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研究论文

小波分析方法在心叶驼绒藜(*Ceratoides ewersmanniana*)空间格局尺度推绎研究中的应用

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摘要 以古尔班通古特沙漠南缘莫索湾沙地选取相隔15km的两个200m×200m样地，以建群种心叶驼绒藜(*Ceratoides ewersmanniana*)及其生境地形为研究对象，应用小波分析定量研究了多尺度上空间格局的推绎以及空间异质性、空间格局依赖于尺度的变化关系。研究发现：小波分析尺度由1(5m)变化到4(20m)时，两个样地小尺度上的异质性和格局被合并到更大的尺度上，当小波分析的尺度大于等于5(25m)时，两个样地的格局变化平稳，对应地形（丘顶、丘坡、丘底）的基频稳定在110m左右，心叶驼绒藜的数量动态变化周期稳定在115～125m之间。结果表明：小波分析对信号整体特征的提取作用实现了小尺度上的信息到大尺度上的聚合。结合小波分析对信号突变点的检测，利用位置方差检验局部空间异质性程度，发现位置方差将大尺度上的格局分解到每个取样小样方，位置方差最大的地点对应的异质性也最强，实现了大尺度上的信息到小尺度上的分解。总结认为应用小波分析可以实现对空间格局的尺度推绎，具有对植被、环境的分布格局以及异质性有双重度量作用，由小波系数以及由其衍生的小波方差、位置方差来实现这种度量，图形表现直观，优越性明显。

关键词 小波分析；尺度推绎；空间格局；小波方差；位置方差

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Ecological application of wavelet analysis in the scaling of spatial distribution patterns of *Ceratoides ewersmanniana*

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Abstract Ecological experiments are usually conducted on small scale,but the ecological and environmental issues are usually at large scale. Hence,,there is a clear need of scaling. Namely,when we deal with the patterns and processes at larger scale, a special connection needs to be established to the small scale that we are familiar with. Here we presented a wavelet analysis method that could build relationships between spatial distribution patterns at different scales. And with this method, we also studied the how spatial heterogeneity and patterns changed with scale. We investigated the distribution and the habitat of *C.ewersmanniana* in two plots (200m×20m, the distance between the plots is 15 km) at Mosuowan desert..The results demonstrated that spatial heterogeneity and distribution patterns were incorporated into larger scale when wavelet scale varied from one (5m) to four (20m). However, if the wavelet scale was above five (25m),the spatial distribution patterns varied placidly, oscillation period of landform stabilized at 110m, and the dynamic quantity period of *C.ewersmanniana* stabilized at 115-125m.We also identified signal catastrophe points with wavelets and verified heterogeneity degree of local space with position variance. We found that position variance decomposed the distribution patterns at large scale into small sampling plot, and the position with the largest variance also had strongest heterogeneity. In a word, wavelet analysis method could scale-up spatial distribution patterns and habit heterogeneity. With this method and other method derived from this one, such as, wavelet scale, wavelet variance, position variance, and extremely direct-viewing graphs, wavelet analysis could be widely applied in sol

ving the scaling problem in ecological and environmental studies.

Key words wavelet analysis _ scaling _ spatial distribution patterns _ wavelet vari
ance _ position variance

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