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Yaxin Chen

*Inner Mongolia Agricultural University, China*

Bing Xu

*Inner Mongolia Agricultural University, China*

Kezhen Guo

*Inner Mongolia Agricultural University, China*

Quanming Liu

*Inner Mongolia Agricultural University, China*

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## Application of fractal on ecosystem in grassland

CHEN Yaxin<sup>1</sup>, XU Bing<sup>1,2</sup>, GUO Kezhen<sup>1</sup>, Liu Quanming<sup>1</sup>

<sup>1</sup> Institute of Water Resources and Water Engineering in Inner Mongolia Agricultural University, Hohhot, 010018, China;

<sup>2</sup> Institute of Water Resources for Pastoral Area of IWHR, Hohhot, 010010, China, E-mail: xb151@sohu.com

**Key words :** fractal, geostatistics, spatial variability, grassland, ecosystem

**Introduction** Water and soil loss and deterioration of the environment are serious in the western grasslands of China, and this restricts the local sustainable development of the economy. The environment is influenced by spatial and temporal distribution of water, soil, and vegetation. Understanding the complex phenomenon of spatial and temporal distribution of ecological elements is very important for agriculture and safeguarding the environment of grasslands. Since grasslands are complex ecosystems with strong spatial and temporal variability, we can utilize Geostatistics to demonstrate the patterns and the internal relationships of ecosystem elements. Traditional parametric Geostatistics has some short comings for explaining complex phenomenon of ecosystems, while Fractal Geostatistics perhaps is more appropriate. Compared with Geostatistics, Fractal Geostatistics is good at illustrating the nonlinear problems, which provides a totally new idea for the internal regularity study of the complexity and scrambling of ecosystems in grasslands. Fractal Geostatistics has great value in research and application.

**Theories and methods** Fractal Geostatistics is the organic combination of Fractal theory and Geostatistics. Geostatistics can be used to study relativity in distribution of spatial information in a certain scale. Self-similarity theory of fractal can be used to study the heterogeneity of the spatial information, and then we can simulate and predict the distribution of spatial information by integrating correlation and heterogeneity.

**Applications** As a complex ecosystem, patterns and processes in grasslands are always the emphasis of ecology and grassland science, which is closely related to spatial variability. In 1993, the 78th annual meeting of ecology (USA) opened, with the subject Geostatistics and Ecology. Some people showed the potential application of Geostatistics in ecology, and since then it has been used by more and more people. At present, the main applications are as follows: (1) Analysis with R/S. It reveals the variety of regional variability in a certain temporal-spatial scale (Wang Kaoli, 2002). (2) Interpolation and simulation. Based on the fractal relationship and correlativity of variable, the value at unsampled locations can be estimated according to the known information (Grane, 1990; Cheng Qiuming, 2001). (3) Characterization of soil in structure. Particle-size distribution, soil water retention curve and current in porosity medium have fractal characteristic, which the variability can be described by Fractal Geostatistics (Tyler, 1990; Huang Guanhua, 2002; Xu Bing, 2007). (4) Variety of vegetation. Shape of vegetation, community and landscape patterns have close affinity with scale. Fractal Geostatistics can explain the complicated variety of vegetation in a certain spatial-temporal scale (Palmer, 1998; Su Litan, 2005; Ren Haibao, 2005).

**Conclusions** The study on spatial problems are at the forefront of ecological research (P. Kareva, 1994), and Geostatistics has proved to be a good method for the study of spatial variability. With the development of Geostatistics (e.g. the development of Fractal Geostatistics), it will be a powerful tool to study the complicated ecosystem in grassland.

### Reference

Chen Yaxin, Shi Haibin, et al, (2005). Spatial Variability Prediction Theory and Conditional Simulation for Soil Water and Salt. Beijing: Science Publishing Company.