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Soil microbial community as a proxy for the ecological service condition in karst soils of SW China

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Karst is a key landscape covering extensive areas of Southwest China that has undergone rapid intensive land use change and degradation over the last 50 years. Clear evidence of environmental degradation and its damaging consequences for the reduction of intrinsic value of the land for local human populations has led to an increasing focus on landscape rehabilitation. This has included unmanaged abandonment and attempts to re-vegetate denuded surfaces. However, this has achieved limited success and there is a clear need to develop restoration strategies underpinned by robust quantitative and mechanistic understanding of critical zone (CZ) functioning. Thus, a karst Critical Zone Observatory (CZO) was established in June 2016 in Chenqi, Guizhou Province, along a gradient through three levels of human perturbed landscapes: sloping farmland; recovery phase 1 (recently abandoned, within 5 years); and, recovery phase 2 (secondary forest, abandoned > 5 years).
We hypothesise that there is a tipping point along the degradation gradient beyond which key biological controls over CZ function are lost, resulting in declining nutrient cycling and rock weathering rates, and increased soil erosion rates. This paper will present preliminary data from the application of the CZ approach using space-for-time substitution. We characterised soil microbial community dynamics along the degradation gradient using geochemical biomarkers and soil properties measured in soil profiles (<1.5 m depth; n = 3) at three slope positions at contrasting topographical aspects around the Chenqi catchment. We integrate measurements of mycorrhizal fungi and free-living soil microbes, and pools of soil carbon (C), nitrogen (N) and phosphorus (P), with estimations of soil erosion rates using radionuclide 137Cs/Pb210, within the karst ecosystem to evaluate the status of key ecosystem functions (e.g. nutrient cycling, carbon sequestration, soil stabilisation).