

MONITORING OF GREEN AREAS IN THE CENTRAL PART OF PLOVDIV CITY USING HIGH RESOLUTION SATELLITE DATA

*Rumen Nedkov, Eugenia Roumenina, Georgi Jelev
Space Research Institute, Bulgarian Academy of Sciences*

Abstract

Information updating for the biggest municipality's green areas' size and position is a problem related with two main characteristics of the municipality's ecosystem status. The green area and plantation system is an important space structure and functional part of the inside and outside of Plovdiv city's residential territory. It serves as a basis in the decision-making process on environmental improvement, recreation, and their connection with city architecture. The normalization of the green area system, which performs various functions, is of basic importance for all residential areas in Plovdiv city, which experience aggravated microclimatic conditions. The paper provides brief description of the methodology and the results of a scientific study of the central part of Plovdiv city.

The study was carried out based on aerospace, ground-based, and GPS data.

Key words: *satellite images, green areas, GIS, GPS.*

Introduction

A scientific and application research of the green areas status on the territory of the Plovdiv municipality was carried out, using aerospace, ground-based, and GPS data from various time periods.

The objects of the present paper are the green areas situated in the central region of the Plovdiv municipality.

The main objective is to update the area, position and dynamics of the green areas in the studied region using aerophoto and satellite images. For the purposes of change detection analysis, a 21-year interval is used, providing to best reveal the developmental tendency in the studied region.

Major tasks:

1. To create a GIS database comprising information on green area dynamics;
2. To monitor green areas using aerophoto and satellite images with very high spatial resolution alongside with the previously created GIS;
3. To create maps, reflecting the contemporary structure of the green areas in the central region;
4. To analyze the spatial dynamics of the same region's green area for the year 2003 compared to the year 1982.

The performed scientific study is underlined by modern aerospace, GPS and GIS technologies. Their use enables to obtain unbiased and accurate results, providing for immediate practical application. (The study was assigned and funded by the Plovdiv municipality).

Input Data

To create the GIS database, both remote-sensing and ground-based information was used. Remote-sensing information consisted of panchromatic and multispectral aerophoto and satellite images; ground-based information included very-high-scale topomaps, field-check data (terrain data) and GPS measurements. (aerophoto 1982, very-high-scale topomaps, Landsat 1992, QuickBird 2003, GPS data).

The methodology used to create the geographic database included several work stages: radiometric and geometrical corrections of the aerophoto and satellite images; remote-sensing and ground-based data rectification; thematic computer-based visual image recognition; creation of green area maps for the years 1982 and 2003; assessment of the green areas' spatial dynamics.

For the geometric correction model, 28 GPS identical ground control points (GCPs) and 51 triangulation points (TP) were used, which were undoubtedly recognized on an aerophoto, satellite images, topomaps of scale 1:5,000 and Digital Elevation Model (DEM). All GCPs coordinates and TPs were defined in the Baltic altitude coordination system, 1970. All GCPs and TPs were defined and located in the green areas or in their close vicinity. The GCPs and TPs were placed normally to the territory of the studied region.

Geometric orthorectification and georeferencing of input data was performed, followed by thematic recognition and interpretation.

The data were arranged and described into two levels according to their territorial location and economical importance: first level - terrains located in residential or industrial areas and second level - terrains occupied with parks and forest; green areas (shrubbery, grass areas in sport

equipments); green areas near transport equipments; other kind of land cover.

Central Region

The total area of the central region amounts to 8,320.14 dca, whereas almost 99 % of it is occupied by residential districts and only 105.1 dca are occupied by industrial terrains. The green areas during 2003 constituted 27 % of the total region area (Fig.), while in 1982, this percentage amounted to 19 %. The terrains covered with parks and forests remained almost unchanged, but green areas increased by 66 %, due to the new alleys and gardens located in the central part of the city, as well as the transient free areas from the Maritsa river.

Summary and conclusion

The results from the study feature very high spatial and temporal resolution. They were obtained based on modern aerospace, GIS and GPS technologies. The RMS of the TPs is 0.45 m and the RMS of the GCPs is 0.65m. The basic RMS is 1.1m.

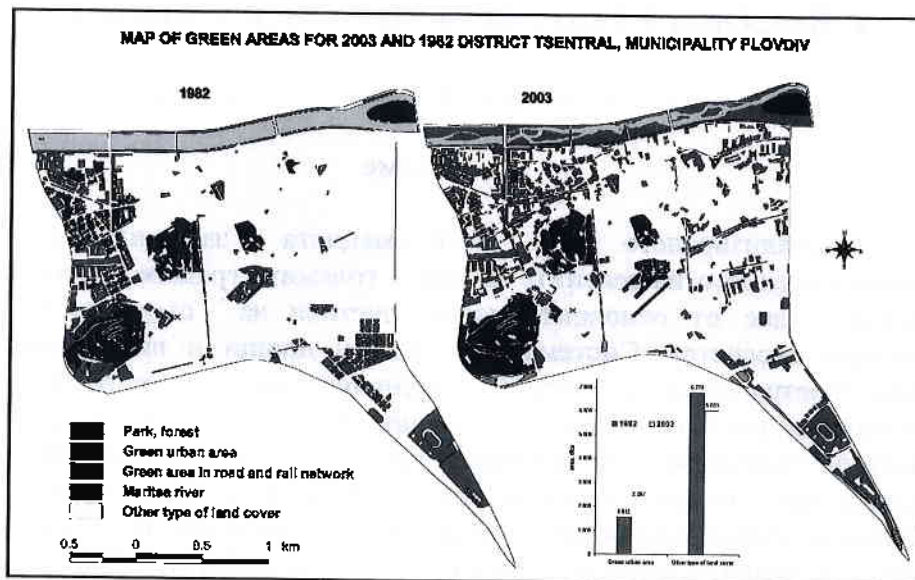


Fig.1 Thematics maps of green areas for 2003 and 1982 – Plovdiv.

A database was created, which contains information for the green areas of the Plovdiv Municipality (thematic maps of the various regions with very high scale of 1:5,000).

The dynamics of the green areas from 1982 to 2003 was assessed. The accuracy of the quantitative assessment is 4.5 %. The tendency revealed by the quantitative assessment shows an increase in the dimensions of the green areas not only in the central part but also in the inside and outside of the central part's residential territory.

References:

1. Nedkov, R. Using GPS/GIS technologies in land reform (forest) in Bulgaria, Third International Conference on Geospatial Information in Agriculture and Forestry, Denver, Colorado, 5-7 November 2001.
2. Contracts № 01, 02/June 2003 – Municipality of Plovdiv, SRI BAS.
3. Contract № BG/47376451/23025 – Sovinformsputnic SRI BAS.

МОНИТОРИНГ НА ЗЕЛЕНИТЕ ПЛОЩИ НА ЦЕНТРАЛНАТА ЧАСТ НА ГРАД ПЛОВДИВ С ПОМОЩТА НА СПЪТНИКОВИ ДАННИ С ВИСОКА РАЗДЕЛИТЕЛНА СПОСОБНОСТ

Румен Недков, Евгения Руменина, Георги Желев

Резюме

Актуализирането на информацията за площта и местоположението на зелените площи в големите градове е проблем, свързан с две от основните характеристики за състоянието на градската екосистема. Системата от зелени площи и насаждения е важна пространствено-структурна и функционална част от селищната и извънселищната територия на Пловдив. Чрез нея се решават редица задачи за подобряване на околната среда, отдиха на населението, и връзката им с околната среда и естетиката на града. Нормирането на система от зелени площи, която изпълнява разнообразни функции е от голямо значение за всички селища и особено за големите градове като Пловдив, с утежнени микроклиматични условия на жилищната си среда. В работата накратко са изложени методиката и резултатите на проведеното от авторите изследване на територията на район централен от гр.Пловдив. Изследването е извършено на базата на аерокосмически, наземни и GPS данни.