Ecological restoration experiment in a calamine grassland

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Résumé

Soil pollution is one of the main factors responsible for biodiversity loss. Accordingly, metal-polluted environments are generally considered as wastelands without significant ecological value. However, many anthropogenic soils enriched with zinc (Zn), lead (Pb) and cadmium (Cd) have been covered by a unique vegetation, called calamine grassland, targeted by conservation programs. In this study, we considered a calamine grassland from North of France, occurring in the close vicinity of a former smelter. In the 1960's, calamine vegetation grew around the slag heap, forming a typical open grassland association, showing dominance of the two locally absolute metallophyte species: *Armeria maritima* and *Arabidopsis halleri*, in association with *Agrostis capillaris*. But after the closure of the factory, this calamine vegetation gradually regressed, evolving towards a calamine meadow largely dominated by a tussock-forming grass: *Arrhenatherum elatius*. In the 2010's, the calamine grassland and its emblematic species were close to extinction. In this context, we tested two restoration methods involving annual mowing with or without removal of the plant biomass. The test ran for seven years. Meanwhile, we accumulated soil chemistry and functional ecology data in order to better understand the successional dynamics of the local vegetation and the effects of the managing strategies on this dynamics.

In the absence of human intervention, the decline of the calamine grassland was confirmed, largely advantaging *A. elatius*. On the contrary, mowing and removing organic matter allowed the restoration of the grassland. Although this mostly favored *A. capillaris*, dicot species (*A. halleri* and *A. maritima*) also benefited from the program. Soil elemental analyses revealed that Cd, Pb and Zn contents were still high, especially in the first horizon (0-20 cm). Functional analyses suggested that, in comparison to developmental strategies of dicot species, *A. elatius* was more competitive.

As concentrations of metals in soil did not significantly decrease, the replacement by less metal-tolerant species cannot be a major cause of the decline in the calamine grassland. Instead, the competitive ability of *A. elatius* is probably one of the main explaining factor of the successional dynamics. Therefore, repeated disturbances, like removing tussocks through annually mowing the vegetation, have limited *A. elatius* abundance and favored a partial recovering of the calamine grassland.

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Mots-Clés: Conservation, metallic pollution, calamine grassland, ecological succession, functional traits