

高原鼠兔洞穴与其栖息地植被空间分布特征的关联性研究

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GIS analysis of the spatial relationship between plateau pika burrow distribution and vegetation distributional patterns

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摘要

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摘要 高原鼠兔(*Ochotona curzoniae*)是青藏高原高寒草甸生态系统的关键种,其生境利用特征对高寒草甸植被保护的影响一直是重要的研究内容。我们于2008年9月在四川省石渠县云波沟面积为44 km²的研究区域内进行了高原鼠兔有效洞穴数量样线调查。该地区一直以来放牧压力较小,2006年起执行国家西部退牧还草政策后,放牧完全停止。调查期间共完成样线7条,总长度19 km,获得取样单元2,423个。根据中巴资源2号卫星2008年9月18日拍摄的遥感图像计算并提取研究区域归一化植被指数(normalized difference vegetation index, NDVI)数据。利用石渠县地形数字地图建立数字高程模型计算坡度。用Bonferroni z 检验比较取样单元内鼠兔洞穴数量与NDVI以及洞穴数量与坡度间的相互关系发现:NDVI值较低区间(0.1 - 0.3)内鼠兔洞穴数量显著低于理论预期值,中等NDVI值区间(0.3 - 0.4)内鼠兔洞穴的数量与理论值没有显著差异,而NDVI值较高区间(0.4 - 0.6)内,鼠兔洞穴的数量显著高于理论预期。回归分析结果表明:NDVI与洞穴数有显著正相关的线性回归关系 $y = 16.50x + 0.87$ ($R^2 = 0.78$, $P < 0.001$);鼠兔有效洞穴数量和坡度没有显著的线性关系($R^2 = 0.04$, $P = 0.441$)。因此,我们认为在无家畜竞争的自然环境中,栖息地植被的质量是影响高原鼠兔空间分布的重要因素。高原鼠兔有选择地利用植被较好的生境而避免使用植被过度退化的生境,这种利用方式在客观上防止了栖息地植被的过度破坏。

关键词: 高原鼠兔 洞穴 栖息地 高山草甸 NDVI

Abstract: The plateau pika (*Ochotona curzoniae*) is a keystone species in alpine meadow ecosystems on the Tibetan Plateau. Therefore, ecological studies of the relationship between plateau pika habitat use and the stability of alpine meadows are important. However, little information is available about large-scale spatial relationships between plateau pika habitat use and vegetation distribution. Therefore, we studied this topic using Geographic Information System (GIS) analyses. The number and position of active plateau pika burrows were sampled along seven line transects totaling 2,423 sampling units, 19 km in length, in a 44 km² study area in Yunbo Gou, Shiqu County, Sichuan Province during September 2008. Historically, domestic livestock grazing and other human activities were rare in this area. A no-grazing policy has been in effect since 2006, thereby removing livestock competition in the study area. Normalized Difference Vegetation Index (NDVI) values within the study area were extracted from a CBERS-02 remote sensing image taken September 18th, 2008. A digital elevation model (DEM) of the study area was established based on a digitized topographical map of Shiqu County, and slope values within the study area were subsequently extracted using the DEM. NDVI and slope values were compared with the number of plateau pika burrows in each sampling unit. A Bonferroni z test revealed that numbers of pika burrows were lower than expected in units with low NDVI values (NDVI of 0.1 - 0.3), not different than expected in middle NDVI groups (0.3 - 0.4), and higher than expected in high NDVI groups (0.4 - 0.6). A linear regression model found a significant positive correlation between NDVI value and pika burrow count ($y = 16.50x + 0.87$; $R^2 = 0.78$, $P < 0.001$). In contrast, no linear relationship was detected between slope and pika burrow number (linear regression, $R^2 = 0.04$, $P = 0.441$). This study showed that plateau pikas use areas with higher vegetation coverage more than areas with lower vegetation coverage in the absence of livestock competition. Our results lend some support to the conclusion that the pika's natural use of vegetation does not accelerate the destruction of the alpine meadow vegetation in this region.

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