EGU21-3986
https://doi.org/10.5194/egusphere-egu21-3986
EGU General Assembly 2021

Holocene alluvial floodplains in Belgium: from natural to human-dominated environments

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Rivers and alluvial floodplains are dynamic environments that experience both natural and anthropogenic impacts. Sustainable management of these ecosystems requires a thorough understanding of the functioning of floodplains and their sensitivity to changes in driving forces, including anthropogenic land-cover change. Looking at past human-environment interactions in river catchments can help to develop such sustainable management strategies for the future.

During the Early and Middle Holocene, most floodplains in northeastern Belgium were stable environments, mainly driven by natural forces, resulting in large marshes where peat accumulated and river channels were absent or small. During the Late Holocene, these environments changed completely towards single channel meandering rivers with overbank deposits, impeding peat accumulation. These changes can to a large extent be linked to increasing human activities in the catchment. However, the timing of this change in floodplain geoecology strongly varies within and between different catchments.

Five river catchments in northeastern Belgium with varying soil properties, topographies, and durations and intensities of human impact were selected in this study, to uncover regional differences in land-cover evolution. The catchments of Dijle (750 km²), Grote Gete (300 km²) and Mombeek (90 km²) are located in the central Belgian loess belt, whereas the Grote Nete (525 km²) and Zwarte Beek catchments (50 km²) are situated in the sandy Campine region. A multi-proxy approach, including sedimentological proxies, pollen, and macrobotanical remains, was chosen to reconstruct alluvial floodplain characteristics and anthropogenic land-cover changes. We constructed a database of 27 records for these five catchments (of which 9 containing pollen, 4 containing macrobotanical remains, and 14 containing both) for which 132 radiocarbon dates in total provide a chronostratigraphic framework.

Qualitative, semi-quantitative (NMDS) and quantitative (REVEALS) analyses of the palynological data revealed regional differences in the initiation and intensity of human impact. From the Neolithic period onwards, deforestation is detected in both the loess and sandy region, although the loess belt underwent a more rapid and severe reduction of woodland. While this deforestation is accompanied by an increase in cropland in the loess region from the Bronze Age onwards, the sandy region only starts to show limited agriculture from the Iron Age onwards, related to its later and less dense human occupation.

While the amount of records and their resolution is rather low in the sandy region, the numerous and detailed records of the loess belt also allow detection of more local and short-term effects (< 200 years) of changes in human impact. A decrease in human impact during the Dark Ages, which can be related to the decreased population density in Europe during the first millennium AD, is visible: hillslope–floodplain connectivity reduced due to the regeneration of vegetation barriers, in turn lowering sediment input, which facilitated local reactivation of peat growth and regrowth of the natural alder-carr floodplain vegetation. After this temporary decrease, human impact on floodplain geoecology started to increase again up till modern times. The impact also got more direct, as peat extraction from the floodplains became common practice, especially in the sandy Campine region.