The effects of earthworm bioturbation on metal availability in river floodplains

In the Netherlands, the natural character of floodplains in the river Rhine tributaries has been lost due to agricultural, industrial and urban activities during the past centuries. Fortunately, nature restoration has become more important nowadays, and a lot of nature development projects have been situated within these areas. However, due to former emissions and sedimentation of contaminated solids, these floodplains are polluted. In spite of the improved water quality, high concentrations of various contaminants are still present. Managing and cleaning these areas is too expensive. For this reason specific knowledge concerning ecotoxicological processes in floodplains is needed to assess the ecological risks in these ecosystems. This is the major aim of the Stimulation Program "System-Oriented Ecotoxicological Research" (SSEO), in which many researchers are involved.

One of the processes, which may be important with respect to pollutants in soil is the presence of bioturbators, like earthworms. By mixing the soil, earthworms affect the distribution of pollutants in the soil and change physical soil properties, which have an influence on the availability of contaminants like zinc and cadmium. On the other hand, by living in the soil, earthworms are exposed to these contaminants, and might become negatively affected. Moreover, accumulation of these contaminants in earthworms can result in food web poisoning. One additional stress factor, typical for floodplain areas, is frequent inundation, which may further enhance the risk of contaminants.

The main goals of this research are:

1. To investigate the impact of earthworm activity on the fate and effects of heavy metals, like zinc and cadmium.
2. To assess the impact of floodplain characteristics (including inundation) on earthworm activity.

Research is carried out in the Afferdense and Deestsche Waarden, a floodplain area of the river Waal near Nijmegen. Earthworm population composition and dynamics have been followed over the last three year, in relation with flooding events, vegetation types and the presence of heavy metals in the soil. Soil columns were used to study the burrowing behavior of the different earthworm species, the transfer of (polluted) soil and their effect on metal availability in polluted soil, in the laboratory. A field experiment was performed to study the influence of earthworm burrowing behavior on metal distribution and availability in soil columns under field conditions, in combination with their effect on decomposition (see project of D. Heemsbergen).

Together with Sander Wijnhoven, a PhD student of Nijmegen University working on a closely related project, a field mesocosm experiment is currently being performed to determine the effect of other bioturbators, like mice, on the earthworm population and their combined bioturbation effect.

Duration:

4 years (September 2000-September 2004)

Participants

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