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Biological soil crusts in subtropical China and their influence on initial soil erosion

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Soil is one of the most valuable resources we have on our planet. The erosion of this resource is a major environmental problem, in particular in subtropical China where high rainfall intensity causes severe and continuous soil losses. One of the main mechanisms controlling soil erosion is surface coverage, typically by vegetation, litter, stones and biological soil crusts (BSCs).

BSCs play significant functional roles in soil systems, such as accelerating soil formation, changing water and nutrient cycling rates, enhancing soil stability and thus preventing erosion by wind or water. In initial ecosystems, cyanobacteria, algae, fungi, mosses and lichens are the first organisms to colonize the substrate; they form a biological crust within the first millimetres of the surface. BSCs and their effect on erosion are rarely mentioned in literature and most of the work done focussed on arid and semi-arid environments.

This study aims to investigate the role of BSCs controlling the amount of runoff generated and sediment detached during soil erosion events in an initial ecosystem in subtropical China. The study took place on a deforested experimental site (BEF China) near Xingangshan, Jiangxi Province, PR China. We used a total number of 350 runoff plots (ROP, 40cmx40cm) to measure sediment discharge and surface runoff. BSC cover in each ROP was determined photogrammetrically in 4 time steps (autumn 2011, spring 2012, summer 2012 and summer 2013). Perpendicular images were taken and then processed to measure the coverage of BSCs using a 1 cm^2 digital grid overlay. Additionally BSCs were sampled in the field and identified by their taxonomy.

In our ROPs we found 65 different moos, algae and lichen species, as well as cyanobacteria's. Mean BSC cover per ROP in 2013 was 17 % with a maximum of 62 % and a minimum of 0 %. Compared to stone cover with 3 %, our findings highlight the role of BSC in soil erosion processes. The total BSC covered area is slightly decreasing since our first measurements in 2011. Further results show that BSCs have an influence on sediment discharge and runoff volume and there is a considerable link to tree and shrub growth in our sampling area. BSCs disappear as trees and shrubs grow and hide them from sunlight.