

# Loss of environmental heterogeneity and aquatic macroinvertebrate diversity following large scale restoration management

W.C.E.P. Verberk<sup>a,b,\*</sup>, R.S.E.W. Leuven<sup>c</sup>, G.A. van Duinen<sup>a,c</sup> & H. Esselink<sup>a,b†</sup>

<sup>a</sup>Bargerveen Foundation, Radboud University Nijmegen, P.O. Box 9010, 6500 GL Nijmegen; <sup>b</sup>Radboud University Nijmegen, Institute for Wetland and Water Research, Department of Animal Ecology and Ecophysiology, Heijendaalseweg 135, 6525 AJ Nijmegen, The Netherlands; <sup>c</sup>Radboud University Nijmegen, Institute for Wetland and Water Research, Department of Environmental Science, Heijendaalseweg 135, 6525 AJ Nijmegen, The Netherlands.

## Abstract

Restoration management frequently focuses on recreating suitable environmental conditions for a 'target vegetation'. This approach neglects the importance of habitat diversity and spatial configuration for individual species. Here, we investigate the role of environmental heterogeneity in a restoration context and report the response of aquatic macroinvertebrates to re-wetting measures, which were taken to mitigate desiccation in a bog landscape. Because only parts of the study area were affected by re-wetting measures, changes in aquatic macroinvertebrates could be compared between re-wetted and non-re-wetted parts. In addition, species were grouped into life-history strategies to test whether the invertebrate response differed between functional species groups.

Total species numbers declined in the re-wetted parts and invertebrate assemblages became more similar both in terms of species and life-history strategies. These results indicate that large-scale re-wetting caused a functional homogenization. Changes in environmental conditions following re-wetting could be consistently related to changes in strategy composition. Retention of rainwater decreased the influence of groundwater. Here species increased that are adapted to physiological stress as well as those employing risk spreading, which indicates that environmental conditions had become harsher and less predictable. In contrast, reduced drainage locally increased groundwater influence, with life-history strategies indicating enhanced predictability of environmental conditions. Importantly, such conditions also characterise lagg zones and transitional mires in pristine raised bog landscapes, which are hotspots for biodiversity.

Thus, while large-scale re-wetting decreased environmental heterogeneity, increasing the supply of groundwater seems a more promising restoration strategy for aquatic invertebrates in degraded peatlands.

Keywords: Biodiversity; Biological traits; Causal mechanisms; Ecosystem structure; Ecosystem functioning; Habitat heterogeneity; Functional groups; Life-history strategies; Restoration Ecology; Species filter

\*Corresponding author: Dr. Wilco C.E.P. Verberk ([wilco@aquaticcecolgy.nl](mailto:wilco@aquaticcecolgy.nl))

† Deceased 30 August 2008

Contact me if you are interested in a reprint of this article:

Verberk WCEP, Leuven RSEW, van Duinen GA & Esselink H (2010) Loss of environmental heterogeneity and aquatic macroinvertebrate diversity following large scale restoration management. *Basic and Applied Ecology* 11: 440-449. <http://dx.doi.org/10.1016/j.baae.2010.04.001>