riverbank restoration projects, watercourse managers may have to choose which target taxon(s) to favour according to their budgetary and technical constraints.

Mots-Clés: ecological connectivity, graph theory, riverbank, vertebrates, ecological restoration

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