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Structure formation in carbonate-rich alluvial soils along an altitudinal gradient: roles of lithogenic characteristics and biological agents.

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Floodplains are known to be areas of extraordinary biodiversity with a mosaic of shifting habitats with high interdependency. Nowadays, these ecosystems are subject to conservation and protection. Regarding pedology, floodplains contain a wide range of all steps of soil evolution, i.e. from a newly deposited sediment to several hundred year old stable soils. However, less attention has been paid in this context to pedogenesis, especially the very first steps of soil structuring in the youngest and the least developed soils (FLUVIOSOLS).
In this context, our aim is to understand and to compare the structuring processes along a soil stabilization gradient as well as along an altitudinal gradient, testing out the relative importance of mineral inherited deposits due to fluvial dynamics, and the in situ pedogenesis due to biological agents. Our main hypothesis is that at the subalpine level, pedogenesis processes are assumed to be slower than at the hill level. As a consequence, the thickness of soil structured layers as well as the stability of soil aggregates should be higher at the hill level compared to the subalpine one.
To assess these assumptions, we study physicochemical parameters and biological variables (plant root systems and earthworms as ecosystem engineers) in carbonate-rich and calcium saturated environments along:
1- an altitudinal gradient (subalpine, mountain and hill levels).
2- a gradient perpendicular to the river, stratified by vegetation: pioneer willow stage, intermediate alder forest and finally mature forest (beech, ash and/or spruce).
All the ecosystems chosen are still influenced by the fluvial dynamic, undergoing regular flooding.
In order to evaluate the heterogeneity within each site, three replicates are made in each vegetation unit resulting in a total of 27 samples. A topsoil structure classification resulting from a cluster analysis is based on: i) morphological and macroscopic descriptions at the field scale (according to the Sound Reference Base for Soils, 1998) and ii) laboratory measurements of structural stability (mean weight diameter and percentage of water stable macroaggregates, according to Kemper and Rosenau, 1986). The structure groups revealed by these statistical analyses are then explained using multivariate treatments (RDA) that allow us to compare the influence of some variables on the topsoil structure formation: i) physicochemical parameters (texture, carbonate content, different iron forms, and organic matter content), ii) biological agents (root density, total earthworm biomass, abundance of ecological earthworm categories) and iii) local site characteristics (climatic, hydrological and geomorphological factors).