

Секция 6. Геоинформационные системы

Processing remote sensing data using Erdas Imagine for mapping Aegean Sea region, Turkey

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Summary. The study region is located in western Turkey, Izmir surroundings. The research examines spatiotemporal changes in landscapes of Izmir region, during the decade 1995-2005. Methods entail raster processing, spatial analysis and mapping by means of geospatial techniques and Erdas Imagine software. The Landsat TM images were geo-processed for detection of changes in the land cover types. It demonstrated effective use of the remote sensing data and spatial analysis for vegetation studies: a combination of digital satellite images, GIS cartographic tools and methods of spatial analysis of vegetation coverage are highly suitable and efficient for the monitoring of highly heterogeneous landscapes located in the area of intensive anthropogenic activities (western Turkey). The study contributes towards technical development of cartographic methods of the environmental monitoring.

Methods. Many reports about modelling land cover types and vegetation coverage use support of the Landsat products and remote sensing methods [1], [2], [3], [4], [5]. Though the variety of them focus on other research areas in Mediterranean region, they were reviewed in this study and their developed methodologies and techniques were considered. The Landsat Thematic Mapper (TM) images have been downloaded from the Global Land Cover Facility (GLCF) Earth Science Data Interface website (<http://glcfapp.glcfc.umd.edu>). For selecting the target area, a spatial mask of coordinates ranging from 26°00'–26°00' E to 38°00'–39°00' N has been applied (Fig.1). Among various available images, the target images were chosen on 1987 and 2000 year.



Fig.1. Data capture from the GLCF website: Landsat TM scenes.

The selected images are visualized on Fig.2. The choice of the data is explained by the territorial and temporal suitability: both images cover the same territory in Izmir surroundings, and temporally they have a reasonable time span (13-years) which enables to perform change detection in land cover types. Also both images are taken during summer months: June 1987 and June 2000, which allows to analyze vegetation types

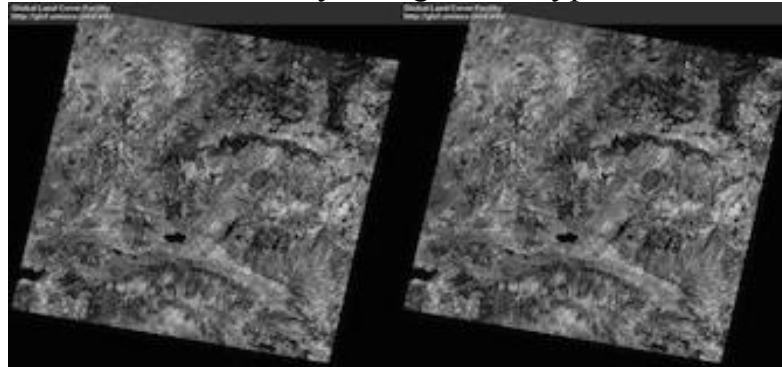


Fig2 Data: Landsat TM images in 1987 (left) and 2000 (right).

The main chosen software is Erdas Imagine, since it provides wide range of tools for raster image processing and spatial analysis. The logical parts of the research work include problem definition, studying existing research literature on the actual topic, obtaining relevant data, import and per-processing the data, spatial analysis of the land cover types, landscape mapping illustrating received results, quality assessment and final conclusion. The important technical part of the work has image classification, which is the key technique for the current research.

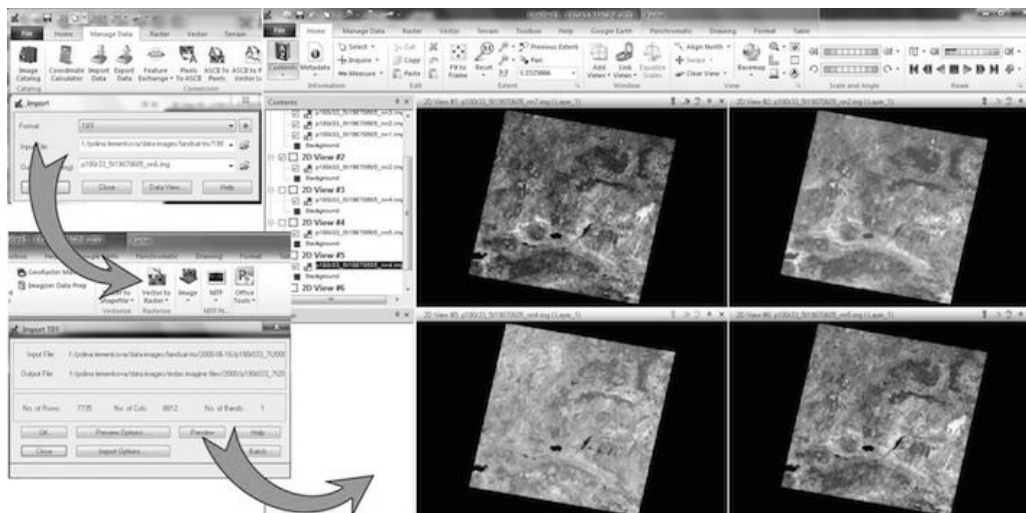


Fig 3. Conversion of raw TIFF Landsat TM images into Erdas Imagine “.img” format.

The Landsat TM image that has 7 wavebands and contains information of 512 rows and columns. Therefore, both Landsat scenes were captured a series of GeoTIFF files with separate TIFF file for each of the bands, respectively. At the next working step the Landsat bands were unpacked for each image. Then these TIFF layer bands of Landsat were imported from the initial format (.tiff) to Erdas Imagine format (.img): Fig.3. To facilitate work with imagery, the default directory both for input and output files has been set up in 'Preferences' to current working folder. The scheme summarizing the workflow of the current research is presented at Fig.4. During the next working step, the seven Landsat bands were imported into a single Erdas Imagine file (.img) for each image (year 1987 and year 2000, respectively). The different Landsat TM bands represent a multispectral data set, so the color composite, or false color composite, is created from the images obtained in different bands. Different combinations were tried to achieve optimal one. Thus, a standard true color composite of the image data is represented by the corresponding colors: red, green and blue spectral areas are assigned red, green and blue image bands, respectively. But for the false color composite they are displayed in the inverse way, i.e. by placing the infrared, red, green in the red, green and blue channels, respectively.

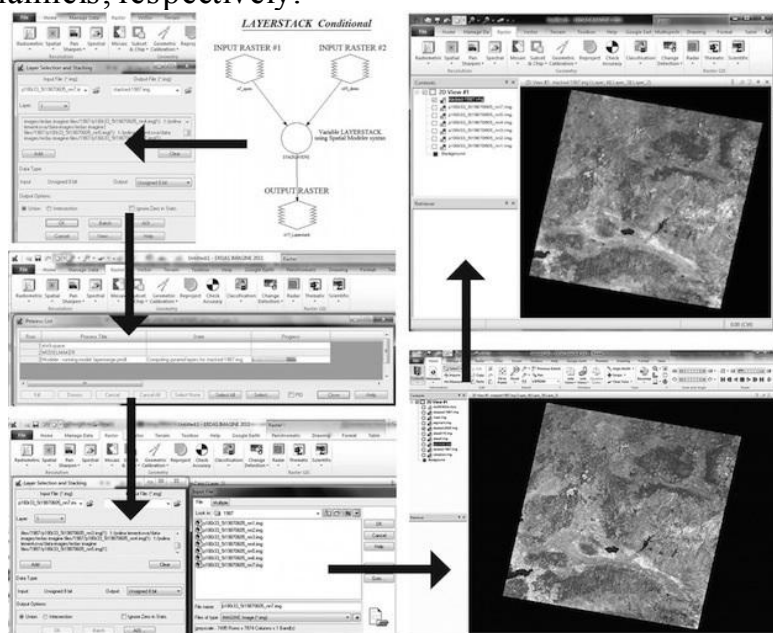


Fig.4. Logical model and scheme of working process for bands stacking Erdas Imagine. Right: multi-band image layer, color composites for 1987 (above) and 2000 (below).

This allows to easily distinguish vegetation areas from the built-up regions. Thus, fresh and healthy vegetation of the agricultural fields is being represented in reddish colors, as vegetation absorbs green color but reflects

infrared one. On the contrary, built-up areas of the human settlements are usually appear as steel grey, since these areas reflect equal portions of near infrared, red and green. Color composition has been done using the erdas imagine toolbar, raster/spectral/layer stack module. During this procedure the individual layers were merged into single multi-layer “.img” file. Since thermal band was necessary (which is nr.6 for landsat tm), the merged layers included only non-thermal bands of landsat (bands 1, 2, 3, 4, 5, and 7). As a result, the separate bands were combined into single, multi-layer image fort the year 1987 in .img format. The same procedure was repeated for the second image for year 2000. The color composite has been created using composition of individual layers / bands of the image by using 'raster options' in 'open raster layer' menu. In section 'layers to colors' the band were assigned to colors combination. To visualize the image in natural color composite that represent true color composite combination, the function “natural color” was applied from the spectral menu. To select target region, the images have been cropped, i.e. The selected portion area of interest cut off from the whole area. The two images were overlapping not perfectly (fig.5) but the discrepancy at both images can bee easily seen. Therefore, we needed to define the area common for both images that will be used for further images processing. For that we used crop selection of the both images. This has been done using create subset image tool from the menu subset and chip. The clipped area was applied to both images in order to achieve identical area of interest. First, the area of interest (aoi) layer file was created to identify the area of detailed interest on both images in erdas imagine viewer. The next working step included supervised classification of both images (1987 and 2000).

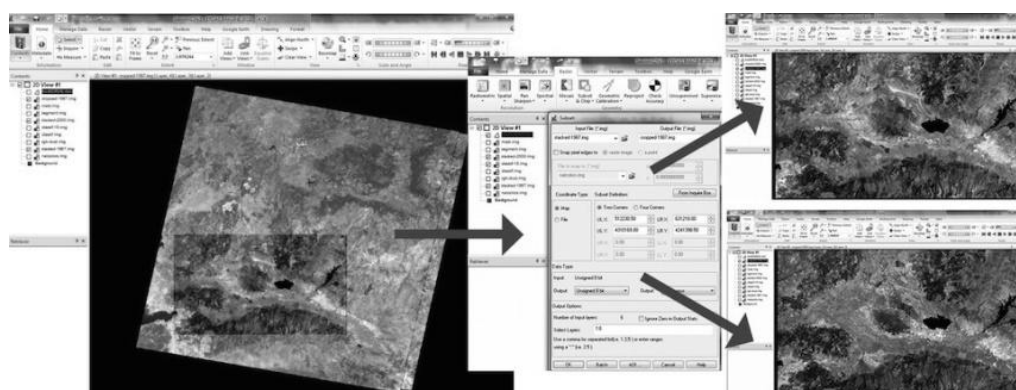


Fig. 5. Left: Selecting AOI from the initial scenes. Center: adjusting parameters. Right: AOI 1987 (above) and AOI 2000 (below).

At the final working step the areas covered by diverse land cover types were calculated and compared using erdas imagine functionality. The assessment of the areas of all land cover classes has been done using

calculation of the pixels in each corresponding land cover class multiplied by spatial resolution of the landsat images. The results indicate changes in certain land cover types: increase in land cover types “agricultural areas (cotton, etc).”, “urban areas”, “croplands 1 (wheat)”, “croplands 2 (barley, cereals)”, “sparsely vegetated areas”, and decrease in land cover types “broadleaf forests”, “coppice”, “mixed forests”, “wetlands”. This illustrates impact of anthropogenic activities on the natural ecosystems.

Resuming this work, the following conclusion could be drawn. The presented case study on land cover changes in western Turkey demonstrates that combination of digital remote sensing data, GIS and cartographic tools and methods of spatial analysis of vegetation coverage are highly suitable and efficient for the actual monitoring of the highly heterogeneous landscapes located in the area of intensive anthropogenic activities. The increased human activities, such as agricultural works, city spread and industrialization, affect environment, cause negative impacts on the ecosystems and make changes in vegetation coverage.

Literature

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