COMMENTARY

The fractal dimension of soil particle size

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ABSTRACT

Quantitative soil texture investigations using fractal dimensions of soil particle sizes reveal that fractal dimensions have a substantial linear negative association with sand content (>0.1 mm) and a significant power-law positive correlation with clay and silt content (0.05 mm) (P 0.0001). The extent of spatial heterogeneity, however, was not limited to the shrub canopies of the dominating Ammopiptanthus mongolicus communities in the desert region, according to the findings. These findings refuted the hypothesis of the "fertile island effect," which occurs when fine-grained elements, such as dust, are intercepted by plants in a desert ecosystem. We believe that the significant geographical variability found outside of shrub canopies, as well as the absence of spatial connectivity are to blame.

Key Words: *Quantitative; Soil; Mongolicus; Fractal dimensions*

INTRODUCTION

The constant domination of A. mongolicus communities in these dry desert environments is due to the scope of shr--ub canopies and the lack of adequate soil substrate conditions required for the invasion of other species. With a spatial variation scale of 21.19 m–30.99 m, which is larger than the mean diameter of the shrub canopy but does not reflect the local effect of shrubs, the spatial heterogeneity of the autocorrelation part accounts for up to 83 percent (except for very fine sand in the 60 cm - 70 cm soil layer, where it is 50 percent). The sand-covered terrain in this area encourages rainwater infiltration, which improves A. mongolicus's growing conditions. However, because frequent sand movement in this ecosystem cannot keep fine-grained elements such as dust deposited under the canopy of plants, there is no "fertile island" effect on the exposed ground surface. This contradicts the findings of a large number of researchers. Many researchers have hypothesised that plants in desert ecosystems can intercept dust, minimize raindrop erosion, and boost Spatial semi-variogram model and parameters of various soil particle size fractions and fractal features, but this contradicts their findings. Effective the lack of a "fertile island" effect could be due to the stability of the surface materials as well as the short lifespan of plant species in the habitat Certainly, it has something to do with the fact that A. mongolicus bushes form coppice dunes with varying degrees of development, sparse branches, and high heights. As a result, the psammophyte, A. mongolicus, has a stable existence in the desert. Quantitative investigations of soil texture utilizing fractal dimensions of soil particle sizes reveal that the fractal dimensions of soil particle sizes have a strong linear negative association with sand content (0.1 mm), but a strong power-law positive correlation with clay and silt content (0.05 mm) (P\0.0001). When the silt and clay contents are very low, the rise in fractal dimension caused by an increase in silt and clay content compared to sand content is more pronounced. Because silt and clay concentration in arid desert environments is so low, an increase in their content is critical for fractal dimension accretion. The spatial variability results, on the other hand, demonstrate that the spatial variation scale of soil particle concentration is outside the shrub canopies' range.

This could be owing to the regular erosion and deposition caused by the wind. surface materials in these A. mongolicus-infested locations is the most common psammophytic vegetation species. The morphological changes in A. mongolicus branches and variances in the degrees of development of A. mongolicus.

The "fertile island" is not supported by these coppice dunes effect. The bushes' interception is thought to be the cause of this phenomenon. Fine-grained elements, such as sand, are abundant in the desert habitat. dust, etc., which encourages the growth of other plants. We believe that the lack of this "fertile island effect" is due to a number of factors. due to the soil's considerable spatial variability morphological changes in A. mongolicus branches and variances in

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the degrees of development of A. The "fertile island" is not supported by these coppice dunes. eff. mongolicus, where the range of these spatial differences is greater isn't limited to the variety of shrub canopies and Interspaces between shrubs This geographical heterogeneity is ineffective. when it comes to creating the soil substrate conditions that are essential for as a result of the invasion of other plant species.

In this desert environment, A. mongolicus colonies are stable and dominant. When the fragmentation model is used to sort particles by size, it produces fractal dimensions that are theoretically between 0 and. All of the data in this investigation has fractal dimension values that are compatible with the fragmentation theory's 0D 3 predictions. Demonstrates that the soil texture in the study area's 0 cm-5 cm sandy layer is coarser than the soil texture in the 50 cm-70 cm soil layer. In the 0 cm-5 cm soil layer, the fractal dimension of soil particle size is 1.62-1.89, while in the 50 cm-70 cm soil layer, it is 1.87–2.63, suggesting that the greater the sand concentration, the lower the fractal dimension of soil particle size. The difference in D values between 50 cm-70 cm and 5 cm in this study. The discrepancy in D values between the 50 cm-70 cm and 5 cm depths in this investigation was due to the presence of sand (0.1 mm particle diameter) and silt and clay (0.05 mm particle diameter).

Other Researchers studies show that as soil texture changes from course to fine, the fractal dimension of particle size increases. The fractal dimension increases with clay content and decreases with sand content, according to studies. However, the average sand content (particle size [0.05 mm]) of all soil samples collected at this study site is greater than 49, the silt and clay contents (particle size [0.05 mm]) in the 0 cm-5 cm and 50 cm-70 cm layers are significantly different.

In very finely grained soils, D values reaching 3.0. The comparatively high sand content of the sample was blamed for D2. The high value of R2 (0.87) further demonstrated that mass-based fragmentation models are good representations of the PSD in the size range investigated. As a result, our findings show that a high sand concentration contributes to a reduction in fractal dimension. In our sandy a mongolicus shrubland research region, the variation coefficients (CVs) of the fractal dimensions of soil particle size are low in the 0 cm-5 cm and 50–70 cm soil layers. Clay and very fine sand (sand grains) are the CVs that can be ordered in this sequence. These discrepancies in the CVs of the fractal dimensions of the soil particle size can be linked to changes in clay and silt content caused by high winds in the research area with psammophytic plants. Because of the regional disparities in deflation and transport capacity of sand grains, the CVs for sand content are smaller than those for clay, silt, and very fine sand.