

## **Response to Editor and Referee 1**

Dear Editor and Referee 1,

We sincerely appreciate the editor's and referees' thorough evaluation and insightful comments on our manuscript (EGUSPHERE-2025-3510). These comments are very helpful for improving our paper. We have studied all the comments carefully and have revised the manuscript accordingly. Below is our point-by-point response to each suggestion.

### **Comment 1**

My concerns about over-interpretation of limited data remain. The study measured stocks and ratios, but the mechanistic inferences in the discussion section go quite far beyond what the data show. Specifically, the “high-speed C and N cycling strategy” framing relies heavily on a threshold from a Turkish karst study, but the authors only have SOC:TN, not data on decomposition rates (or microbial activity or mineralization measurements). Similarly, the Ca<sup>2+</sup> section describes a plausible positive feedback loop (calcium -> microaggregate formation -> organic matter stability -> nutrient retention), but none of the intermediate variables were measured.

### **Response Comment 1**

We sincerely thank the referee for this precise and valuable comment. In accordance with your suggestions and the editor's guidance, we have made targeted revisions to the relevant sections. Specifically, we have removed all speculative statements from the original manuscript regarding the “high-speed C and N cycling strategy” and the “positive feedback loop” involving calcium, thereby avoiding inferences that went beyond what our data could support regarding unmeasured processes. The revised discussion is now strictly based on the measured data obtained in this study and no longer extends to unsubstantiated causal mechanisms.

### **Comment 2**

In addition, the VPA shows interactions between the factor categories, but there's

no synthesis of how microhabitat, microtopography, and plant life forms interact.

### **Response Comment 2**

We thank the referee for pointing out this important gap. In response, we have added a new subsection (4.2.4 Interactions among factors) to systematically present a conceptual framework of “primary filtering-biological feedback,” which explains how microtopography and microhabitat jointly shape the physical substrate of the karst surface by modulating resource gradients (moisture, nutrients, light), thereby imposing primary filtering on the spatial distribution of plant life forms. In turn, once established, different plant life forms provide feedback regulation on their residing microenvironments through distinct biological processes (e.g., litter input, root activity). Based on our data, we further hypothesize that, although certain interactions exist among the factors, microenvironmental factors may serve as the “dominant factors” shaping spatial nutrient patterns in the extremely fragmented karst landscape, while the feedback regulation of plant life forms represents local adjustments superimposed on this physical substrate. This addition directly addresses the question of “how they interact” and strengthens the logical coherence of the discussion.