EGU22-12237, updated on 12 Aug 2022
https://doi.org/10.5194/egusphere-egu22-12237
EGU General Assembly 2022

Can litter quality explain landscape evolution: testing a soil-landscape evolution model.

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In the geomorphological literature biota are indicated as major drivers of landscape development, where vegetation and soil fauna can act as ecosystem engineers, changing the environment. However, soil landscape evolution models (SLEMs) have until now mostly neglected these biotic processes, such as bioturbation.

We also know that vegetation with different litter qualities can trigger different degrees of animal bioturbation, which can lead to a heterogeneous soil and landscape development both in space and over time. Soil-landscape evolution models have succeeded in incorporating soil development with landscape evolution. However, in these models the roles of biota, biotic interactions and their connections with soil and landscape evolution processes are still underrepresented.

We identified current SLEMs by a scoping review, and then outlined the role of biota in SLEMs and compared the coverage of processes of SLEMs. From this analysis we selected one of the high-coverage models to testify the hypothesis that landscape patterns can emerge from long-term interactions between biotic processes and soil-landscape processes. In this case we used trees with different litter qualities as biotic factor, and how this can explain the emergence of landscape patterns. We used a test area where topographic differences among species-specific patches are clearly present, taking a well-documented seminatural forest on marls in Central Luxembourg as an example. This system is characterized by a spatially heterogeneous forest pattern dominated by patches of European hornbeam (*Carpinus betulus L.*) and patches of European beech (*Fagus sylvatica L.*) showing also a clear differentiation in hydro-geomorphological process domains. Our hypothesis is that these patterns and process domains emerge over time as a result of these biotic-abiotic interactions. We tested our current landscape process understanding and hypothesis using the SLEMs Lorica with incorporation of these biotic components. The first results shows that after calibration with field data and the inclusion of the litter cycle, the adjusted Lorica model succeeded in simulating the geomorphic processes as affected by different litter qualities in the study area, and that the results are promising in explaining the observed spatial patterns.

Keywords: Soil-landscape evolution model; Biota; Litter quality