Fractal dimension and variability of soil particle in grassland

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Introduction Fractal dimension of soil particle is not only a token of soil particle , but also a index of variability of soil texture . So the study on variability of fractal dimension redound is in favor of describing the distribution of soil texture quantificationally It can also provide a basis in improving desertification and protecting ecosystem in grassland .

Methods and materials the proving ground is in the natural grassland in Wushen county in Inner Mongolia . It is sandy soil , the vegetation are composed of natural sabulicola . the total area of proving ground are 5 .04hm^2 (140m × 360m) , the interval of sampling is 20 meters .

Theory and models fractal dimension of soil particle can be expressed in the following :

$$W(\delta > \bar{d}_1)/W_0 = 1 - (\bar{d}_1/\bar{d}_{max})^{3-D} \quad (1)$$

where $\bar{d}_1$ is mean value between d_i and d_{i+1} ; $W(\delta > \bar{d}_1)$ is the total weight of soil particles more than $\bar{d}_1$; $W(\delta < \bar{d}_1)$ is the total weight of soil particles less than d_1 ; d_{max} is mean diameter of the biggest particle size ; W_0 is the total weight of all soil particles is the fractal dimension .
Semi-variogram can be expressed in the following :

$$\gamma^*(h) = \frac{1}{2N(h)} \sum_{i=1}^{N(h)} [Z(x_i) - Z(x_i + h)]^2 \quad (2)$$

where $\gamma(h)$ is the variogram value at lag distance h , $N(h)$ *is* the number of lag distances , and $Z(x_i)$ is the value of the observation at point x_i .

Conclusions (1) The correlativity between fractal dimension and content of sand particle (d > 0 .1mm) is negative proportion , the correlativity between fractal dimension and content of clay particle (d < 0 .05mm) is negative proportion . It indicated the loss of silt (d < 0 .05mm) result in desertification serious and decrease of fractal dimension , so the fractal dimension is a reflection of loss of soil particles , it can be used to denote the degree of desertification ; (2) The variogram of soil particle is spherical model , variability of soil particle is mainly affected by stochastic factors , and the range of fractal dimension is larger than that of soil particle appreciably ; (3) As a general and representative index of soil particle , the relationship between fractal dimension and distribution of soil particle is very close , so soil particle in different size can be replaced by fractal dimension to describe the variability of soil texture and the degree of desertification , and it is more useful in researching the process of desertification and rule of variability of soil in grassland .

References

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