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Cost-Effective Raster Image Processing for Geoecological Analysis using ISOCLUST Classifier: a Case Study of Estonian Landscapes

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кулонометрия) и другие методы. Большое количество часов лабораторных работ (70% от общего количества часов отведенных на изучение дисциплины), позволяют студентам на практике самостоятельно изучить основные современные аналитические методы. Значительное внимание уделяется радиохимическому анализу природных объектов, что связано с загрязнением окружающей среды естественными и искусственными радионуклидами. Поэтому в данном курсе предусмотрены работы по изучению методов дозиметрического контроля. Лабораторный практикум курса «Аналитические методы в геоэкологии» представлен следующими расчетно-аналитическими занятиями:

- взвешивание на весах различных типов;
- методы фильтрации растворов;
- титриметрический метод определения общей щелочности и карбонатной жесткости воды;
- спектрофотометрический метод определения концентрации вещества;
- фотометрический метод определения нитритов с использованием реактива Грисса;
- измерение рН раствора потенциометрическим методом;
- оценка радиационной обстановки в помещениях и на открытом воздухе дозиметрическими методами.

В рамках освоения каждого расчетно-аналитического занятия студенты свободно ориентируются в современных методах физико-химического анализа, могут выбирать аппаратуру в соответствии с типом образца, областью применения, требуемой чувствительностью и точностью, использовать методы количественного определения концентрации различных веществ и применять полученные знания на практике для решения различных прикладных геоэкологических проблем.

COST-EFFECTIVE RASTER IMAGE PROCESSING FOR GEOECOLOGICAL ANALYSIS USING «ISOCCLUS» CLASSIFIER: A CASE STUDY OF ESTONIAN LANDSCAPES

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The goal of the study is to perform comparative analysis of image processing methods, enabled by means of IDRISI GIS software. The purpose has two aims. First, a spatial analysis of land cover types in the coastal landscapes of western Estonia, Pärnu area, at two various temporal dates. Second, an overview of the technical methods of IDRISI GIS enabling to evaluate image processing. The main research method consists in classification of satellite images for resulting geoecological mapping of landscapes. The ISOCCLUS classification enabled to create multi-spatiotemporal thematic maps of Pärnu area (fig. 1). The research method is based on the spatiotemporal analysis of the geospatial data, performed by means of GIS tools and remote

sensing data. The images were downloaded from the Earth Science Data Interface, Global Land Cover Facility. The Landsat TM imagery include scenes of June 2006 and June 1992. Both images cover summer months, thus enabling vegetation cover-age to be easily recognized.

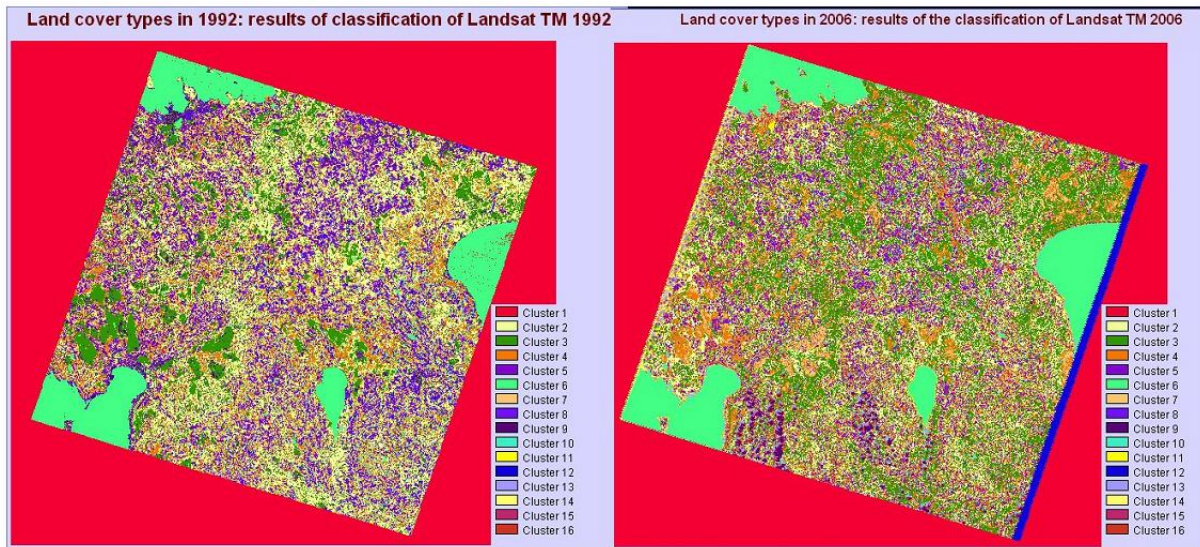


Figure 1. Landscapes of western Estonia in 1992 and 2006.
The results of classification

Raster layers were used in IDRISI GIS, as it is raster-oriented program. The main ground truth data available in the current research included CORINE thematic layers as a basic map. It shows various land cover types and vegetation coverage according to the CORINE («Coordination of information on the environment») European classification: <http://www.eea.europa.eu/publications/COR0-landcover>. Various existing and approved methodological approaches exist on land cover mapping using remotely sensed data, in particular Landsat TM and GIS mapping techniques (e.g., [1], [2], [3]).

Workflow and research outcomes from these and other studies focusing on the same problem of Landsat TM based mapping, were considered methodologically. Image classification was performed using available tools of geospatial processing. Raster data fig.1: Landscapes of western Estonia in 1992 and 2006. The results of classification from the CORINE project were integrated with Landsat TM images using import function of IDRISI GIS tools, in order to enable overlay of land cover types in the selected landscapes. The Landsat TM data were imported to IDRISI from GeoTIFF format to format «.rst», which was executed using import function «Data Provider Format import». As each Landsat TM scene is a multispectral image with several spectral bands, each band was visualized as a separate image. Afterwards, the images were composed using Color Composite function. The next step includes application of chosen classification method of ISOCLUST approach towards images processing. ISOCLUST classifier technique means «Iterative Self Organizing CLUSTERing». It is based on the histogram peak selection technique (fig. 2).

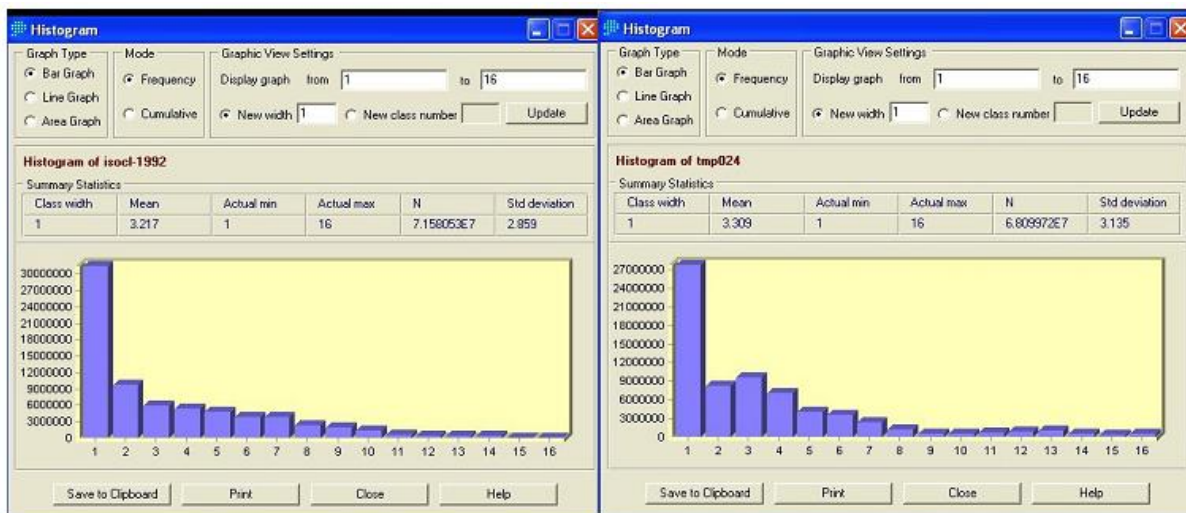


Figure 2. Histograms of ISOCLUST classification

The analysis of spectral reflections strongly depends on the local inner features of the surface: texture, structure, color, etc. Information on spectral signatures is received by the satellite sensors and recorded on the Landsat TM. This information is used for the image classification. Using individual characteristics of objects, derived from the multispectral Landsat TM bands, the information from the image was extracted, analyzed and used for the classification. Since there are 16 classes typical for the land cover types in the study areas, according to CORINE, the pre-defined number of classes for ISOCLUST classifier was 16. Using individual characteristics of objects, derived from the multispectral Landsat TM bands, information from the images was extracted, analyzed and used for land classification. Comparing both images, changes in landscape patterns on 1992 and 2006 can be noticed. It is shown (fig.1, 2) that between 1992 and 2006 there are changes in land cover types in selected Estonian landscapes. In 2006 the urban area is larger than in 1992 (class «3» on the histogram). This can be explained by various reasons, e.g. intensive suburbanization in the touristic zone of Baltic Sea, and increase of summer cottage («dacha») construction on the coasts which increased settled areas.

1. Gumbricht T., McCarthy J., and Mahlander C. 1996. Digital interpretation and management of land cover: a case study of Cyprus. *Ecological Engineering*, 6, 273-279.
2. Brenner J.C., Christman Z., and Rogan J. 2012. Segmentation of Landsat Thematic Mapper imagery improves buffelgrass (*Pennisetum ciliare*) pasture mapping in the Sonoran Desert of Mexico. *Applied Geography*, 34, 569-575.
3. Zhu Z, Woodcock C.E, Rogan J., & Kellndorfer J. 2012. Assessment of spectral, polarimetric, temporal & spatial dimensions for urban and peri-urban land cover classification using Landsat & SAR data. *Remote Sensing of Environment*, 117, 72-82.