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Evolution of Fractal Parameters through Development Stage of Soil Crust

Abelardo Ospina (1), Adriana Florentino (1), Ana Maria Tarquis (2,3,4)

(1) Instituto de Edafología, Facultad de Agronomía, Universidad Central de Venezuela, Ciudad Universitaria, Maracay, Venezuela, (2) CEIGRAM, Universidad Politecnica de Madrid, Spain (anamaria.tarquis@upm.es), (3) Grupo de Sistemas Complejos, UPM, Madrid, Spain., (4) Dept Matematica Aplicada, UPM, Madrid, Spain.

Soil surface characteristics are subjected to changes driven by several interactions between water, air, biotic and abiotic components. One of the examples of such interactions is provided through biological soil crusts (BSC) in arid and semi-arid environments. BSC are communities composed of cyanobacteria, fungi, mosses, lichens, algae and liverworts covering the soil surface and play an important role in ecosystem functioning.

The characteristics and formation of these BSC influence the soil hydrological balance, control the mass of eroded sediment, increase stability of soil surface, and influence plant productivity through the modification of nitrogen and carbon cycle.

The site of this work is located at Quibor and Ojo de Agua (Lara state, Venezuela). The Quibor Depression in Venezuela is a major agricultural area being at semi-arid conditions and limited drainage favor the natural process of salinization. Additionally, the extension and intensification of agriculture has led to over-exploitation of groundwater in the past 30 years (Méndoza et al., 2013).

The soil microbial crust develops initially on physical crusts which are mainly generated since wetting and drying, being a recurrent feature in the Quíbor arid zone. The microbiotic crust is organic, composed of macro organisms (bryophytes and lichens) and microorganisms (cyanobacteria, fungi algae, etc.); growing on the ground, forming a thickness no greater than 3 mm. For further details see Toledo and Florentino (2009).

This study focus on characterize the development stage of the BSC based on image analysis. To this end, grayscale images of different types of biological soil crust at different stages where taken, each image corresponding to an area of 12.96 cm2 with a resolution of 1024x1024 pixels (Ospina et al., 2015).

For each image lacunarity and fractal dimension through the differential box counting method were calculated. These were made with the software ImageJ/Fraclac (Karperien, 2013).

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