

Conservation of natural and cultural heritage – integrated use of earth observation satellite and in-situ data

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INTRODUCTION

In a global world of rapid changes and development, the question of Natural and Cultural Heritage preservation is more topical than ever. Remote sensing and GIS technologies can be successfully put in work in environmental studies, archaeological surveys and in conservation of natural landmarks, archaeological sites and structures. The nature and cultural sites' preservation underlie in a number of European directives and conventions, such as Cultural landscapes and biodiversity heritage published by EEA, UNESCO's Convention concerning the protection of the world cultural and natural heritage. ESA and UNESCO have been collaborating to use remote sensing to preserve heritage, biodiversity and resources worldwide. Since 2003, ESA has been contributing to the protection of 812 listed sites under UNESCO's Convention. The idea for preservation is one of the tasks of the Global Monitoring for Environment and Security (GMES) initiative, which aims to coordinate Earth observation from space for the protection of the environment.

The paper aims to present the integrated use of satellite and in-situ data for studying the natural and cultural heritage sites and their conservation.

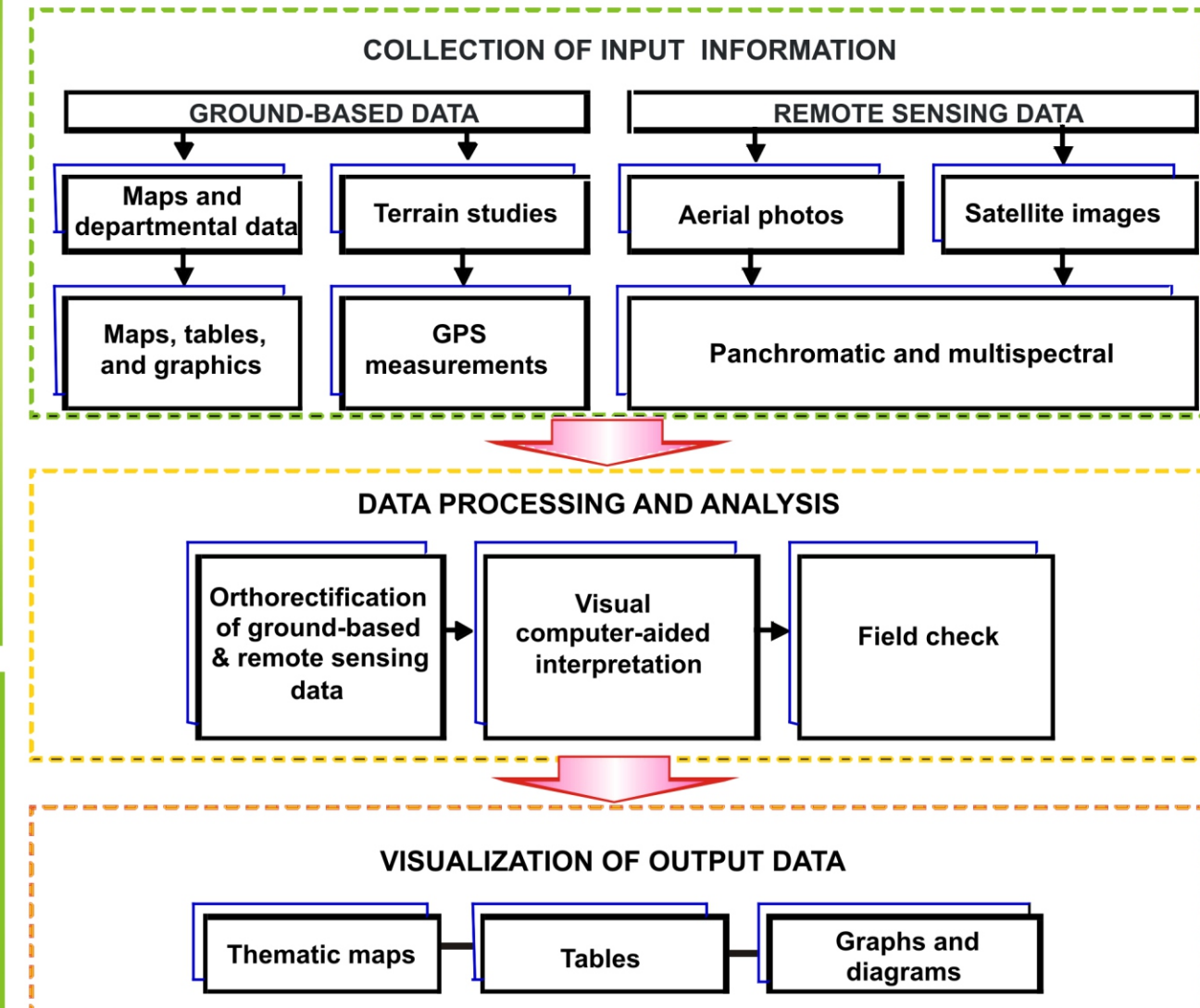


STUDY AREA

The research is conducted for parts of two Bulgarian aerospace test sites – Shoumen and Novi Iskur.
- The archaeological site *Pliska* located in Shoumen
- *Kutina Pyramids* natural landmark in Novi Iskur region

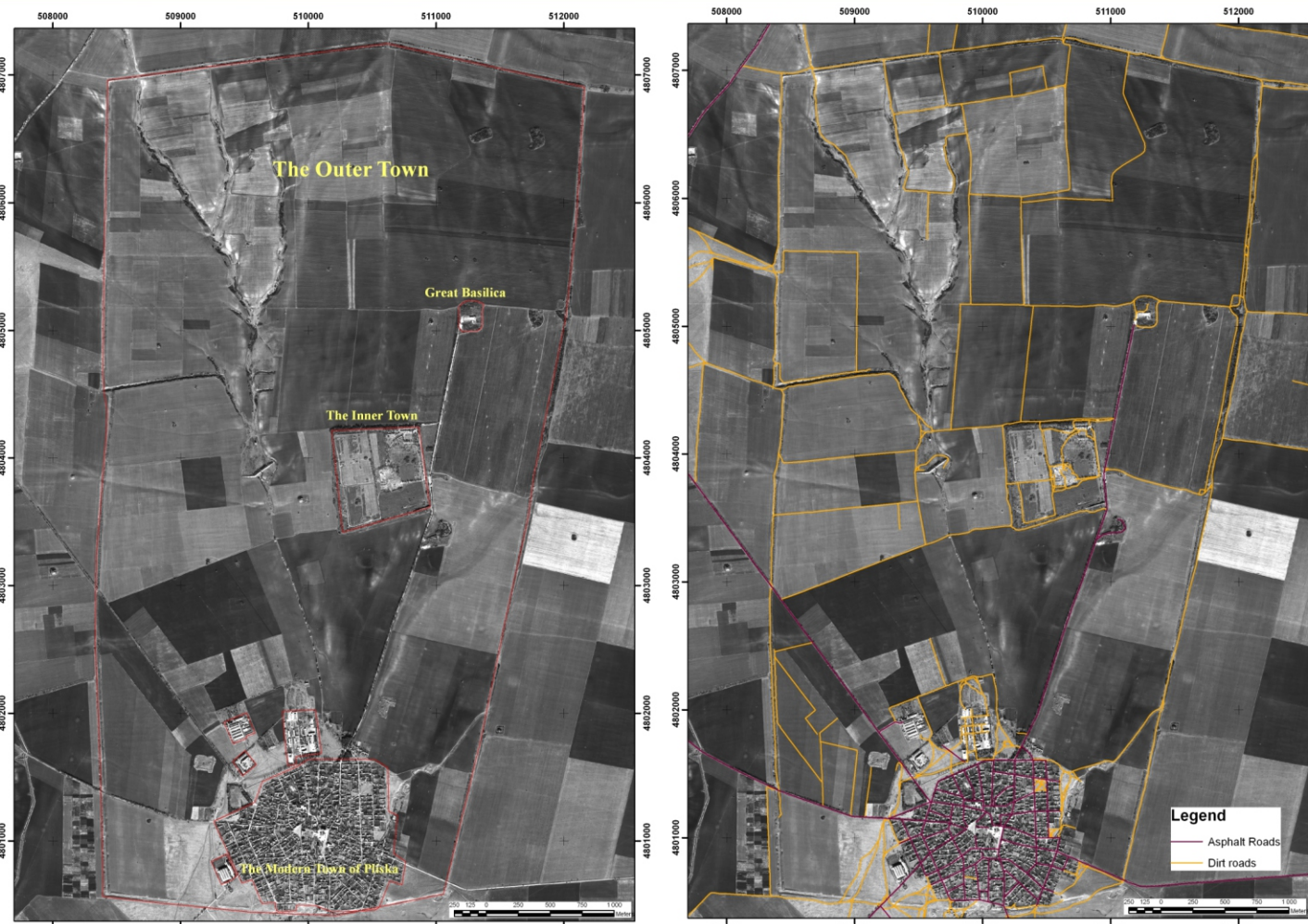
It is also supported by the Society for Conservation GIS and SPOT Planet Action. The site of the medieval town of Pliska is orientated to application of satellite data and ground-based information for archaeological study, whereas Novi Iskur region serves as a test site for environmental research and assessment of the cultural heritage.

DATASET AND METHODS

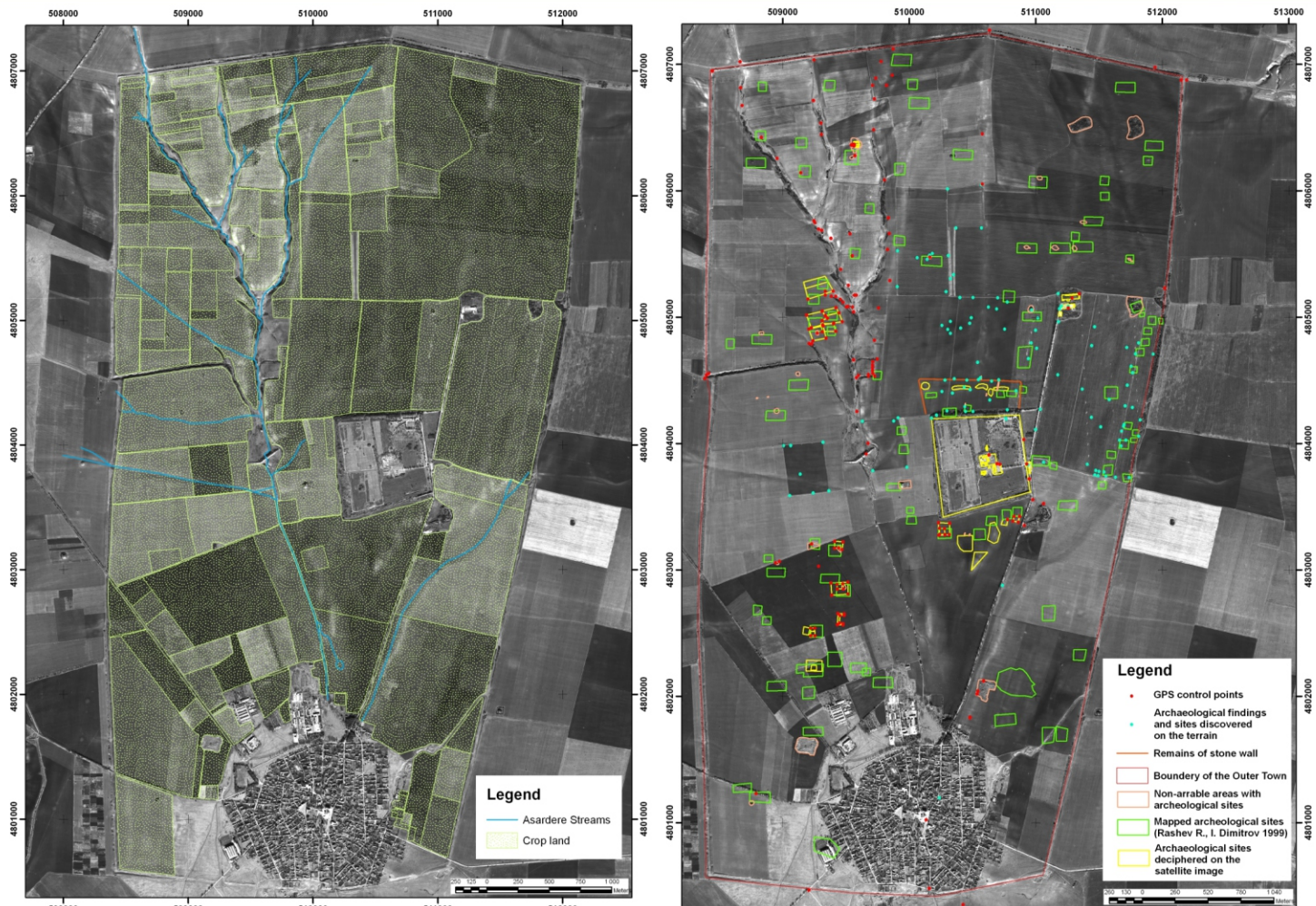


Archaeological Site *PLISKA* - *SHOUMEN* Aerospace Test Site

The application of remote sensing data and geoinformation technologies for Pliska is innovative to archaeological research on a national scale. The research is a serious scientific contribution to the local archaeological community and a strong impetus to the development of conservation activities and non-destructive exploration of unique Bulgarian archaeological sites.



The medieval Town of Pliska is the first Bulgarian capital. It is one of the most significant archaeological sites in Bulgaria. This study is a result of scientific-research project for development of a primary geodatabase for the Outer Town of Pliska using satellite and ground-based data, according with contract between the National Archaeological Institute with Museum - BAS and Space and Solar-Terrestrial Institute-BAS. The goal of the poster is to show the results of computer aided visual interpretation of a satellite image of the site and correlation of the detected signs with mapped structures from archaeological researches.

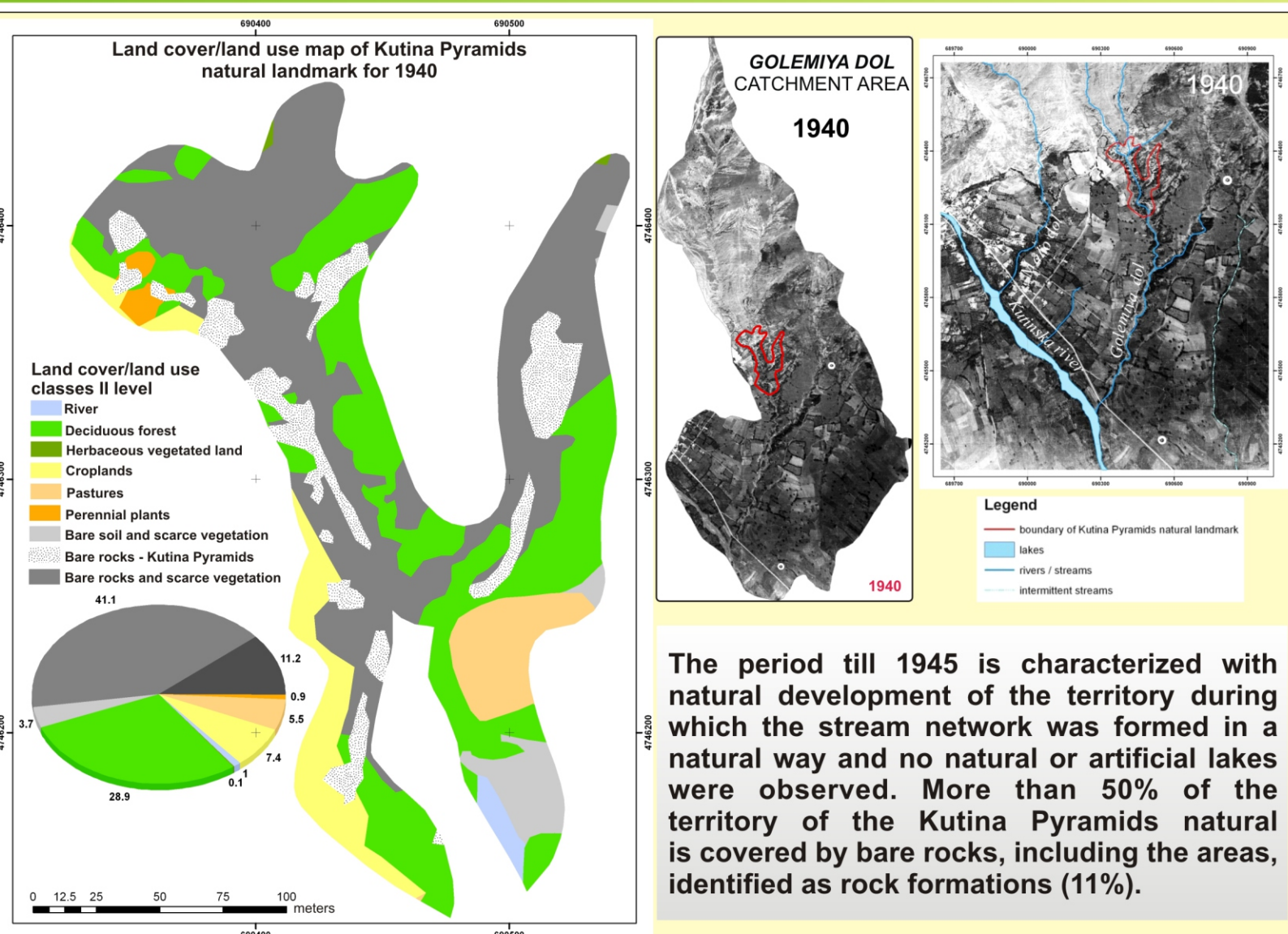


The spatial model and the further actualization of the geodatabase, combined with remote sensing data is essential part of application of non-destructive exploration methods in the medieval town of Pliska. The creating of this type of maps will be useful for conservation and preservation of this archaeological area, whose cultural importance has been already acknowledged by giving it the official status of a reserve area. The integrated application of remote sensing and ground-based data are very useful in preventing turning regions into endangered archaeological structures areas. The presented results are obtained by computer-aided visual deciphering and interpretation of WorldView-1 panchromatic satellite image with very high spatial resolution, correlated with field observations, which includes GPS measurements and photo documentation. The spatial analysis is supplemented by information about the land cover detected on the satellite image and information from archaeological terrain studies and published archaeological surveys.

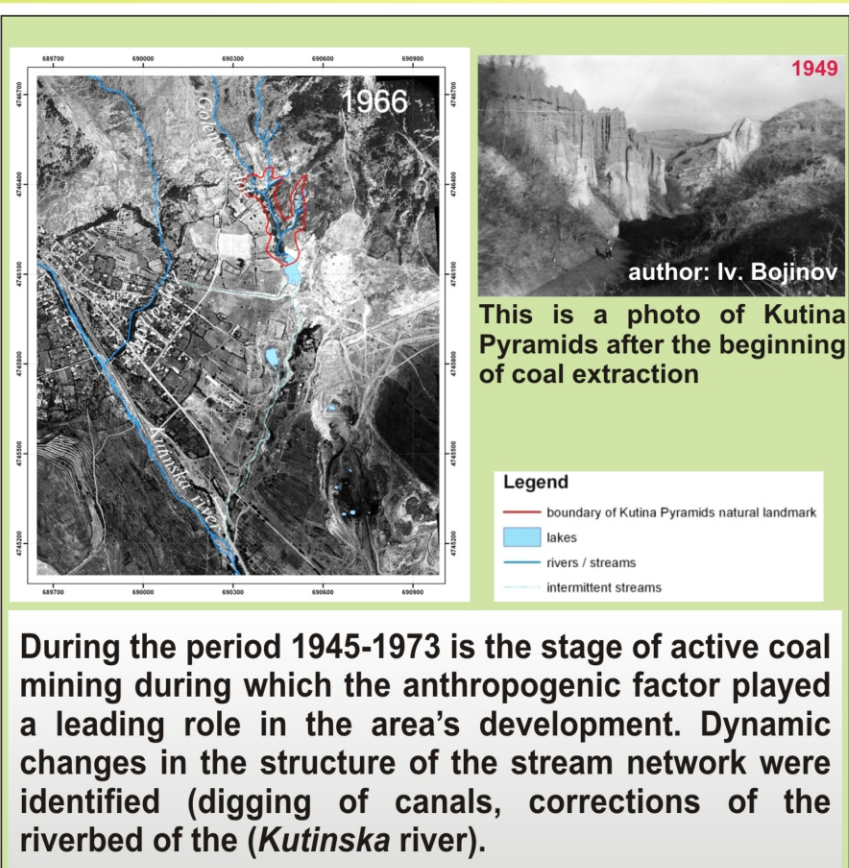


KUTINA PYRAMIDS Natural Landmark - *NOVI ISKUR* Aerospace Test Site

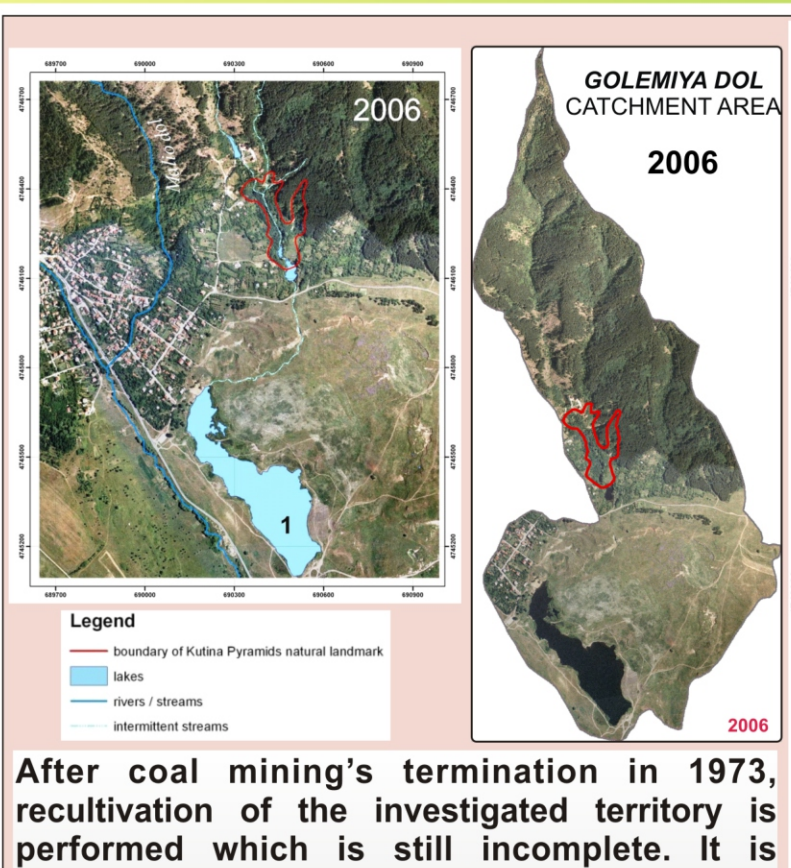
The conservation aspect of the environmental research carried out in the Novi Iskur region is focused on the Kutina Pyramids natural landmark, announced in 1962. It is the only natural landmark of the type of rock formations on the territory of the Sofia Municipality. Nowadays, they are experiencing accelerated destruction as a result of the anthropogenic activity carried out in its immediate vicinity. Special attention is being paid to clarify the reasons for its destruction by the integrated use of satellite and ground-based data for the period from 1940 to 2010 and to apply efforts for its conservation. Another aspect of the conservation studies of Novi Iskur region are related to mapping the cultural heritage site and environmental problems in the area.



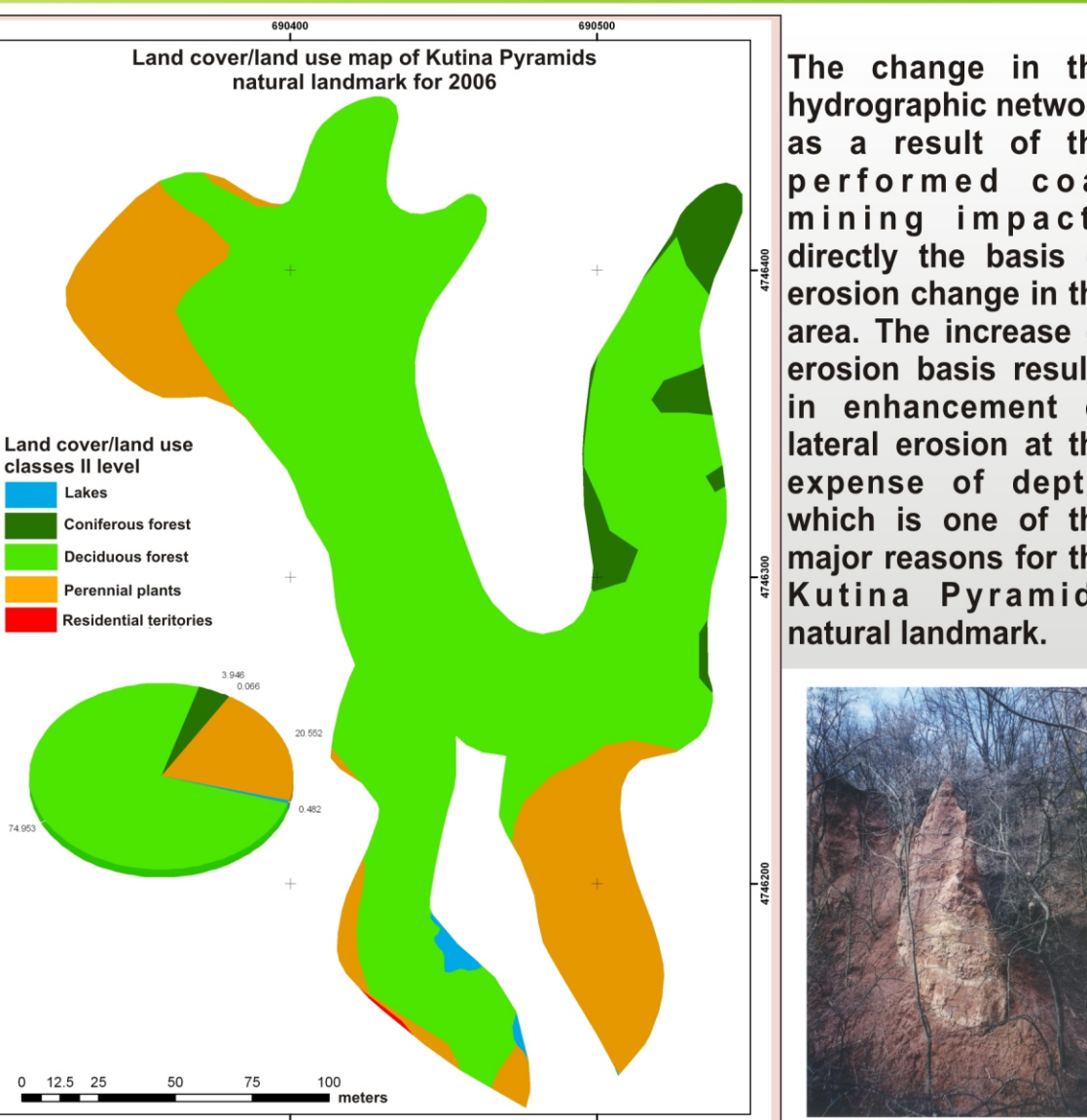
The period till 1945 is characterized with natural development of the territory during which the stream network was formed in a natural way and no natural or artificial lakes were observed. More than 50% of the territory of the Kutina Pyramids natural is covered by bare rocks, including the areas, identified as rock formations (11%).



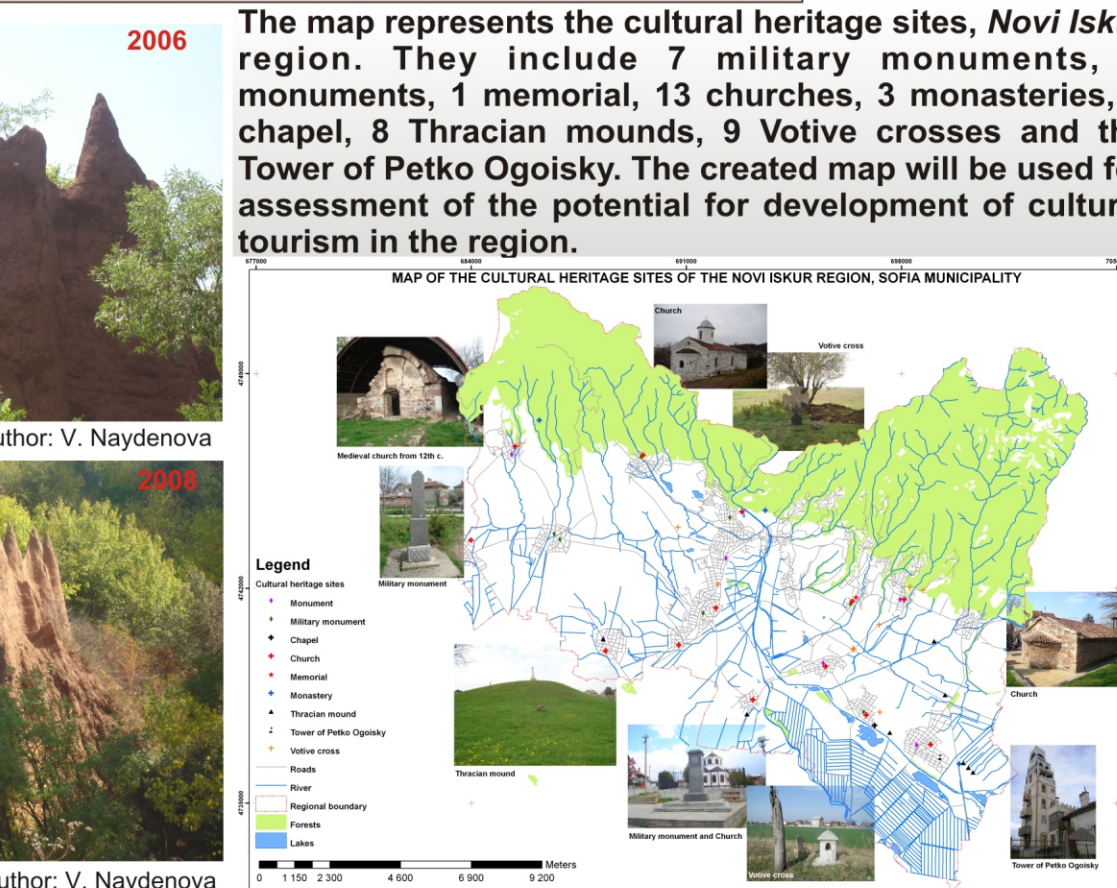
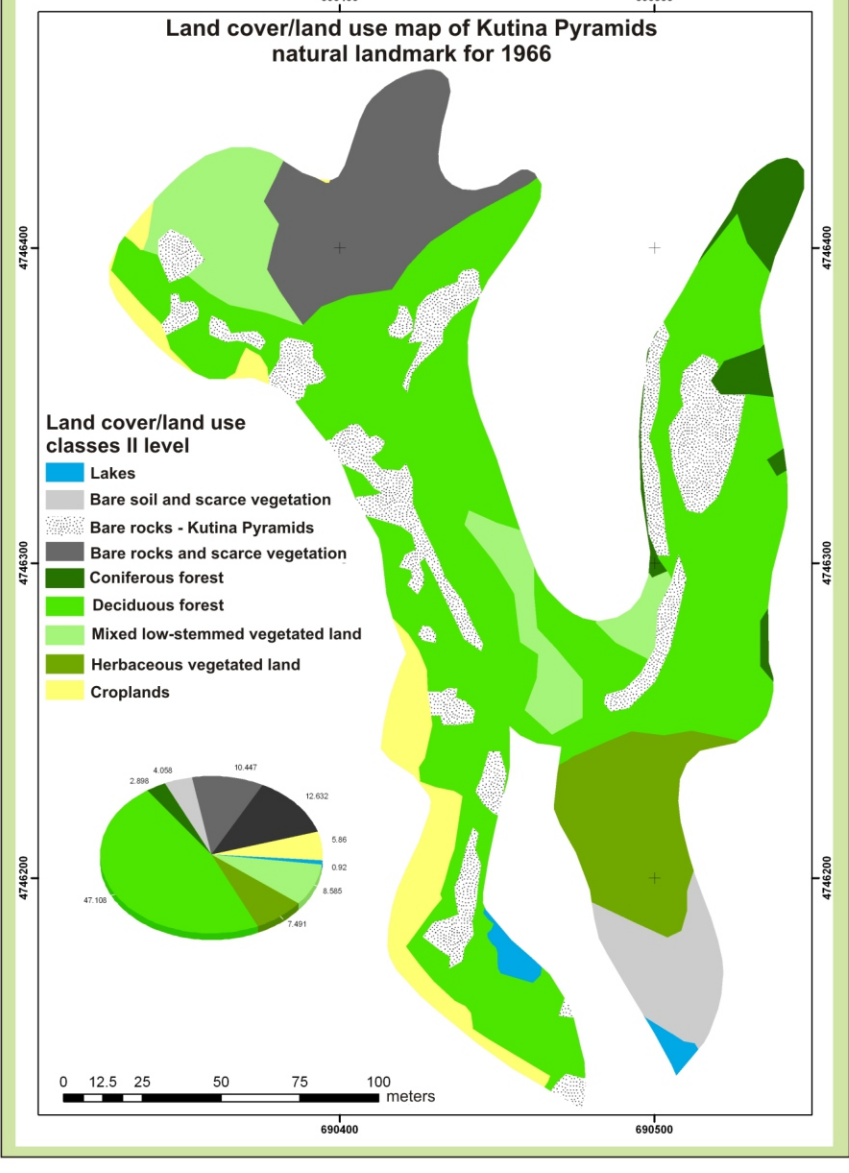
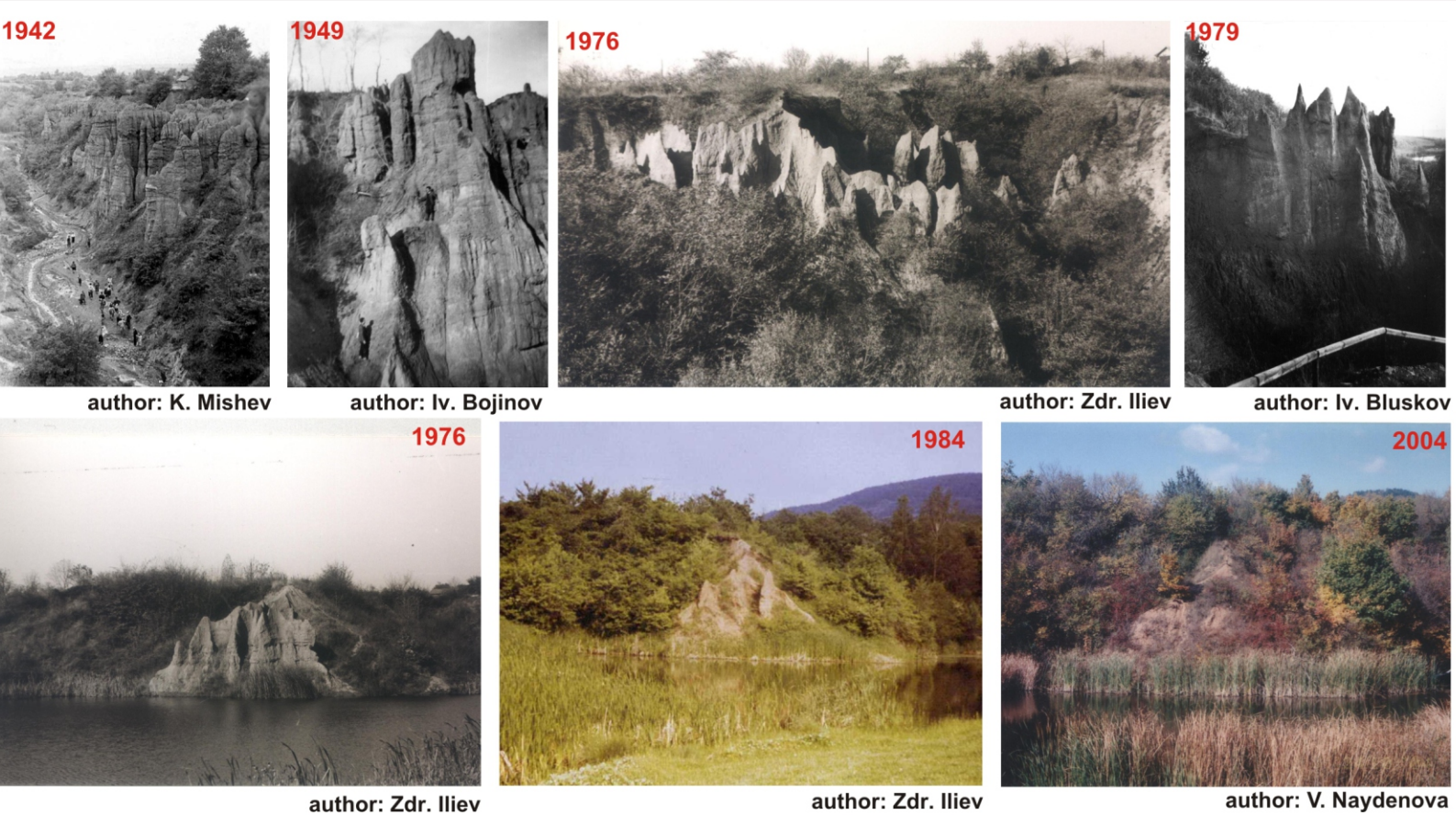
During the period 1945-1973 is the stage of active coal mining during which the anthropogenic factor played a leading role in the area's development. Dynamic changes in the structure of the stream network were identified (digging of canals, corrections of the riverbed of the *Kutinska* river).



After coal mining's termination in 1973, reactivation of the investigated territory is performed which is still incomplete. It is characterized by periodic manifestation of landslide processes generating numerous ecological problems. The stream network is completely transformed, and technogenic lakes are formed. Nowadays, the study area is entirely covered by forest, where deciduous forest increased to 75% while 4% of the territory is afforested with coniferous species.



The change in the hydrographic network as a result of the performed coal mining impacts directly the basis of erosion change in the area. The increase of erosion basis results in enhancement of lateral erosion at the expense of depth, which is one of the major reasons for the Kutina Pyramids natural landmark.



CONCLUSIONS:
Earth observation satellite and in-situ data are useful for conservation and preservation of the archaeological area, whose cultural importance has been already acknowledged by giving it the official status of a reserve area. Environmental research based on integrated use of remote sensing, geoinformation technologies and conventional methods provides a wealth of information, which allows adequate conservation measures and activities to be undertaken.

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