Dominant plant species are the drivers of postindustrial sites ecosystem functioning

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Introduction

The vegetation developing systems that emerge on habitats recognized as novel ecosystems of Anthropocene (Hobbs et al. 2006), such as post-industrial sites, can be an opportunity to understand the links between the clue ecosystem elements like the dominant plant species and the abiotic and biotic substrate (anthroposols) conditions (Waters et al. 2016). Dominant species influence both vegetation as well as soil properties such as soil seed bank properties of the soil substrate. However, knowledge about the role played by dominant species in the process of shaping their habitat within post-industrial ecosystems is limited. Some study on dominant plant species has also been conducted on many habitats including post-industrial sites (Prach and Pyšek 1999, Woźniak 2010) and these studies have mostly been focused on the species composition that accompanies the dominant plants on a range of different types of post-industrial sites. The vegetation growing on coal mine spoil heaps consists of a mosaic of patches dominated by various species confined to a variety of microhabitats (Woźniak et al. 2015, Rawlik et al. 2018a, Rawlik et al. 2018b). We aimed to assess the role of some dominant species, expressed as their influence on soil substratum abiotic and biotic properties, and to assess the dominant species role in novel ecosystem function development.

Materials and methods

In the studies plots we have assessed the dominant species and the accompanying species biomass. We have assessed the above ground biodiversity by using various diversity indicators. We have measured soil chemistry, including the content of carbon, nitrogen, phosphorous potassium as well as sodium and magnesium content, conductivity, pH and enzyme activities as well as PLFA, species diversity and functional diversity of vegetation for each species studied.

Results and discussion

The spontaneous vegetation developing on post-industrial sites influenced both species and functional composition, as well as the chemical and biological properties of soil substratum. The primary vegetation types (plots dominated by *Tussilago farfara*) had the highest influence on post-industrial site habitats on coal mine heaps and the extreme values of some soil substratum parameters. The decrease of species and functional diversity of vegetation has been also recorded. The parameters of rhizosphere substrate samples under the dominant plant species has revealed differences in soil substratum organic matter

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content. While the content of potassium did not differ in the substrates from the studied vegetation patches, the rhizosphere soil substrate conditions in patches dominated by *D. carota* and *P. compressa* were statistically significantly different in terms of Mg content. About phosphorus content the highest value has been recorded for patches dominated by *T. farfara* and *P. compressa*. The study has provided results of analysis which revealed that dominant species in the spontaneous vegetation developing on post-industrial sites alters the chemical and biological properties of the post-industrial sites soil substratum. The species with the highest mean dominant biomass did not always cause lower biodiversity in vegetation patches. Some dominant plant species such as *Tussilago farfara* appeared to have the major impact on the habitat features on post-industrial sites. The highest impact of the soil substratum parameters were recorded as being extreme for other dominant plant species then the those dominant plant species for which the highest biodiversity values have been recorded.

Conclusions

The stages of the ecosystem development and the relationship between the biota (including vegetation types) in Novel Ecosystems did not follow the rules known for natural or semi-natural vegetation. The results confirmed that the spontaneous development of novel ecosystems are barely understood and require additional research.

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