Establishing of dry grassland on dump sites for nature conservation development (Lusatian Lignite District) – a 14-years-documentation

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In the early 1990s a project has started together with the Lausitzer Braunkohle AG and in consultation with the local authorities of nature conservation and the State Office of Environment to create a model landscape for nature development. For this purpose, a 200 hectare area (Brandenburg, 13°42‘16“ - 13°43‘43“ E, 51°32‘35 - 51°33‘17“ N) situated in the former open-cast mine Kleinleipisch was used. In the following time the area has been integrated into a network of ecological priority sites. Since 2003, it is part of the "Naturparadies Grünhaus", a conservation area owned by the NABU Foundation for National Natural Heritage, and designated as nature reserve in 2006.

Within the study area coal-bearing (0.8 %) dump sand (ojb-(x)ss (pq)) predominantly occur, which is characterized by a high content of sulfur and extreme low pH values (pH 2.8 to 3.3). Without any manipulation succession pass a long-term (>50 years) vegetation-free stage on such sites. In order to minimize wind erosion loads into neighboring residential areas, it was necessary to reduce this period to a minimum. In addition, effects of initiated vegetation development on colonization processes should be observed.

Therefore, in 1991/92 a grass mixture consisting of 60 % sheep fescue (*Festuca filiformis*, *F. brevipila*), 30 % *F. rubra* and 10 % *Agrostis capillaris* following shallow amelioration (25 to 100 dt CaO ha^{-1}) was used on a total area of 120 ha. Seed density was 6 $g*m^{-2}$.

Within the first years a sparse, grass cover has developed mainly composed of *Festuca filiformis* and *F. brevipila*. Only a few pioneer species are found. In the subsequent years, density of grass cover has increased and other vascular plants first of all typical grassland species have migrated. The total number of vascular plant species increased to 55 (mean number of species per $25m^2$-plots: 16 ± 9) until 2005. Within 8 years after sowing a dry grassland has developed with a distinct layer of mosses and lichens.

According to the development of the vegetation within 8 years the community of epigeic spiders has changed from a species-poor community dominated by field and bare soil inhabiting species to a typical community of dry grassland vegetation. Afterwards, a clear increase of species and individuals is observed until 2005. Finally, approximately 80 % of all epigeic spider species recorded in 2005 prefer dry grassland vegetation. 51 endangered species (about 50 % of them „critically endangered“) are known from the study area.

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Grassland restoration to conserve landscape-level biodiversity: a synthesis of early results and experiences from a large-scale project

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European landscapes have been influenced by centuries of intensifying use by humans. Restorations can theoretically reverse these processes, but in practice are often limited in space and time by socio-economic constraints. Here we synthesise the early results of a grassland restoration project exceptional in spatial scale in Europe. Restoration was carried out on 760 hectares of arable lands in the Egyek-Pusztakócs unit (4000 ha) of Hortobágy National Park, E-Hungary between 2005 and 2008. We targeted two priority habitat types of Annex I of the Habitats Directive by sowing seeds of two grasses for alkali steppe and three grasses for loess grassland restorations and by mowing once every year thereafter. Both types of restorations had high weed cover in Year 1, which, however, facilitated the development of grass cover. Weed cover and biomass were suppressed by Year 2 by higher cover and biomass of the sown grasses. The species composition of alkali restorations approached that of target alkali steppes as early as Year 3 after sowing. The species composition of loess restorations also progressed towards the target loess grasslands, however, the progress was much slower than for alkali steppes. Weed suppression in restorations on former alfalfa fields was more successful than in those on cereal or sunflower fields. Changes in arthropod assemblages quickly followed the changes in vegetation as the naturalness of the assemblages greatly increased from Year 1 to Year 2. Our results show that grassland restoration was successful in accelerating secondary succession toward the target habitats. Succession, however, could take different pathways depending on the local soil conditions and water availability, therefore, creating slightly different vegetation at sites within the landscape. Our project provides useful practical insights in grassland restoration and in applying restoration to conserve biodiversity on the landscape scale.

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