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SOC stocks of alluvial and dredged sediment soils near tidal rivers in Flanders (northern Belgium)

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Alluvial soils near rivers are often characterised by high soil organic carbon (SOC) stocks. Small changes in these stocks may result in significant C sequestration or emission and thus these areas play an important role in climate regulation. We carried out a comprehensive soil survey of alluvial soils that are designated as controlled flooding areas near tidal rivers in Flanders (northern Belgium). Additionally, we collected a large number of C measurements in soils where historical deposition of dredged sediments occurred. The aim of the present study is to estimate SOC stocks in natural alluvial and dredged sediment soils and to evaluate their relative importance for total SOC stocks in Flanders. The importance of other measured soil variables (texture, pH, sulfates, iron) and landscape variables (such as elevation and land use) on soil carbon stock was studied. Soil samples (N = 2178) were collected in 23 controlled flooding areas (2682 ha). Most measurements were limited to the upper 10 cm. Soil organic matter was measured by loss-on-ignition (LOI). In order to compute TOC values from LOI, a linear model with covariates LOI, % clay and CaCO₃ content was constructed. Soil bulk density was estimated based on the covariates TOC and % clay. Dredged sediment soils were sampled up to a depth of maximum 2 m. In total 1187 soil samples from 597 sample points on dredged soils were analysed (541 ha). Organic matter was measured by LOI or the Walkley-Black (W-B) method. A linear model was constructed to derive TOC from either LOI or W-B measurements. Linear mixed effect models were applied to evaluate the importance of soil and landscape variables on the SOC stocks. Alluvial soils store on average 4.1 kg C/m² in the upper 10 cm, dredged soils store 4.1 kg C/m² on average as well. However, dredged sediment soils store high amounts of C up to a considerable depth. In the upper 20 cm, 8.2 kg C/m² is stored, while in the upper 1 m, these soils contain a fourfold (36.9 kg C/m²). SOC stocks of dredged sediments and alluvial soils along tidal rivers are large. Although the C content of did not differ in the upper 10 cm of soil, deeper layers of dredged sediment soils contain high C concentrations, which creates a large total SOC stock. Obviously, the limited area of these soils will always constrain their importance for total stock calculation on the scale of Flanders.