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WEB-СЕРВИС GOOGLE EARTH КАК ПОДДЕРЖКА ГИС-КАРТОГРАФИРОВАНИЯ ПРИ РЕШЕНИИ ГЕОПРОСТРАНСТВЕННЫХ ЗАДАЧ В ВЫСШЕЙ ШКОЛЕ

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Данная работа представляет результат геопространственного анализа выбранной территории (западная часть Турции, регион Измир) с комбинированным использованием космических снимков Google Earth, Landsat TM и ГИС ПО Erdas Imagine. В работе рассмотрены преимущества совместного использования космических снимков разной категории и детальности (мультиспектральные снимки Landsat TM и ETM+, а также Google Earth веб-сервис) вкупе с ГИС обеспечением для задач геопространственного анализа, часто решаемые в Высшей школе на курсах географии и наук о Земле. Данная работа приводит пример успешного изучения ландшафтов. Изучение распространения различных типов земной поверхности, моделированное с помощью Landsat TM и Google Earth позволяет анализировать динамику изменений ландшафтов, а также подтверждает возможность эффективного использования веб-сервиса Google Earth для тематического картографирования. Для классификации снимков были использованы технологии обработки снимков методами доступных модулей ПО Erdas Imagine. Веб-сервис Google Earth был успешно использован для верификации и валидации результатов картографирования с помощью модуля «Linking with Google Earth».

Ключевые слова: Google Earth, ГИС, экологическое моделирование.

Introductoin. Methods of multi-temporal remote sensing approach (Landsat TM images taken on different years) together with Google Earth web services and GIS spatial analysis techniques facilitate assessment of changes in land cover types over the decades. Current paper is a contribution to the studies of Aegean landscapes in western Anatolia, and in general, towards Mediterranean ecological studies.

Methods. The logical algorithmic approach of current work is shown on Fig. 1: Methodological flowchart. The existing methodologies have been studied [1, c. 266; 2, c. 107-109; 3, c. 221; 4, c. 64] and applied to the current work with modifications. The images have been downloaded from Web Internet, uploaded to the Erdas Imagine software and processed. The main processing technique was clustering segmentation which consists in merging pixels on the images into clusters, which is based on the assessment of their homogeneity or, on the contrary, on their distinguishability from the neighboring pixel elements. Comparing to the group of pixels, or clusters, single separate pixels cannot be used successfully for the image classification, since they do not provide valuable, meaningful topological-semantic information for the interpretation of the image. Therefore, the resulting clusters enabled to analyze spectral and textural characteristics of landscapes, and to perform spatial analysis.

METHODOLOGICAL FLOWCHART

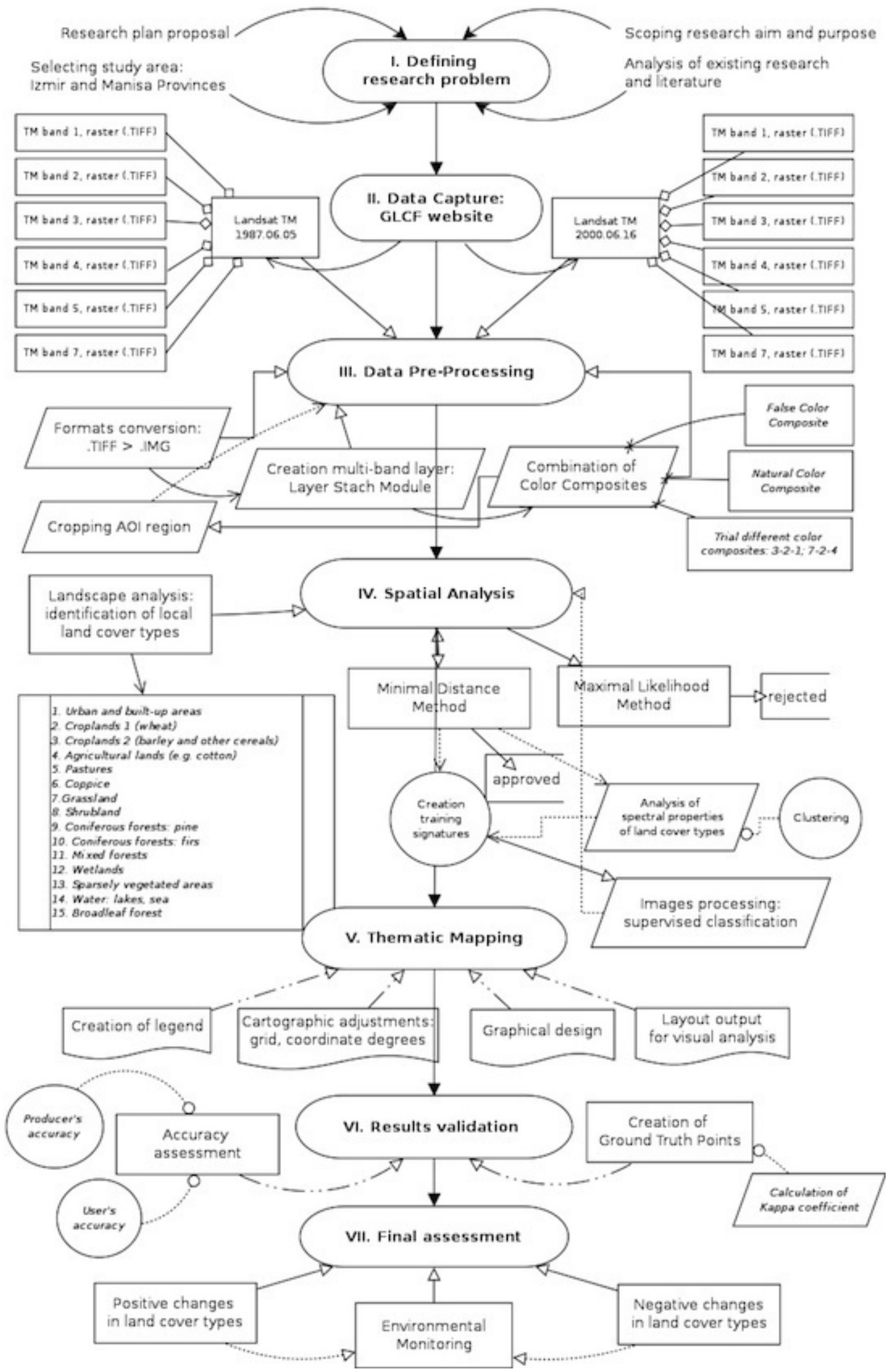

Fig. 1. Methodological flowchart

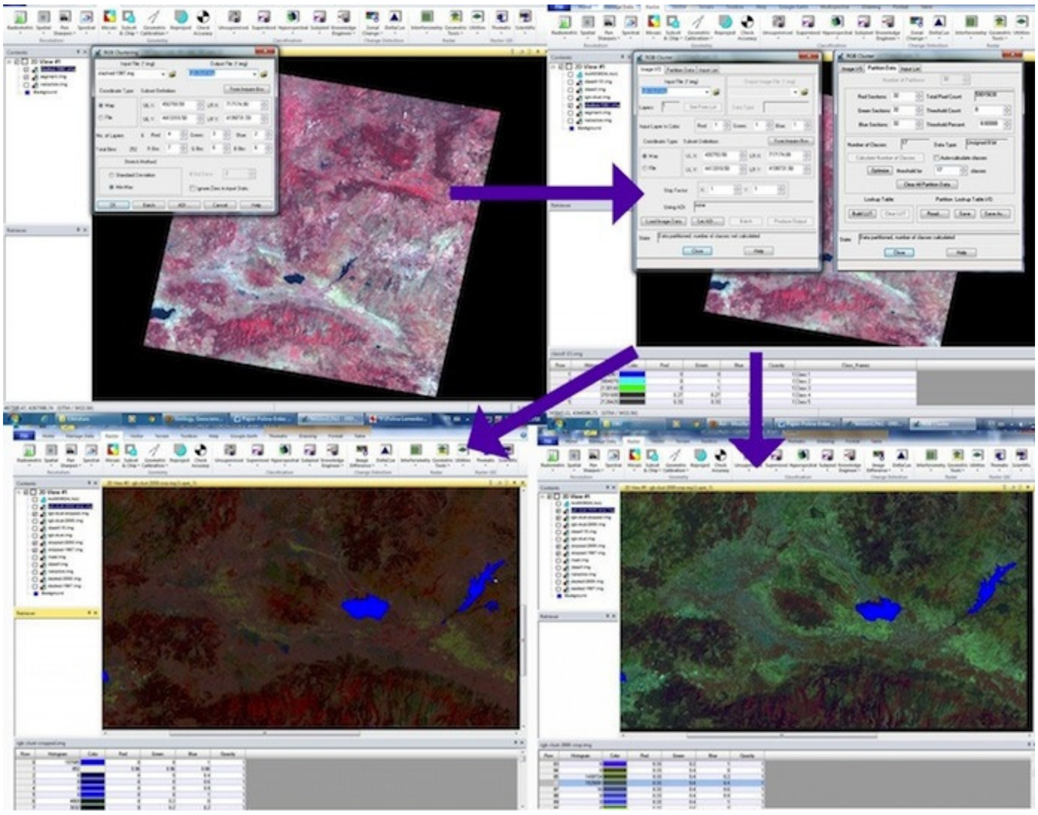

Fig. 2. Clustering, Landsat 1987 (below, left), clustering, Landsat 2000 (below, right)

The accurate cluster segmentation of the Landsat TM images was next important step for supervised classification. There are numerous clustering algorithms that determine natural spectral groups from the initial pixels sets, for instance, the «K-means» approach and ISODATA (Interaction Self-Organizing Data Analysis Technique). Clustering was performed to classify pixels into thematic groups, or clusters (Fig.2). The number of clusters was assigned to 15, which responds to the selected land cover types in the study area. These cluster centers were then located within the study area. During clustering procedure, each digital pixel on the image is categorized to the respecting cluster, to which the mean Digital Number (DN) value of the given pixel is the closest. Upon classification of all pixels in such a way, the revised mean vectors for each of the clusters were computed. The process was repeated in an iterative way until optimal values of the class groups were assigned and the pixels were grouped to the corresponding classes. Afterwards, the land cover types were visually assessed and identified for each land cover class. Based on the cluster segmentation the land cover classes were derived and homogenous land use zones were differentiated.

The next step of developing of training sites for the spectral signatures for supervised classification was performed as «Spatial Analysis» and «Supervised classification». The general aim of the image classification consists in automatic assignation of all pixels on an image into land cover classes that are typical for this study area. Classification was done on the basis of the multispectral data, spectral pattern, or signatures, of the pixels that represent each land cover class. Different land cover types and landscape features are detected using individual properties of DNs of the pixels. The DNs show values of the spectral reflectance of the land cover features, and individual properties of the objects. For instance, the most well-known are Parallelepiped classification, Neural Nets, Decision Trees, Mahalanobis Distance, Minimum Distance, and Maximum Likelihood classifiers. Usually, it is not easy to decide, which classifier method is a priori the best for the actual research problem, due to different factors: characteristics of the images, mapping scales and specific situation of the study area, reflectance properties of the local land cover types, landscape structure and heterogeneity vary significantly. However, in current research the appropriate classifier was chosen as a Minimal Distance. The images were classified and the changes in the land cover types were detected.

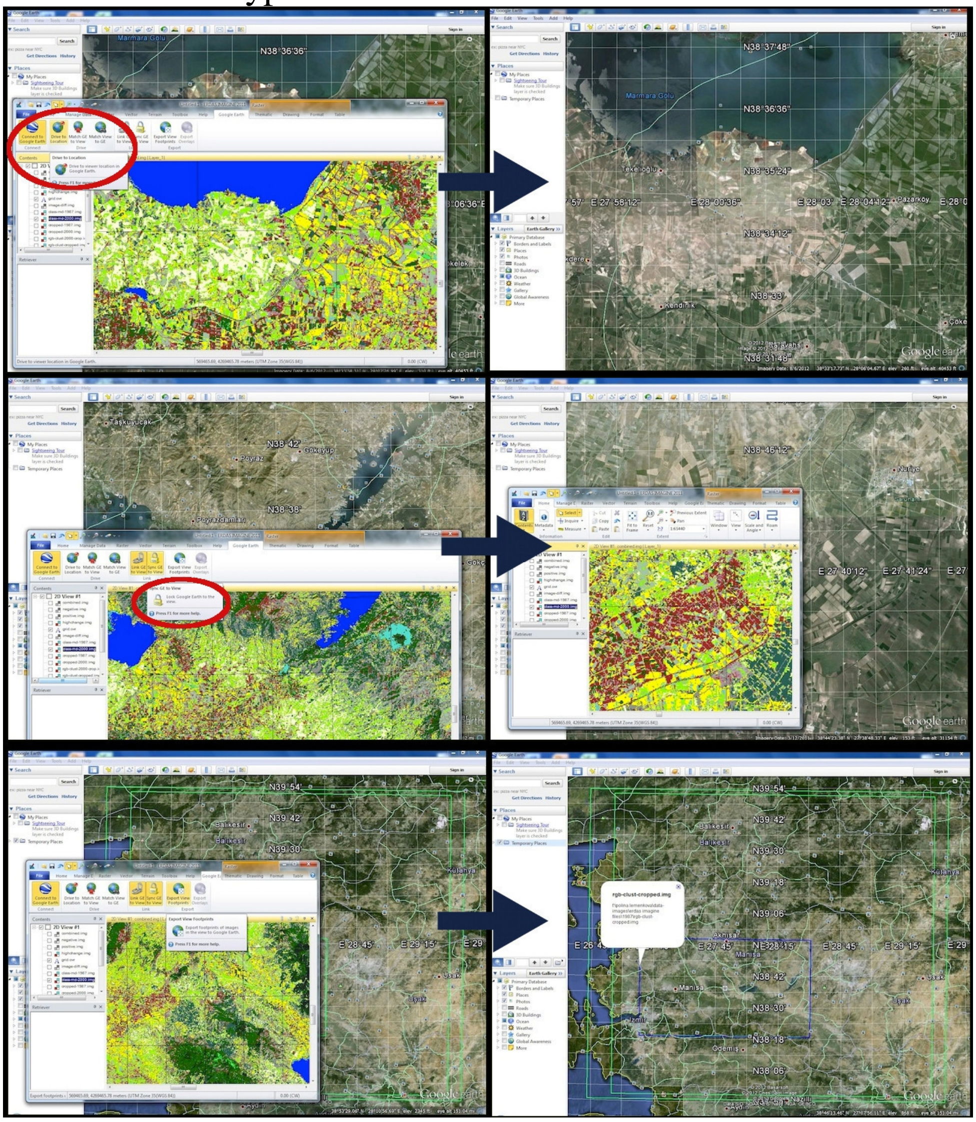

Fig. 3. Linking the satellite Landsat TM images with Google Earth server, and verification of the selected landscapes via Google Earth large-scale aerial imagery

Results. Verification via Google Earth. During the classification process, the selected areas with the most diverse landscape structure and high heterogeneity of the land cover types, have been verified by the overlapping of the Google Earth. For that the function «connect to Google Earth» was activated that enabled to visualize the same region of the current study on the Google Earth in a simultaneous way. The functions «Link Google Earth to View» and «Sync Google Earth to View» enabled to synchronize the view areas between the Google Earth and the current view on the image. This enabled to check the most difficult and dubious study areas, to assure to which land cover type this site belongs. Final thematic mapping is based on the results of the image classification: visualizing landscape structure and land cover. The quality control and validation of the results has been performed using accuracy assessment operations in Erdas Imagine menu. The landscapes in the study area of Izmir region are highly heterogeneous and fragmented, and changed since 1987.

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GOOGLE EARTH WEB SERVICE AS A SUPPORT FOR GIS MAPPING IN GEOSPATIAL RESEARCH AT UNIVERSITIES

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The geospatial work has been performed using combination of the Google Earth imagery, Landsat TM images and Erdas Imagine GIS software. The advantage of utilizing Google Earth scenes with Landsat TM satellite imagery, along with GIS techniques and methods, for inventorying land cover types has been demonstrated for landscape studies. Combination of land cover type characteristics and landscape changes enabled to analyze landscape dynamics, as well as applicability of Google Earth service for thematic mapping. The used data included Landsat TM and ETM+ multi-band imagery covering area in Izmir, western Turkey. The image processing was performed using supervised classification in Erdas Imagine software. The Google Earth web service technologies were applied to test the accuracy of mapping via the available module of Erdas Imagine «Linking with Google Earth».

Keywords: Google Earth, GIS mapping, environmental modeling.

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