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Kinetic energy and spatial variability of throughfall in forest ecosystems as a function of biodiversity

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Soil erosion by water is an important process regarding ecosystem stability and ecosystem functions; this is especially true for subtropical regions with high intensity rainfall. Rainfall erosivity is one important factor in estimating soil erosion as an ecosystem function under forest. The power of raindrops to detach sediment at the soil surface is influenced by drop size and velocity. When passing through vegetation, rain drop size as well as rain drop velocity are changed depending on several vegetation parameters e.g. leaf area index (LAI). The role of biodiversity as one of these vegetation parameters on soil erosion processes is not yet clear and more information on the spatial distribution of throughfall under vegetation canopies is needed.

In this study throughfall kinetic energy (TKE) as a unit of rainfall erosivity was measured and the effect of biodiversity on TKE and their spatial distribution was investigated. The experiment was carried out within the DFG research unit "Biodiversity and Ecosystem Functioning (BEF)-China" in subtropical China. To measure biodiversity effects, splash cups have been used as a high-precision device with a high number of replications possible. 1800 Splash Cups were installed in the field during five different rainfall events on 40 plots with different tree diversity levels with a total of 24 tree species. For investigating spatial distribution of TKE, these splash cups have been set up in distinct distances from tree individuals (15cm, 30cm and 45cm away from stem, in the middle of two and four individuals, under the first branch, at the intersection of a 45cm and 105cm circle around two stems and one free from vegetation to determine freefall kinetic energy). Additional vegetation parameters have been measured: LAI and ground coverage under each splash cup, height, stem diameter, crown expansion in north-south and west-east direction, number of branches and crown height of each tree individual.

First results show a higher kinetic energy of raindrops in splash cups under vegetation than exposed to open field. However, TKE is not influenced by tree species richness as a measure of biodiversity. Neither could we detect a biodiversity effect regarding all rainfall events nor within a single event. Contrary, our first results show a significant spatial dependency of TKE, where areas under the first branch of each tree individual show the lowest kinetic energy amounts.

These preliminary findings will now be analyzed in detail using mixed effect models to better understand the effects and parameters involved.