

# Species Diversity on Urban-Industrial Brownfields with Urban Forest Sectors compared with Semi-Natural Habitats in Western Ruhrgebiet (Germany)

First Results of Investigations in Flowering Plants and Various Animal Groups

Peter Keil, Christine Kowallik, Randolph Kricke, Götz Heinrich Loos & Martin Schlüpmann

Biologische Station Westliches Ruhrgebiet, Ripshorster Straße 306, 46117 Oberhausen, Germany; info@bswr.de



Biotope diversity caused by different stadiums of vegetation successional development on an industrial brownfield (former steel works, Duisburg)



Ensemble of urban forest, open dry land and pond-like wetlands caused by coal mining (Oberhausen)



Urban forest on a former coal mining site with open forest edges and an occurrence of the forest orchid Common Twayblade (*Listera ovata*) (Oberhausen)

The high species diversity of urban-industrial brownfields is well-known from numerous studies (summarized e.g. in Sukopp & Wittig 1998 and Rebele & Dettmar 1996). In the Ruhrgebiet (Northrhine-Westphalia, Germany), lots of data are available for fallow areas in former coal mines and steel works which were embedded in urban settlements (see Seipel & al. 2006).

Their high species-diversity is explained by the large variety of ecotopes and numerous microhabitats, e.g. urban forests. In the Western Ruhrgebiet (cities of Duisburg, Mülheim an der Ruhr and Oberhausen) urban-industrial fallow areas have been studied extensively in the past three years. In addition to flowering plants, various animal groups like birds, bats, amphibians, grasshoppers and dragonflies were studied. The results of the studies can be compared with those of natural or semi-natural habitats, to emphasize the importance of these deserted industrial areas for species diversity.

Besides, a direct comparison of the number of species, an assessment of occurrence of threatened and endangered species is important as well (Red Data Book of Northrhine-Westphalia, LÖBF 1999). Among these taxa, the number of forest-dwelling species is interesting and highlights the conservation value of urban forests (even considering that flora and fauna of industrial forests differ from that of natural and semi-natural forests). This aspect is apparent in the high number of neophytic trees and shrubs in urban forests.

Urban-industrial open brownfields and forests are inhabited by numerous endangered species (according to Red Data Book of Northrhine-Westphalia, LÖBF 1999), e.g.: **Flowering plants:** *Asplenium adiantum-nigrum*, *Carex praecox*, *Centaurium pulchellum*, *Dianthus armeria*, *Genista tinctoria*, *Hyoscyamus niger*, *Kickxia elatine*, *Malva sylvestris*, *Nepeta cataria*, *Salvia pratensis*, *Sherardia arvensis*, *Viola tricolor*; **birds:** Meadow Pipit (*Anthus pratensis*), Little Ringed Plover (*Charadrius dubius*), Peregrine (*Falco peregrinus*), Northern Wheatear (*Oenanthe oenanthe*), Redstart (*Phoenicurus phoenicurus*), Green Woodpecker (*Picus viridis*), Little Grebe (*Tachybaptus ruficollis*), Lapwing (*Vanellus vanellus*); **amphibians:** Natterjack Toad (*Bufo calamita*), Pool Frog (*Rana lessonae*); **dragonflies:** *Lestes virens*, *Sympetrum fusca*, *Sympetrum fonscolombei*; **grasshoppers:** *Oedipoda caerulea*; *Spingonothus caeruleans*.

Species diversity as well as the number of endangered species of open industrial brownfields is higher than in urban forest areas. Compared with most semi-natural habitats within the conurbation of the Western Ruhrgebiet it turns out that the number of endangered species on fallow land in general is fairly similar. And finally, total species diversity can be even higher on fallow land than in most semi-natural areas.

Tab. 1: Species diversity of flowering plants of different former industrial sites with high biotope diversity in western and central Ruhrgebiet (all including extended urban forest sectors; data from Dettmar 1992, Gausmann & al. 2004 and Seipel & al. 2006)

Site	Area (ha)	Species
Mine Area Alma (Gelsenkirchen)	30	201
Mine Area Rheinelbe (Gelsenkirchen)	50	162
Mine Area Zollverein (Essen)	50	285
Steel Works Duisburg-Meiderich	40	>300
Steel Works Duisburg-Ruhrort	160	385
Steel Works Duisburg-Beeckerwerth	200	323
Sinteranlage Duisburg-Beeck	30	316

Tab. 2: Species diversity of tree and shrub taxa of former industrial sites with urban forests compared with semi-natural forests

Site	Species
Steel Works Mannesmann (Mülheim an der Ruhr)	42
Kokereigelände Duisburg	>40
Mine Area Vondern (Oberhausen)	>35
Sinteranlage Duisburg-Beeck	>30
<b>Semi-natural Forests</b>	
Coppice Forest (Weißenstein, Hagen)	max. 20
Galio-Fagetum (Mastberg, Hagen)	max. 15
Luzulo-Fagetum (Auberg, Mülheim an der Ruhr)	max. 10



Lesser Centaury (*Centaurium pulchellum*)



Meadow Clary (*Salvia pratensis*)



*Populus maximowiczii* hybrid poplar taxon, a product of recent evolution on brownfields



Natterjack Toad



Peregrine



*Lestes virens*



Lapwing



Species-rich urban forest

References

Dettmar, J., 1992: Industrietytische Flora und Vegetation im Ruhrgebiet. *Dissertationes botanicae* 191, 397 pp.  
 Gausmann, P., Loos, G. H., Keil, P. and Haeupler, H., 2004: Einige bemerkenswerte Funde auf Industriebrachen des mittleren Ruhrgebietes. *Natur u. Heimat (Münster)*, 64 (2): 47-54.  
 LÖBF 1999: Rote Liste der gefährdeten Pflanzen und Tiere in Nordrhein-Westfalen. 3. Fassung. *Schriftenr. LÖBF* 17, 641 pp.  
 Rebele, F. and Dettmar, J., 1996: *Industriebrachen – Ökologie und Management*. Ulmer, Stuttgart, 188 pp.  
 Seipel, R., Keil, P. and Loos, G. H., 2006. Floristische und vegetationskundliche Untersuchungen auf dem Gelände der ehemaligen Sinteranlage in Duisburg-Beeck. *Decheniana*, 159: 51-75.  
 Sukopp, H. and Wittig, R., 1998. *Stadtökologie*. Ed. 2. Gustav Fischer, Stuttgart, Jena, New York, 488 pp.