SUSALPS
Internationale Grünland-Konferenz 2025

Contribution ID: **56** Type: **Poster presentation (4:40 PM - 6:30 PM)**

Mechanism-based climate-smart soil management options

Tuesday 15 July 2025 16:40 (1h 50m)

To achieve climate-smart soil management under the climate change crisis, mechanism-based management is essential for addressing agricultural productivity needs and enhancing carbon sequestration under contrasting land uses.
Based on a mechanistic assessment of grassland and cropland soils in a hillslope-floodplain system in Bavaria, this study provides several practical climate-smart soil management options targeted specifically to each land use.
For extensively managed grassland soils, minimal soil disturbance coupled with continuous organic amendments (such as grass biomass residues, manure, or slurry amendments) is recommended. These practices take advantage of the well-preserved subsoil structure that enriched in organic carbon (OC), nitrogen (N), and phosphorus (P), and the high nutrient availability deriving through active microbial processes and optimal C-N-P stoichiometric ratios.
Conversely, intensively managed cropland soils, characterized by lower plant biomass inputs and subsoil degradation due to deep-plowing and clear-harvesting practices, have reduced OC and N stocks, which organic fertilizers alone cannot fully replenish. Additional practices beyond avoiding deep-plowing and clear-harvest are thus necessary to reverse depleted OC stocks and mitigate P losses. Enhanced rock weathering (ERW) is suggested to be a viable climate-smart option, given its advantages for long-term carbon sequestration, sustained slow-release P supply, and soil acidity neutralization with minimal carbon losses.
This study provides targeted, mechanism-driven soil management recommendations that optimize agricultural productivity while preserving essential ecological functions in each land use in a hillslope-flood plain ecosystem in Bavaria, Germany.

Primary authors: LEI, Kaiyu (Chair of Soil Science, School of Life Sciences, Technical University of Munich,); B. BUCKA, Franziska (Soil Geography and Ecosystem Research, Institute of Physical Geography, Goethe University Frankfurt); JUST, Christopher (Chair of Soil Science, School of Life Sciences, Technical University of Munich); TEIXIERA, Pedro P. (Chair of Soil Science, School of Life Sciences, Technical University of Munich); VAN GRINSVEN, Sigrid (Department of Geomorphology and Soil Science, Technical University of Munich); FLOSSMANN, Sebastian (IMK-IFU, Karlsruhe Institute of Technology); BUEGGER, Franz (Research Unit Environmental Simulation, Helmholtz Zentrum München); DANNENMANN, Michael (IMK-IFU, Karlsruhe Institute of Technology); VÖLKEL, Jörg (Department of Geomorphology and Soil Science, Technical University of Munich); KÖGEL-KNABNER, Ingrid (Chair of Soil Science, School of Life Sciences, Technical University of Munich/ Institute for Advanced Study, Technical University of Munich)

Presenter: VÖLKEL, Jörg (Department of Geomorphology and Soil Science, Technical University of Munich)

Session Classification: Poster Session & Get-Together (including Beer & Pretzels)

Track Classification: Day 1: Science (English) / Tag 1: Wissenschaft (Englisch): Biogeochemical

processes in grassland soils