Application of fractal on ecosystem in grassland

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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

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