

Biodiversity Research: Urban Waterbodies

From conservation science to practical conservation

Urban aquatic biodiversity

Urban waterbodies are highly abundant and provide diverse aquatic habitats. Facing the ongoing loss and degradation of freshwater habitats they may offer a great chance for the conservation of threatened aquatic biodiversity. We are working on urban waterbodies in order to assess their potential for aquatic biodiversity conservation.

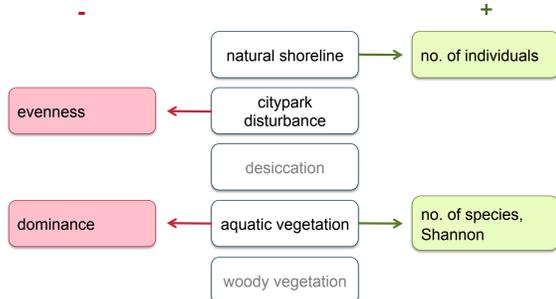
Our current research focuses on understanding biodiversity patterns and the causal relationships with environmental determinants in urban surroundings. This knowledge is essential to develop sustainable management implications for successful biodiversity conservation. We work on dragonflies and other aquatic invertebrates because they are established indicator organisms for habitat as well as water quality.

Biodiversity determinants

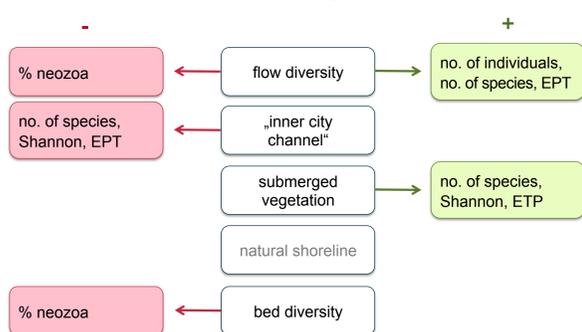
The characteristics of urban ponds and streams strongly impact their biodiversity potential. Urban waterbodies show a wide range from a fairly natural to a strongly modified appearance regarding bottom, water regime, vegetation, shoreline, and surrounding.



Determinants of dragonfly diversity in urban ponds (1)



Determinants of macrozoobenthos diversity in urban streams (in prep.)



We could identify major determinants for urban aquatic biodiversity, which is a natural shoreline in ponds and the flowing diversity in streams. High structural heterogeneity (e.g. of substrate or vegetation) usually leads to increased biodiversity.

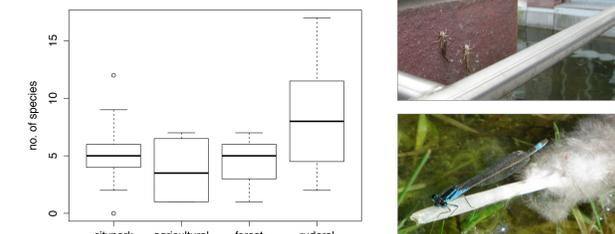
Diversity patterns

Urbanisation affects biodiversity at different spatial scales, therefore we study diversity patterns of dragonflies at the scale of habitats (i.e. single ponds), cities and landscapes in Central Europe.

Habitat scale

Objectives: surveying dragonflies in urban environments (2-4), analysing α - and γ -diversity patterns and identifying determinants for dragonfly diversity (1).

Species richness of urban pond types (based on sampling of larvae)

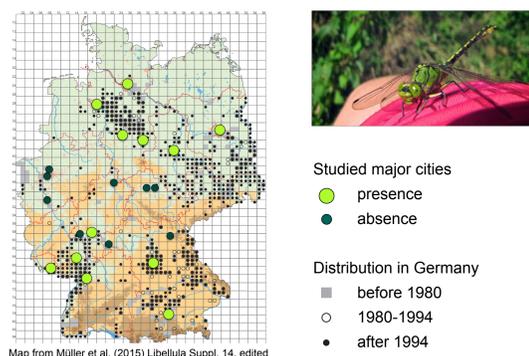


Urban ponds can host species-rich dragonfly assemblages, but α -diversity varies between pond types. High pond diversity increases γ -diversity. Some species are able to develop in strongly modified ponds or to be highly abundant in citypark ponds.

City scale

Objectives: learning how many species occur in cities, comparing regional species pools with the urban fauna and assessing the potential of cities to host regional diversity, including species of conservation concern (5)

Distribution of *Ophiogomphus cecilia* and its occurrence in major cities, a species listed in the FFH Directive

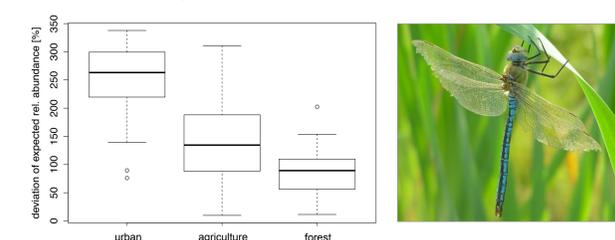


Cities have great potential for high dragonfly species richness, as almost all Central European species occurred in cities. Where a species occurs in the hinterlands there is a great chance for it to occur also in the city, even for species of conservation concern.

Landscape scale

Objectives: analysing abundance patterns of species in response to different land-use types and investigating the impact of large-scale urbanisation on dragonfly diversity (in prep.)

Abundance of *Anax imperator* in response to land-use type



One third of 30 widespread dragonfly species showed highest abundance in areas with high proportion of urban land-use, for instance *Anax imperator*. Abundance of only few of the studied species significantly decreased with high levels of urbanisation.

Water quality assessment

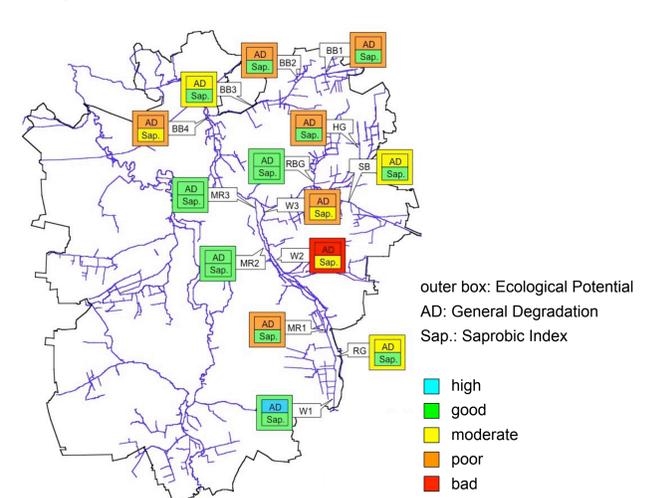
The Water Framework Directive (WFD) demands good status of all waterbodies. To put the WFD into practice water quality assessment and, in case of insufficient results, corrective measures or restoration are required.

Monitoring

In collaboration with the local company SE|BS we perform a regular monitoring of the water quality („Gewässergüte“) as well as the structural quality („Strukturgüte“) of urban streams in Braunschweig. Results are published in an annual report (e.g. 6,7).



Ecological Potential of stream sites in the Schunter catchment (6)

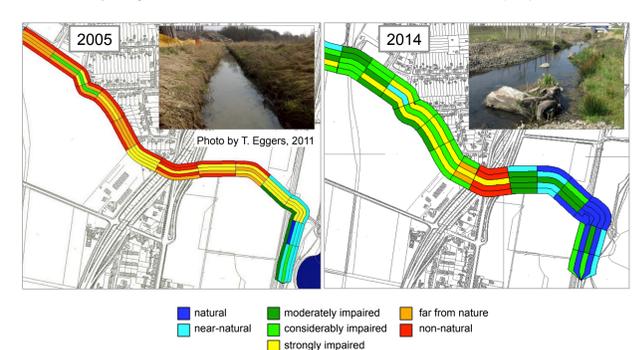


Sampling according to WFD (Periodes) using aquatic macroinvertebrates allows for comparative assessment of water quality and reveals qualities as well as deficiencies of a stream site.

Management and Restoration

Based on these assessments we can develop management suggestions to improve the ecological status of urban waterbodies. We use the field data for scientific analyses to deepen the knowledge on the success and sustainability of waterbody management (in prep.). With this knowledge we offer consulting for local stakeholders.

Structural quality of the Fuhsekanal before and after restoration (6,7)



Monitoring of the structural quality of streams (according to „Strukturgütekartierung“) reveals where improvement of stream structure is necessary and which are the deficiencies. It is also a useful tool to evaluate the success of stream restoration.

Publications (selection)

- Goertzen, D. & Suhling, F. (2013) Promoting dragonfly diversity in cities: major determinants and implications for urban pond design. *Journal of Insect Conservation*, 17, 399–409.
- Suhling, F., Martens, A., Leipelt, K.G., Schütte, C. & Hoppe-Dominik, B. (2009) Libellen Braunschweigs – Verbreitungsmuster und Bestandstrends der Libellenfauna einer Großstadt (Odonata). *Braunschweiger Naturkundliche Schriften*, 8, 449–476.
- Goertzen, D., Bennen, G., Soinski, M. & Werkmeister, W. (2012) Libellen in Dortmund – ein Beitrag zur Libellenfauna von Großstädten (Odonata). *Libellula*, 31, 179–210.
- Goertzen, D. (2008) Industriebrachen im Ruhrgebiet – Lebensraum für Libellen? (Odonata). *Libellula*, 27, 163–184.
- Goertzen, D. & Suhling, F. (2015). Central European cities maintain substantial dragonfly species richness – a chance for biodiversity conservation? *Insect Conservation and Diversity* 8: 238–246.
- Goertzen, D. (2015). Gewässerstruktur- und Gewässergüteuntersuchungen in Fließgewässern im Gebiet der Stadt Braunschweig – Jahresbericht 2014. Gutachten im Auftrag der Stadtentwässerung Braunschweig GmbH, Braunschweig, 93 pp.
- Eggers, T. O. (2012). Gewässerstruktur- und Gewässergüteuntersuchungen in Fließgewässern im Gebiet der Stadt Braunschweig – Jahresbericht 2011. Gutachten im Auftrag der Stadtentwässerung Braunschweig GmbH, Braunschweig, 86 pp.

