

Experimental investigation of the early interaction between cyanobacterial soil crusts and vascular plants

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While there are hints that biological soil crusts (BSCs) can constitute physical barriers for the emergence of vascular plants, a conceptual approach for the quantitative evaluation of these effects is still missing. Here we present an experimental design to test the emergence of seedlings *in situ* with (i) capping natural intact, (ii) destroyed and (iii) removed BSC. The selected field site is directly adjacent to the constructed Hühnerwasser catchment (Lusatia, Germany). This site exists since the end of 2008 and consists of loamy sand. Serving as proxy for seedling thrust, we inserted pre-germinated seeds of three confamiliar plant species with different seed masses (members of the Fabaceae family: *Lotus corniculatus* L., *Ornithopus sativus* Brot., and *Glycine max* (L.) Merr.). In each treatment as well as in the control group planting depths were 10 mm. We took care that experimental plots had identical crust thickness, slightly less than 4 mm, serving as proxy for mechanical resistance.

A plot became established as follows: Firstly, the pristine crusted surface was vertically cut. To the windward side the BSC remained intact (*i*: “with BSC” stripe). To the downwind side soil material was temporarily excavated for laterally inserting the seeds beneath the surface of the first stripe. Then at the thereby disturbed second stripe pulverised BSC material became filled as a top layer (*ii*: “BSC mix” stripe). From the next stripe the BSC was removed (*iii*: “no BSC” stripe). Thus each plot had each experimental group in spatial contiguity (within 50 cm × 50 cm). The overall 50 plots were distributed across an area of 40 m × 12 m. When individuals of a species either emerged at all stripes, “× × ×”, or at no stripe of a plot, “– –”, there was no reason to suppose any effect of a crust. The “– × ×” emergence pattern (depicting the appearance of seedlings in both stripes possessing manipulated surfaces) points towards hindrance more clearly than “– × –” or “– – ×”. Altogether eight possible combinations exist.

Combinatorial analysis turned out that seedling emergence had been notably impeded for light-weighted seeds but little for heavy seeds. Repeated recordings enable to account for adaptable emergence of seedlings according to varying crust conditions – in spatial as well as temporal terms. The proposed experimental procedure hence is highly recommended as a viable instrument to further investigate filter and facilitation processes between BSCs and vascular plants.