

[Time is no healer: increasing restoration age does not lead to improved benthic invertebrate communities in restored river reaches \(Leps et al. 2016\) \[1\]](#)

Evidence for successful restoration of riverine communities is scarce, particularly for benthic invertebrates. Among the multitude of reasons discussed so far for the lack of observed effects is too short of a time span between implementation and monitoring. Yet, studies that explicitly focus on the importance of restoration age are rare.

We present a comprehensive study based on 44 river restoration projects in Germany, focusing on standardized benthic invertebrate sampling. A broad gradient ranging from 1 to 25 years in restoration age was available. In contrast to clear improvements in habitat heterogeneity, benthic community responses to restoration were inconsistent when compared to control sections.

Taxon richness increased in response to restoration, but abundance, diversity and various assessment metrics did not respond clearly. Restoration age was a poor predictor of community composition and community change, as no significant linear responses could be detected using 34 metrics. Moreover, only 5 out of 34 tested metrics showed non-linear shifts at restoration ages of 2 to 3 years. This might be interpreted as an indication of a post-restoration disturbance followed by a re-establishment of pre-restoration conditions. BIO-ENV analysis and fourth-corner modeling underlined the low importance of restoration age, but revealed high importance of catchment-scale characteristics (e.g., ecoregion, catchment size and land use) in controlling community composition and community change.

Overall, a lack of time for community development did not appear to be the ultimate reason for impaired benthic invertebrate communities. Instead, catchment-scale characteristics override the effectiveness of restoration. To enhance the ecological success of future river restoration projects, we recommend improving water quality conditions and catchment-scale processes (e.g., connectivity and hydrodynamics) in addition to restoring local habitat structure.

Highlights

- Restored rivers were analyzed for benthic invertebrate community change over time
- Restoration age was a poor predictor of community composition and community change
- Non-linear community shifts revealed post-restoration disturbance effects
- Catchment-scale characteristics overrode the effectiveness of river restoration
- Hydromorphological restoration alone was not sufficient to repair communities

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