EGU22-5075
https://doi.org/10.5194/egusphere-egu22-5075
EGU General Assembly 2022

Initial soil formation in an artificial river valley - Interplay of anthropogenic landscape shaping and fluvial dynamics

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Recultivation is a strategy for restoring near-natural landscape systems in anthropogenically influenced environments. Especially in post-mining landscapes after open pit mining, recultivation gives opportunities and potential for near-natural landscape modeling. In order to evaluate the success of the applied measures, biological monitoring approaches with a focus on biodiversity are often carried out. However, the loss of natural soils, which are the result of long-term formation, is an irreversible damage to the pedosphere. The natural soil functions must be completely re-established and it is difficult to examine its success. In our study we therefore investigated initial soil formation in an morphodynamically active artificial river valley, modeled and constructed with a recultivation substrate called “Forstkies”. The study area is located in the catchment of the Inde River (North Rhine-Westphalia, Western Germany), which is part of the international River Basin District Meuse. Due to the progress of the open pit lignite mining, a 5 km long river course had to be relocated. With the aim of creating a near-natural landscape and an appropriate development corridor for the river, a ~ 12 km long river relocation was designed. The artificial river section "Neue Inde" is still geomorphologically naïve and characterized by temporary, highly energetic morphodynamic processes resulting in strong erosion processes in the river bed and the surrounding area. To characterize the morphodynamics and to detect initial soil formation processes, we analyzed a transect of seven soil profiles. The transect includes floodplains and slope areas further away from the river. Allochthonous flood sediments can be differentiated from the underlying artificial Forstkies sediments by inherited contamination of the heavy metals Pb, Zn and Cu. By means of common soil parameters (grain size, $CaCO_3$, total organic carbon, pH value and sediment colors) and geochemical weathering indices, first initial post-sedimentary alterations can be detected. The quality of the soils is absolutely appropriate to the state of development. The results obtained can be helpful for the planning of future renaturation in post-mining landscapes.