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MICROGEOMORPHOLOGY RELATED SOIL CHARACTERISTICS DETERMINE THE HETEROGENEITY OF BIOLOGICAL SOIL CRUST COMMUNITIES

Abstract: Hassanzadeh Bashtian M., Sepehr A., Bahreini M. & Farzam M., *Microgeomorphology related soil characteristics determine the heterogeneity of biological soil crust communities.* (IT ISSN 0391-9838, 2019).

We examined how biological soil crust (BSC) communities are affected by micro-geomorphology and soil characteristics in an arid ecosystem in northeastern Iran. Sampling was carried out systematically in the summer of 2016 along a geomorphic gradient within an alluvial fan by using micro-scale plots (0.25 m^2) and soil samples from the top soil layer (0-5 cm). According to the geomorphologic features and particle size distribution, the landform surfaces were divided into three units across the topographic gradient. From top downstream: Unit 1 involved coarse particles, Unit 2 included medium, and unit 3 comprised fine deposits., A total of 16 samples were taken for each unit (48 samples in total) along the alluvial fan from the apex to the base sector. The results indicated that micro-geomorphic and soil characteristics play an important role in the development of biological soil crust (BSC) micro-habitats. Decreasing content of calcium carbonate, pH, and soil salinity versus increasing soil moisture and clay content along the gradient of the alluvial fan showed a relevant correlation with increased BSCs coverage. BSCs increased along the landform gradient, although their diversity tended to decrease; in that way complex communities in the apex (Unit 1) involved cyanobacteria, lichen, mosses, and algae, while the dominant BSCs in the base (Unit 3) included moss species.

Key words: Alluvial fan, Biological Soil Crusts (BSCs), Microgeomorphology, Soil heterogeneity.

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INTRODUCTION

BSCs consist of tiny organisms such as cyanobacteria, algae, lichens, mosses and other close ties that form a coherent horizontal layer with particles of soil surface (Li & *alii*, 2005; Friedmann & Galun, 1974; Belnap & Gardner, 1993; Williams & *alii*, 2012). BSCs vary widely in biotic combinations and surface morphology, crusts can possess up to 70% of the living soil cover in arid landscapes (Belnap, 1994). They are usually widespread under dryland conditions (Belnap, 2006; Büdel & *alii*, 2009). Biocrust cover is diverse across spatial scales (from centimeters to kilometers), and it could depend not only on the surrounding vascular vegetation cover but also on soils and microgeomorphology or terrains in arid, semi-arid and temperate environments (Evans & Johansen, 1999; Ullmann & Büdel, 2003; Kidron & *alii*, 2009; Bowker & *alii*, 2016; Seitz & *alii*, 2017). Different BSCs distributions are related to the microclimatic gradient under the influence of elevation and terrain (Kutiel & *alii*, 1998), different geomorphic regions (Eldridge, 1999), various aspects and soil types (George & *alii*, 2000; Bu & *alii*, 2016). As a result, the development of BSCs characterized by a high complexity and spatial heterogeneity with many microclimatic and micro-topographic factors, is of great importance to conduct studies on the spatial distribution of BSCs (Bu & *alii*, 2013; Pietrasiak & *alii*, 2014; Williams & *alii*, 2013).

There is a nearby relationship between soil physicochemical properties, denudation processes and BSCs. They generally reduce erosion (Longton, 1997; Belnap & Gillette 1998; Belnap & Lange 2003; Cornelissen & *alii* 2007; McKenna Neuman & *alii*, 1996), runoff and redistribution of water and soil surface stability (Goudie & Middleton, 2006), and also reduce pH and increase the availability of nutrients (Kleiner & Harper, 1977, Evans & Belnap, 1999). Natural nitrogen cycles are very important in soil fertility and preventing desertification (Webb & *alii*, 2009). BSCs provide the required nitrogen (Belnap & Long, 2003) for different organisms of soil.