RECARBON

Restoring carbon sinks in floodplains through different land use practices

DURATION
1/09/2022 – 1/12/2026

BUDGET
1 039 213€

PROJECT DESCRIPTION

In order to achieve climate neutrality by 2050, absorption of CO_2 by nature is seen as vital. Enhancing the natural carbon sink is thus an integral part of climate mitigation. Amongst terrestrial ecosystems, fluvial systems are important carbon stocks, and floodplain soils are – especially in a Belgian context – hotspots for carbon storage at millennial timescales. However, due to climate change and changing land use practices (including drainage, vegetation changes and urbanization, both local and in the catchment), these carbon stocks are under pressure and floodplains might change to net carbon sources, in particular because alluvial peatlands, often buried under mineral sediment, tend to degrade. A lot of emphasis is being put on rewetting floodplains in order to increase carbon storage and reduce flooding downstream by increasing the water buffering capacity. However, the impact of rewetting floodplains on carbon dynamics in Belgian ecosystems at a wide range of timescales is not well constrained, furthermore, conflicts with other goals and stakeholders (e.g. Nature 2000 conservation, agriculture) pose additional uncertainties on the effectiveness of this management practice.

Within this project, we aim to evaluate the potential of land use management practices within floodplains in general, and in Belgium in particular, as a climate mitigation tool through carbon capture and storage (CCS). This project combines a detailed insight in the present-day characteristics of carbon storage in floodplains with the dynamic nature of C in floodplain environments. In particular, in this project it is aimed to

- quantify C-stocks in Belgian river valleys and identify which environmental factors control C-stocks in floodplains;
- assess the quality of floodplain C under a range of hydrological and land use settings by studying in detail its biological, physical and thermal stability as a function of moisture regime, land use and depth of C-storage, but also determine the drivers;
- develop high-resolution age-depth curves for long alluvial peat and organic-rich sediment sequences and compare the age of the preserved C with the age of the deposit in order to identify variability in C-preservation with age and depth;
- develop and calibrate an alluvial soil+peat-C model that simulates C-dynamics in floodplain wetlands under different environmental conditions and management policies;
- to identify management and governance options for C-rich floodplains, which take into consideration other desired functions of the floodplains while considering the levels of acceptable change for society.

Contemporary C-stocks will be inventoried for floodplain environments with different hydrological settings and land-use conditions, and with a variability in flooding frequency.

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Hence, we will explore how the variability in contemporary C-stocks can be explained by differences in soil hydrological status, land use practice and flooding frequency. Detailed high-resolution data on long-term C storage will be gathered at 6 key catchments that are representative for the environmental settings of Belgian floodplains. Age-depth models for several long profiles in each case study site will be constructed through radiocarbon dating on bulk C vs plant macrofossils. Differences in radiocarbon ages between plant macrofossils and various peat fractions, as well as variation in age-depth models at each site will be complemented with data on C-quality to assess the degree of decomposition of the C with depth. C-quality will be assessed by studying the (i) biological, (ii) physical and (iii) thermal stability of SOC, each reflecting processes determining C-turnover at a particular temporal scale, i.e. from years over decades to centuries, respectively. The development of a floodplain C model, building on expertise in alluvial peatland modelling and topsoil carbon models, should account for both organic and mineral soils and will require the inclusion of additional processes such as overbank sedimentation and river meandering. In addition, a detailed calibration and validation procedure, specifically focussing on a set of alluvial peatland case-studies would provide robust parameter values and reduce the uncertainty on the associated C dynamics.

The outcome of this project will be relevant for all governmental and non-governmental institutes and organizations that are dealing with the development and implementation of floodplain management policies and with climate mitigation policies. It is expected that the project results will allow these organisations to evaluate their present-day policy and management activities in the light of C-storage in floodplains and climate mitigation. The various stakeholders active in floodplains will be involved from the start of the project and through participatory approaches it is foreseen that the stakeholders will co-design the research actions. Given this co-creative approach, the impact for these stakeholders is expected to be higher, as well as the chances that the outcome of the project will be implemented in the future management and policy activities of the stakeholders.

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