Knowledge based methods of analysis of remotely sensed images for landscape ecology

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Abstract

Aerial photos and satellite images display and reveal the landscape structure in a particularly descriptive and clear way. State-of-the-art image analysis methods can be used to evaluate the structural information in these images according to the following principles:

- Landscape elements can be delineated by segmentation methods. Segmentation is the process of partitioning the image into homogeneous regions which correspond to landscape elements.
- Properties of the landscape elements can be determined from spectral characteristics, shape parameters and context information. In particular, the landscape elements can be categorized into patches, corridors and matrix. Land cover characteristics of landscape elements can be identified. Various indices with ecological relevance can be deduced.
- The landscape elements can be aggregated to landscape units according to homogeneous mosaic criteria. This process of partitioning the whole set of landscape elements into subsets of adjacent elements with similar characteristics can be seen as a sort of “metasegmentation”. Landscape unit boundaries can be delineated.
- Structural indices of landscape units can be deduced. By assigning ecological meaning to these indices, they can be transformed to ecological indicators to be used in environmental monitoring and planning.

Research in the analysis of landscape structure from remotely sensed images not only results in techniques which produce information from images for assessment and monitoring purposes faster than by visual interpretation. A main outcome of this type of research also is insight into the theory of landscape ecology and thus an increase of landscape-ecological knowledge.

Image analysis of landscape structure can be supported and improved by employing graph-theoretical methods:

- Graphs can be used for segmentation (delineation of landscape elements) and metasegmentation (aggregation of landscape elements to landscape units).
- Graphs can be used for the representation and analysis of landscape structure with the aim to infer ecological processes from landscape structure and to deduce ecological indicators.