



How does litter cover, litter diversity and fauna affect sediment discharge and runoff?

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Litter cover plays a major role in soil erosion processes. It is known that litter cover reduces erosivity of raindrops, decreases sediment discharge and lowers runoff volume compared to bare ground. However, in the context of biodiversity, the composition of litter cover, its effect on sediment discharge and runoff volume and their influence on soil erosion have not yet been analyzed in detail. Focusing on initial soil erosion (splash), our experimental design is designated to get a better understanding of these mechanisms.

The experiments were carried out within the DFG research unit “Biodiversity and Ecosystem Functioning (BEF)-China” in subtropical China. The “New Integrated Litter Experiment (NILEx)” used as platform combining different subprojects of BEF-China dealing with “decomposition and nutrient cycling”, “mechanisms of soil erosion” and “functional effects of herbivores, predators and saproxylics” in one experiment.

In NILEx, 96 40cm x 40cm runoff plots on two hill slopes inside a castanea molissima forest plantation have been installed and filled with seven different types of litter cover. 16 one-species plots, 24 two-species plots, 4 four-species plots and 4 bare ground plots have been set up, each replicated once. We prepared 48 Plots with traps (Renner solution) for soil macrofauna (diplopods and collembola), so half of the plots were kept free from fauna while the other half was accessible for fauna. Rainfall was generated artificially by using a rainfall simulator with a continuous and stable intensity of 60 mm/h. Our experiments included two runs of 20 minutes duration each, both conducted at two different time steps (summer 2012 and autumn 2012). Runoff volume and sediment discharge were measured every 5 minutes during one rainfall run. Litter coverage and litter mass were recorded at the beginning (summer 2012) and at the end of the experiment (autumn 2012).

Our results show that sediment discharge as well as runoff volume decreases significantly with litter cover. The reduction of sediment discharge was positively related to biodiversity. At level 1, sediment discharge was reduced by 45 percent compared to the bare soil plots. At biodiversity level 4, sediment discharge amounts only 28 percent compared to bare ground. This biodiversity effect could be explained by a better overlap and gap filling of leaves of different litter species in a way that overland flow below the litter cover on the soil surface was less erosive at higher biodiversity levels. No strong correlation was found between sediment discharge or runoff and fauna indicating that litter decomposition in such subtropical systems is mainly driven by microbiological processes rather than macrofaunistic processes like litter consumption by diplopods and collembola. A negative correlation of sediment discharge and runoff volume over time during the rainfall events was found.

These preliminary findings will now undergo a more detailed analysis using linear mixed effect models to understand the utterly part of litter cover diversity in soil erosion and to give more information about the mechanisms involved.