

The Protective Effect of Lichen in Maintaining Moisture and Modulating the Temperature Fluctuations of Soil Susceptible to Wind Erosion

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Article History (Received: 2017/10/12

Accepted: 2019/02/14)

Extended abstract

1- INTRODUCTION

Soil erosion is one of the most destructive processes of arid and semi-arid areas, which leads to desertification in a large area of the region. In windy areas, the wind in the region increases the probability of wind erosion. Soil moisture and soil temperature are the two effective factors in soil erosion control. Vegetation is also one of the effective factors in maintaining moisture, but in the arid and semi-arid areas where vegetation is distributed and Scattered, biological soil crusts between dispersed vegetation can be effective in maintaining moisture and soil temperature. Currently, the results of the effects of biological soil crusts on the moisture and soil temperature are contradictory, and these opposite results may be due to differences between different types of crusts or different climatic conditions. Rangeland is one of the most important sources of sediment production, so studying the factors affecting the process of reducing soil erosion is very important. The aim of this study is to evaluate the effectiveness of lichens in maintaining moisture, soil temperature and wind erosion control.

2- THEORETICAL FRAMEWORK

It is expected from the lichens, due to their unique characteristics and structures, to increase the amount of moisture and reduce the temperature of the soil during warm and dry seasons. So far, the role of lichens in different seasons has not been studied on microhabitat characteristics and wind erosion control, so we need to know how the lichens act in maintaining moisture and modulating the temperature fluctuations.

3- METHODOLOGY

The study area is located in the steppe rangelands of Golestan National Park. The wind speed is relatively high in this region and the dominant vegetation of the region is *Artemisia Sieberi* which is distributed sporadically in the region, in free space sparse vegetation, lichens are present in the form of a patch. Soil moisture under the lichen and bare soil during 4 time intervals using a moisture meter and also minimum, maximum, mean and diurnal temperature fluctuations (DTF) soil under lichen and bare soil during the three different seasons were measured using the thermometer ibutton. To determine the most important factor affecting soil moisture and temperature including treatments, season and their interactions, GLMM was applied and Tukey test was used to compare the means.

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4- RESULTS

According to GLMM results, the season ($F= 182.41$; $P < 0.0001$) had the highest significant impact on soil moisture. The mean comparison results indicate that soil moisture content of lichen and bare soil did not differ significantly in winter, but during the spring and summer, the moisture content of the lichen was higher than bare soil. The temperature fluctuations of lichen ($4-23^{\circ}\text{C}$) in spring and summer are lower than bare soil ($3.5-35^{\circ}\text{C}$) and at the end of winter there is no significant difference between two treatments. The maximum temperatures were observed in the bare soil and the minimum temperatures in both lichen and bare soil treatments were the same. Therefore, the temperature equilibrium created by the lichen is higher than the bare soil.

5- CONCLUSIONS & SUGGESTIONS

Biological soil crusts are important in maintaining soil moisture, so that high humidity can be effective in reducing temperature and erosion control. Lichens with mucilage secretion, the aggregate stability increases so that soil moisture amount is increased and soil erosion decreases. Also biological soil crusts affect the temperature equilibrium, the temperature equilibrium created by biological soil crusts in the warm and cold seasons, improves the water status, available food, soil structure, decreases erosion and controls desertification. The reason for the decrease in the degree of soil temperature by biological soil crusts is related to the evaporation rate, so when evaporation increases, it causes more water to exit. In addition, most of the dominant lichens in the area have light color, which has a significant role in reducing the degree of soil surface temperature.

Key words: Biological Soil Crust, Temperature, Moisture, Lichens, Rangeland.