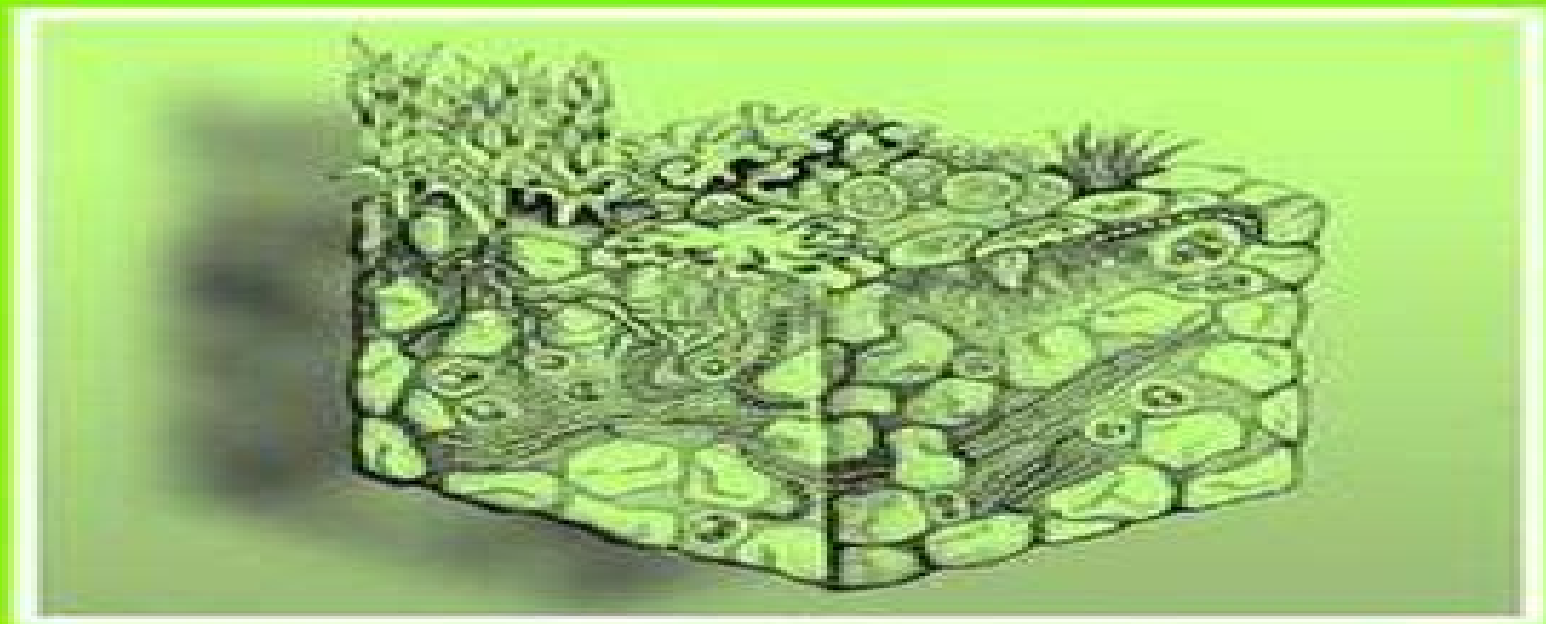


Ecological Studies 150

J. Belnap O. L. Lange (Eds.)

Biological Soil Crusts: Structure, Function, and Management



Springer

Biological Soil Crusts Structure Function And Management

Minjie Lin



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Biological Soil Crusts Jayne Belnap, Otto L. Lange, 2014-09-01 [Biological Soil Crusts: An Organizing Principle in Drylands](#) Bettina Weber, Burkhard Büdel, Jayne Belnap, 2016-05-21 This volume summarizes our current understanding of biological soil crusts biocrusts which are omnipresent in dryland regions Since they cover the soil surface they influence or even control all surface exchange processes Being one of the oldest terrestrial communities biocrusts comprise a high diversity of cyanobacteria algae lichens and bryophytes together with uncounted bacteria and fungi The authors show that biocrusts are an integral part of dryland ecosystems stabilizing soils influencing plant germination and growth and playing a key role in carbon nitrogen and water cycling Initial attempts have been made to use biocrusts as models in ecological theory On the other hand biocrusts are endangered by local disruptions and global change highlighting the need for enhanced recovery methods This book offers a comprehensive overview of the fascinating field of biocrust research making it indispensable not only for scientists in this area but also for land managers policy makers and anyone interested in the environment

[The role of physical and biological soil crusts on the water balance in semiarid ecosystems](#) Sonia Chamizo de la Piedra , 2014-11-06 In arid and semiarid areas the interplant spaces are usually covered by physical and biological soil crusts These crusts though representing an almost negligible portion of the soil profile have a number of crucial roles Soil crusts form the boundary between soil and atmosphere and therefore control gas water and nutrient exchange into and through soils Concretely in the last decade the study of biological soil crusts BSCs complex communities of cyanobacteria algae fungi lichens mosses and other microorganisms in intimate association with soil particles has drawn the attention of a growing number of researchers due to the key role they play in numerous processes in the ecosystems where they appear Unlike physical crusts BSCs protect soils against erosion by water and wind and increase soil fertility by fixing atmospheric C and N synthesising polysaccharides and reducing nutrient losses by runoff and erosion Through their influence on numerous properties that affect how water moves through soils such as roughness porosity hydrophobicity cracking and albedo BSCs play a key role in water processes such as infiltration and runoff evaporation and soil moisture It is widely known the role of physical crusts in decreasing soil porosity and hydraulic conductivity thus decreasing infiltration However there is controversy regarding the role of BSCs in infiltration and runoff processes Some studies indicate that BSCs increase infiltration and consequently decrease runoff whereas others have reported that they decrease infiltration and increase runoff or that they have no effect on either of them In addition the influence of BSCs on other soil water balance components such as evaporation and soil moisture has hardly been studied and the scarce existing studies also show contradicting results With the aim of enlightening the role that BSCs play in the water balance in semiarid areas in this thesis it has been analysed the influence of different soil crust types physical crusts and various developmental stages of BSCs on

key soil water balance components such as infiltration runoff evaporation and soil moisture at plot scale Furthermore to better understand how these crusts affect hydrological processes the influence of the type of crust and developmental stage of the crust on different properties that affect water movement and retention in soils has been analysed Last spectral characteristics of the different crust types as well as of vegetation have been examined with the aim of developing a spectral classification system for differentiation of these common ground covers in semiarid areas that allows their mapping and the modelling of the effects of the crusted areas on hydrological and erosion processes on larger spatial scales hillslope and catchment To conduct this research two areas where BSCs are widespread and that represent key spatial distributions of BSCs in semiarid ecosystems were chosen in the province of Almeria SE Spain El Cautivo in the Tabernas Desert a badlands catchment with silty loam textured soils and Las Amoladeras in the Cabo de Gata N jar Natural Park a flat area with sandy loam textured soils Our results show that BSCs increase aggregate stability water retention capacity and organic carbon and total nitrogen content compared to physical crusts and within BSCs these properties increase in the crust and the underlying soil as the crust is more developed in terms of greater biomass and later successional species composition The increase in soil properties with the presence of BSCs is especially noticeable in the top layer of soil 0 01 m and decreases with depth 0 01 0 05 m Chapter I Through their effect increasing surface roughness and physico chemical soil properties BSCs increase infiltration and decrease runoff compared to physical crusts In general infiltration increases with greater BSC development Chapter II However there are exceptions to this general pattern that are conditioned by other factors such as the spatial scale under study or the type of rainfall At small plot sizes 0 25 m² and after 1 h high intensity simulated rainfall 50 mmh⁻¹ we found that well developed BSCs such as lichens generate higher runoff rates than less developed BSCs as cyanobacteria and similar runoff rates to physical crusts Chapter II Thus at microplot scales and under extreme events the effect of well developed BSCs in enhancing infiltration due to their greater roughness can be overcome by their ability to clog soil pores when wet thus increasing runoff However when the influence of BSCs on infiltration and runoff is analysed under natural rain events and at larger spatial scales 1 10 m² we found that in low intensity rainfalls runoff decreases with the cover of well developed BSCs lichens and this effect is higher as the plot size increases Chapter III Such decrease in runoff with the presence of well developed BSCs is due to the microtopography that these crusts confer to soils Under high intensity rainfalls BSC cover has no significant effect on runoff yield and the main factor acting to determine runoff generation is rainfall intensity Chapter III The removal of the crust initially causes infiltration to increase But this effect diminishes over time as raindrop impact reseals the surface and a new physical crust is formed that increases runoff Chapter II Moreover crust disturbance by trampling but especially by removal causes a dramatic increase in erosion Chapter II Erosion also depends on the type of BSC Well developed crusts as lichens and mosses generate lower erosion rates than less developed crusts as cyanobacteria Regarding the influence of BSCs on soil evaporation under saturation conditions and warm ambient

temperatures soil water loss is quick in all types of surfaces and no significant differences are found in soils with or without BSCs Chapter V However during long cold wet periods soil water loss is faster in soils devoid of BSCs than in those covered by them Thus BSC crusted soils maintain more soil moisture at the upper soil layer 0.03 m than adjacent soils where the BSC has been removed during wet periods At deeper soil 0.10 m soil moisture is similar in both BSC crusted and uncrusted soils The removal of the BSC causes a higher decrease in soil moisture in fine textured soils Cautivo where the presence of BSCs has a stronger influence on increasing porosity and infiltration than in coarse textured soils Las Amoladeras During dry soil periods soil moisture is similar in soils with or without BSCs Chapter V Last a quantitative analysis of spectral characteristics of vegetation physical crusts and BSC developmental stages has demonstrated the possibility of classifying these common ground covers in semiarid areas based on distinctive spectral features Chapter VI The application of the classification system developed to multi and hyperspectral provides the possibility for future mapping of spatial distribution and temporal dynamics of BSCs which is crucial to incorporating the effects of crusted surfaces in current hydrological and erosion models Summarizing compared to physical crusts the presence of BSCs increase physico chemical properties of underlying soils especially in the first centimeters of soil and this enhancement is greater as the BSC is more developed Due to this increase in soil properties and the higher roughness that BSCs provide to soils BSCs increase water input by increasing infiltration and soil moisture and reduce water output by reducing soil evaporation Hence compared to physical crusts the presence of BSCs and especially the presence of well developed BSCs have an overall positive effect on the local water balance in semiarid ecosystems in addition to having a major role in protecting soils from erosion **Biological Soil**

Crusts: Spatio-temporal Development and Ecological Functions of Soil Surface Microbial Communities across Different Scales Shubin Lan, David R. Elliott, Sonia Chamizo, Vincent John Martin Noah Linus Felde, Andrew David

Thomas, 2024-08-09 Biological soil crusts biocrusts are widely distributed throughout the world and cover approximately 12% of the terrestrial surface Biocrusts are composed of cyanobacteria algae lichens mosses and a great diversity of other microorganisms which bind soil particles together to form a layer of biological soil matrix on the soil surface typically of several millimetres thickness They are important sites of regional and global microbial diversity and perform multiple ecological functions multifunctionality During the evolution of terrestrial life on earth biocrusts are regarded as the main colonising photosynthetic organisms before the advent of vascular vegetation They not only represent the early stages of terrestrial ecosystems but also facilitate the ecosystem's development and succession Therefore biocrusts are recognised as ecological engineers in the natural development of ecosystems and for the restoration of degraded terrestrial ecosystems The development of biocrusts is highly heterogeneous which is reflected on both temporal and spatial scales and this heterogeneity is still clearly visible even in a small scale However up to now only limited knowledge is acquired on biocrust temporal and spatial organisation In particular there still is a large knowledge gap regarding the various biocrust

communities under different developmental states and their related physiological metabolisms and ecological functions. Therefore, in-depth studies of these issues will undoubtedly further promote our understanding of the heterogeneous development of biocrusts as well as their ecological multifunctionality in terrestrial ecosystems. The relevant contributions are expected to provide a scientific basis for the management of biocrusts and technology development, e.g., cyanobacteria-induced biocrust technology for ecological restoration and the promotion of soil health.

Microorganisms in Soils: Roles in Genesis and Functions Francois Buscot, Ajit Varma, 2007-01-04. Soils would not exist without the complex and heterogeneous activities of microorganisms. For the third volume of *Soil Biology*, an international board of renowned scientists shed light on the significant role of these organisms. The following key topics are covered: Microorganisms in bioerosion, humification, mineralization, and soil aggregation; Microbial energetics and microbes in biogeochemical processes such as carbon and nitrogen cycles and phosphorus bio-availability; Interactions in the mycorrhizosphere, e.g., between mycorrhizal fungi and bacteria; Impact of microbes on plant nutrient cycling and the possible effects of transgenic rhizospheres on soil fungi; Functions of microbes in specific soil compartments such as soil surface or toxic metal polluted soils; Regulation of microbial activities in functional domains that are influenced by biotic or abiotic factors; Use of marker genes and isotopes as examples for modern techniques in soil microbiology.

The Fungal Community John Dighton, James F. White, 2017-03-16. A number of chapters provide excellent summaries of the modern methods available for studying fungal ecology along with those more traditional methods that are still extremely valuable. Overall, it is a hugely valuable compendium of fungal ecology research. It is a must for the library shelf. Lynne Boddy, Cardiff University, UK, Mycological Research, 2006. These 44 chapters are an excellent starting point for anyone interested in fungal communities in the broadest sense of the term. It is a book for dipping into; may be the last comprehensive treatment of fungal communities before the molecular revolution. Meriel Jones, University of Liverpool, UK, Microbiology Today. The scope of the work is tremendous. Excellent chapters providing overviews of methods provide a snapshot of the current approaches used to understand fungal communities at several levels of organization. This book should probably be on the shelf of every student of mycology and many ecologists too. For all students, this book should be a valuable resource and source of inspiration. Daniel Henk, Imperial College Faculty of Medicine, London, Inoculum, Vol. 59, No. 3, May 2008. Thorough taxonomic and subject indices further aid the reader in navigating through multiple authors' treatments of subjects of interest. Anthony Amend, Department of Botany, University of Hawaii at Manoa, in Economic Botany, Vol. 61. In all subjects in science, new findings and the use of new technologies allow us to develop an ever greater understanding of our world. Expanded and updated coverage in the fourth edition includes: Adds new sections on Integrating Genomics and Metagenomics into Community Analysis; Recent Advances in Fungal Endophyte Research; Fungi in the Built Environment and Fungal Signaling and Communication. Includes a broader treatment of fungal communities in natural ecosystems with in-depth coverage of fungal adaptations to stress and conservation. Expands coverage of the influence of climate change on

fungi and the role of fungi in organically polluted ecosystems Includes contributions from scientists from 20 nations to illustrate a true global approach for bridging gaps between ecological concepts and mycology Encyclopedia of Microbiology Thomas M. Schmidt, 2019-09-11 Encyclopedia of Microbiology Fourth Edition Five Volume Set gathers both basic and applied dimensions in this dynamic field that includes virtually all environments on Earth This range attracts a growing number of cross disciplinary studies which the encyclopedia makes available to readers from diverse educational backgrounds The new edition builds on the solid foundation established in earlier versions adding new material that reflects recent advances in the field New focus areas include Animal and Plant Microbiomes and Global Impact of Microbes The thematic organization of the work allows users to focus on specific areas e g for didactical purposes while also browsing for topics in different areas Offers an up to date and authoritative resource that covers the entire field of microbiology from basic principles to applied technologies Provides an organic overview that is useful to academic teachers and scientists from different backgrounds Includes chapters that are enriched with figures and graphs and that can be easily consulted in isolation to find fundamental definitions and concepts Ecological Development and Functioning of Biological Soil Crusts After Natural and Human Disturbances Vincent John Martin Noah Linus Felde, Steven D. Warren, Nicole Pietrasiak, 2021-09-02 **Military Geosciences in the Twenty-First Century** Russell S. Harmon, Sophie E. Baker, Eric V. McDonald, 2014-08-22 Eighteen chapters address the complex yet critical aspects of the role of geosciences in military undertakings The chapters cover a wide range of expertise drawn from the broad area of geology geomorphology geography geophysics engineering geology hydrogeology cartography environmental science remote sensing soil science geoinformatics and related disciplines that reflect the multidisciplinary nature of military geology

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