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研究论文

基于IKONOS数据的植被制图与植被空间格局——以五分地沟试验区为例

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摘要 以五分地沟试验区为例，利用IKONOS卫星遥感图像，结合DEM，对地形复杂的黄土丘陵地区制作植被图，并进行三维显示，直观地表达了研究区域植被的空间分布。使用景观指数，分析了植被空间格局的特点。结果表明，试验区整体格局较破碎，但斑块稳定性较好，分维数为1.25。人工植被占主导地位，人工乔木林和农田成为基质，天然植被、水体等类型以小斑块的形式镶嵌其中。经过综合治理，当前的植被结构和空间布局能有利于控制试验区的水土流失。研究表明，高空间分辨率数据对于地形复杂的沟壑丘陵地区制作植被图及进行综合分析具有明显的优势。

关键词 IKONOS；DEM；植被制图；三维显示；植被分析

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Vegetation mapping and spatial pattern analysis using IKONOS data：a case study in the Wufendigou area

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Abstract The paper demonstrates the use of IKONOS satellite imagery and a Digital Elevation Model (DEM) for vegetation mapping of the topographically complex loess hills in the Wufendigou area. A 3-dimensional view, overlaying the vegetation map on the DEM, was produced to facilitate visual interpretation. The spatial pattern of vegetation in the area was analyzed with different landscape indices.

Three kinds of data were used in the study, remotely sensed digital imagery, topographic maps, and vegetation samples. The IKONOS data, captured on July 23rd, 2002, included 4 bands (blue, green, red, and near infrared with a ground resolution of 4m) and 1 panchromatic band (ground resolution 1m). Four sheets of topographic maps with the scale of 1：10,000 were used. Vegetation samples from quadrates were observed during a field survey from June 24th to July 1st, 2004. Sixty four quadrates were used, including records of herbaceous plants, shrubs, and trees. During the field survey, doubtful and difficult areas encountered in the pre-interpretation process were checked, so was the accuracy assessment of the vegetation pre-interpretation.

Data processes were digital image processing and DEM creation, including the production of slope and aspect data sets. Using PCI, the IKONOS imagery was fused, orthorectified, and geometrically corrected. The Gauss-Kruger projection was used. Topographic maps were scanned, conto

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ur lines and other features were vectorized and corrected with Titan ScanIn. A GRID model DEM was produced and reprojected by use of ArcGIS. Finally, the slope and aspect data was extracted.

The vegetation classification system and corresponding visual interpretation keys were established according to the preliminary interpretation results, field observations, and image characteristics. Visual interpretation in ERDAS IMAGINE was used to produce a vegetation map with the scale of 1： 5000. For the sake of publishing, another vegetation map (1： 25000) was generated as well.

The vegetation map was then overlaid on the DEM, to produce a 3-dimensional view of vegetation in the area. Compared with remotely sensed data of moderate spatial resolution, IKONOS imagery may show detailed objects on the ground, which may improve the accuracy of vegetation interpretation greatly. Using the described methodology, artificial woodland could be defined to species level, and grassland could be defined to association level. A total of 26 surface cover types was recognized, including 8 for natural vegetation, 12 for artificial vegetation, and 6 other types. The 3-dimensional view facilitated interpretation of the spatial distribution of each vegetation type.

Combining slope and aspect data with a vegetation map, this article quantitatively examined the characteristics of vegetation spatial patterns using the landscape indices of dominance, fragmentation and fractal dimension. The results showed that the general vegetation pattern was fragmented. The total area of the study region was 9.02km2, containing 2462 patches, giving a fragmentation of 273 patches/km2. The fractal dimension was 1.25, which suggested that the shape of vegetation patches was more or less simple and stable. Moreover, it effectively illustrated the vegetation recovery since 1979 reported by Jin Zheng-ping.

Artificial vegetation dominates the Wufendigou area, with natural vegetation dispersed as small patches. Artificial vegetation accounted for 59.60% of the total area. The dominance index for artificial vegetation was 38.01, which was much greater than 16.57, the value for natural vegetation. The planted woodland accounted for 29.28% of the total area. Adding the seedlings of Pinus tabulaeformis, this figure increased to 31.32%. The large area of planted woodland showed the efforts to control soil erosion and consequently improve the local ecological environment.

In addition, the area of steep gully walls accounted for 6.94% of the total area. Most of them, accounted for 4.40% of the total area, were bare. It is therefore suggested that soil erosion should not be overlooked in the region.

Key words IKONOS _ DEM _ vegetation mapping _ three-dimensional perspective view _ vegetation spatial pattern

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