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Biological soil crusts in Chile along the precipitation gradient

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Biological soil crusts (BSCs) are an association of different microorganisms and soil particles in the top millimeters of the soil. They are formed by algae, cyanobacteria, microfungi, bacteria, bryophytes and lichens in various compositions; together with their by-products they create a micro-ecosystem that performs important ecological functions, e.g. primary production, nitrogen fixation, mineralization and stabilization of soils. These top-soil assemblages are almost unstudied in South America (Büdel et al. 2016). Therefore, our aim is to investigate for the first time biodiversity of the key photosynthetic organisms, green algae and cyanobacteria following a precipitation gradient along the west coast of Chile. We are applying polyphasic approach - a combination of microscopy, culture dependent (16S and 18S rRNA, ITS) and culture independent molecular techniques (NGS). First results, based on culturing and light microscopy, showed high diversity of eukaryotic algae in biocrusts from humid regions, followed by semi-arid regions. Lichen dominated biocrusts from arid regions were characterized by a high diversity of green algae, while cyanobacteria were scarcely present. The functional role of the BSCs in the biogeochemical cycle of phosphorous (P) was evaluated using state of the art analytical methods including 31P-NMR (nuclear magnetic resonance) spectroscopy and P K-edge XANES (x-ray absorbance near edge structures). Total P as well as P fractions were quantified in all BSCs, adjacent soil underneath and comparable nearby soil of BSC-free areas, revealing a slight accumulation of total phosphorous and a distinct pattern of P fractions in the crust.
Our study describes for the first time the diversity of photosynthetic organisms in BSCs along a precipitation gradient in South America and their functional role in biogeochemical cycle of phosphorus as an important macronutrient.

Reference:
Büdel et al. “Cyanobacteria and Algae of Biological soil crusts”. In B. Weber et al. (eds.), Biological Soli Crusts: An Organizing Principle in Drylands, Ecological Studies 226, Springer International Publishing Switzerland: 2016. (pp. 55-80).