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1. **Ivanova E., Koulov B., Borisova B., Assenov A., Vassilev K.** (2016) GIS-based Valuation of Ecosystem Services in Mountain Regions: A Case Study of the Chepelare Municipality in Bulgaria. *European Journal of Sustainable Development*, Vol. 5, Issue 4, pp. 335–346, ISSN 2239-5938 (Print) , ISSN 2239-6101(Online), DOI: 10.14207/ejsd.2016.v5n4p335 [Indexed in Web of Science]

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GIS-based Valuation of Ecosystem Services in Mountain Regions: A Case Study of the Chepelare Municipality in Bulgaria

Ivanova E.¹, Koulov B.², Borisova B.³, Assenov A.³, Vassilev K.⁴

Abstract

This study imports the Ecosystem Services concept in the economic valuation of the resources of a typical mountain municipality in Bulgaria. It applies a GIS-based approach and employs a system of methods, which include benefit transfer, market price, and contingent valuation, as well as local survey and statistical data for the following key ecosystem services: timber production, forest/agricultural products, and tourism and recreation. The investigation interprets the CORINE Land Cover (2012) classes as spatial units of identification, analysis, and valuation of selected Ecosystem Services, on which the welfare of local mountain population depends. Its results, among which is a map of the total economic value of a set of ecosystem services in the Municipality of Chepelare, is intended to support sustainable local governance in mountain regions.

Key words: ecosystem services valuation, sustainable governance, GIS, mountain regions, Bulgaria.

2. Assenov A., Vassilev K., Padeshenko H., Koulov B., **Ivanova E.**, Borisova B. (2016) Research of the Biotope Diversity for the Purposes of Economic Valuation of Ecosystem Services in Chepelare Municipality (The Rhodopes Region of Bulgaria). *European Journal of Sustainable Development*, Vol. 5, Issue 4, pp. 409–420, ISSN 2239-5938 (Print) , ISSN 2239-6101(Online) DOI: 10.14207/ejsd.2016.v5n4p409 [Indexed in Web of Science]

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Research of the Biotope Diversity for the Purposes of Economic Valuation of Ecosystem Services in Chepelare Municipality (The Rhodopes Region of Bulgaria)

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Abstract.

The application of the philosophy or the management model for sustainable development has two main shortcomings – the condition of the global environment gets worse and the social inequalities deepen. Regardless of the integrity of UN Sustainable Development Goals 2030, the manifestation of the effect of the false demarcation between ecology and development continues. The integrated philosophy for sustainability and development is enriched with new terms, such as natural capital and ecosystem goods and services, while their assessment and evaluation is crucial for the achievement of sustainable development.

The habitat, biotope and landscape diversity interpreted in GIS environment through evaluation of ecosystem goods and services in Chepelare Municipality is the main aim of the research, illustrated with maps of the biotopes, habitat types and landscapes. The obtained data through a GIS-based approach for evaluation and assessment of the ecosystem services is of high importance for the well-being of the municipality's population. The results about the economic value of two main ecosystem services – wild fruits and herbs and genetic resources are comparable with results from other similar studies. An attempt is made for harmonization of information from different scales for examination – land cover classes with habitat types, biotopes and landscapes aiming at the precise evaluation of the interpreted ecosystem goods and services.

Keywords: Biodiversity, biotope, habitat type, landscape biodiversity, environmental management, GIS.

3. **Ivanova E.**, Nedkov R., Ivanova I., Radeva K. (2012). Morpho-hydrographic analyze of Black Sea Catchment Area in Bulgaria. *Procedia Environmental Sciences*, Vol. 14, pp. 143–153, Elsevier, ISSN 1878-0296, DOI: 10.1016/j.proenv.2012.03.014, [SJR 2014=0.218]

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Procedia Environmental Sciences 14 (2012) 143 – 153



Landscape, Environment, European Identity, 4-6 November, 2011, Bucharest

Morpho-hydrographic analyze of Black Sea Catchment Area in Bulgaria

Ekaterina Ivanova Ivanova*, Roumen Donchev Nedkov, Iva Boneva Ivanova,
Kameliya Lyubomirova Radeva

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Abstract

This paper proposes dividing of Black Sea Catchment Area's river basins into four morpho hydrographic regions – Dobrudja, East Balkan mountain, lowland of Burgas and Strandzha Mountain. It is based on geomorphologic and hydrographic characteristics of rivers and river basins (altitude, valleys, slopes, drainage density, river length, catchment shape, stream orders, and curve of the rivers). The work uses GIS to analyze and data of the rivers and the river basins collected from basic topographic maps. Digital Elevation Model (DEM), created on the base of satellite images, was also used. Based on the data collected for this study some basic hydrographical parameters were calculated. This is the first experiment of morpho-hydrographic dividing of the main catchment area in Bulgaria using river basins like basic units. It shows a way to unify separate river basins into major areas that can be useful for analyzing and research of water resources.

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Keywords: GIS; river basin; morpho-hydrographic; DEM; satellite images

4. Lyubenova M., Nedkov R., Ivanova I., Georgieva N., **Ivanova E.**, Lyubenova V. (2012). Ecological space modeling as a pattern for forest vegetation investigation (example with Belasitsa Mt., Bulgaria). *Comptes rendus de l'Académie bulgare des Sciences*, Vol. 65, No4, pp. 483–490, ISSN 1310–1331 (Print), ISSN 2367–5535 (Online) [**IF 2016=0.251; SJR 2016=0.207**]

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Tome 65, No 4, 2012

BIOLOGIE

Ecologie

**ECOLOGICAL SPACE MODELLING AS A PATTERN
OF FOREST VEGETATION INVESTIGATION (EXAMPLE
WITH BELASITSA MT., BULGARIA)**

**Mariyana Lyubenova, Nadezhda Georgieva, Velichka Lyubenova,
Roumen Nedkov, Iva Ivanova, Ekaterina Ivanova***

(Submitted by Academician V. Golemsky on November 22, 2011)

Abstract

The paper presents the results of pilot spatial modelling of forest vegetation types on the northern macro slope of Belasitsa Mountain. The study was conducted on the basis of modern space technology and geo-information environment of GIS. For generating the digital model of the spatial distribution of forest vegetation, a new system complex approach is used. This allows the possibility of adaptation and modification of the model for conducting ecosystem research.

Key words: forest vegetation, space modelling, DEM, satellite data, GIS

5. Milevski I., **Ivanova E.** (2016) “GIS and RS-based modelling of potential natural hazard areas in mountains – case study: Vlahina Mountain”. In “Sustainable Mountain Regions: Challenges and Perspectives in Southeastern Europe”, B. Koulov (Ed.), G. Zhelezov (Ed.), Chapter 14, Springer International Publishing Switzerland 2016, pp. 191–204, ISBN 978-3-319-27903-9, ISBN 978-3-319-27905-3 (eBook), DOI: 10.1007/978-3-319-27905-3 [Indexed in Scopus]

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Chapter 14

GIS- and RS-Based Modelling of Potential Natural Hazard Areas in Mountains. Case Study: Vlahina Mountain

Ivica Milevski and Ekaterina Ivanova

Abstract A common approach of potential natural hazards assessment in mountain areas is presented in this chapter on the base of Geographic Information System (GIS) and Remote Sensing (RS) methods. The subjects include excess erosion, landslides, flash floods, and forest fires. For this purpose, Vlahina Mountain (Kadiitsa, 1932 m), covering 471.2 km² between the Republic of Macedonia and Bulgaria, was selected as a case study. This mountain border territory suffers from frequent and severe natural hazards that have high local impact on the environment, sociodemographic development, and the local economy. First, most relevant stable factors for each type of natural hazard were selected (topography, land cover, anthropogenic objects, infrastructure). Multi-layer calculation was performed based on available traditional equations, clustering and classifying procedures, using GIS and satellite images. In this way, suitable relatively “stable” natural hazard maps were produced (modeled). Then, variable (mostly climate-related) factors are included in previous models correlated with different amounts of precipitation, temperature, wind direction, etc. Finally, the resulting GIS-based models were evaluated and tested with field verification and high-resolution Google Earth images. The verification of the models shows good accuracy. Further development of such GIS models is connected with situating of automatic remote meteorological stations and use of dynamic satellite imagery (such as MODIS), which will provide a timely warning of coming natural hazards and avoid potential damage.

Keywords Natural hazards • Erosion • Landslides • Forest fires • Mountains • GIS modelling

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191

6. Koulov B., **Ivanova E.**, Borisova B., Assenov A., Ravnachka A. (2017) GIS-based Valuation of Ecosystem Services in Mountain Regions: A Case Study of the Karlovo Municipality in Bulgaria. *One Ecosystem 2*: e14062, ISSN 2367-8194, DOI: 10.3897/oneeco.2.e14062 [Indexed in DOAJ]

https://oneecosystem.pensoft.net/articles.php?id=14062&display_type=list&element_type=8



One Ecosystem 2: e14062
doi: 10.3897/oneeco.2.e14062



Case Study

GIS-based Valuation of Ecosystem Services in Mountain Regions: A Case Study of the Karlovo Municipality in Bulgaria

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Abstract

This study aims to apply approaches, methods, and indicators from the conceptual framework of ecosystem services valuation to a real world, local level case study. It tests a GIS-based mapping and valuation of ecosystem services model in a typical mountain municipality in Bulgaria. Investigation results address opportunities, challenges and limitations in the practical application of the ecosystem services concept. They include an integrated assessment of the ecosystem services in a specific administrative territorial unit and suggest its Total Economic Value. The introduction of the term “ecosystem services dysergy” should contribute to valuation theory and practice. The study upgrades the currently available knowledge base that supports geospatial planning and sustainable development of the Karlovo Municipality and offers recommendations for improvement of the municipal ecosystem services utilization, which include identification, analysis, and visualization of hotspots and dysergy areas.

7. Hristova N., **Ivanova E.**, Seimenov K. (2017) Geographical Aspects of Floods in Northwest Bulgaria. KNOWLEDGE - International Journal, Institute of Knowledge Management, Vol. 16.2, pp. 907–914, ISSN 1857-923X [Global impact and Quality Factor 1.023]

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GEOGRAPHICAL ASPECTS OF FLOODS IN NORTHWEST BULGARIA

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Abstract. The occurrence of high streamflow discharge is of a great importance for hydro-engineering researches, construction of reservoirs, exploitation of hydroelectric stations, water management, development of measures for flood protection, etc. Furthermore, the revealing of spatial regularities in occurrence of floods is a challenge in scientific hydrology and geography. This paper investigates the floods separation in hydrological aspect, carried out by threshold level method. The study area is the Northwest part of Danube hydro-geographical region. Daily discharge data for 2000–2005 have been used for the analysis. Fixed threshold level (25th percentile of annual duration curve) for isolation of high flow periods is applied. The study accepts that the flood must last at least ten days to be classified as such. According to the duration, three categories for floods were used: short flood (10–20 days), medium flood (21–30 days) and long flood (above 30 days). In addition, the average date of beginning, the average date of termination and duration of flood’s periods are also calculated. Correlation analysis for describing spatial changes of flood’s characteristic is applied.

The analysis revealed several high flow periods for every year and for every drainage basin, between one and three per year. The number of flood events is highest in the mountain river basins and most of them occurred in 2005, which is the wettest year in the researched period, and in the last 17 years. Least number of floods was detected during 2001 and 2002 – dry years in the given period and for lower reaches of rivers. Generally, short high streamflow periods predominate – 47,4% of all. The rest 52,6% of the events are classified as medium and long by duration, according to the adopted criteria. Floods occur in every spring hydrological season (March – June) and almost every winter hydrological season (November – February). Spring floods (53% of all) occur one or two times in the year, begin during the last ten days of March/first ten days of April and terminate in the first ten days of May and their duration is up to three months. Winter regular floods occur in January and February, rarely in November and December and their average duration is 14–26 days. Long summer-autumn high flow (July – October) are only detected during 2005. The study finds statistically satisfying correlation between the number of floods and the average altitude of catchments and moderate relationship between the duration of flood events and the altitude of river basins. The analysis does not find any geographical regularities for average date of begin and the average date of termination of floods in the studied area. The current study improves knowledge of streamflow regime in North-west part of Danube hydro-geographical region and supplements the hydrological picture of floods in Bulgaria.

Keywords: floods, threshold level method, North-west river basins, Lom River basin.

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8. Нели Христова, **Екатерина Иванова** (2018) Оценка и географско разпределение на речния отток през 2000/2001 година. Годишник на Софийския университет „Св. Климент Охридски“, Геолого-географски факултет, Книга 2 – География, Том 110, с. 39–51, ISSN 0324-2579 (print), ISSN 2535-0579 (online)

https://www.uni-sofia.bg/index.php/bul/universitet/t/fakulteti/geologo_geografski_fakultet/oficialni_izdaniya/kniga_2_geografiya_tom_110

ГОДИШНИК НА СОФИЙСКИЯ УНИВЕРСИТЕТ „СВ. КЛИМЕНТ ОХРИДСКИ“
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ANNUAL OF SOFIA UNIVERSITY “ST. KLIMENT OHRIDSKI”
FACULTY OF GEOLOGY AND GEOGRAPHY
Book 2 – GEOGRAPHY
Volume 110

**ОЦЕНКА И ГЕОГРАФСКО РАЗПРЕДЕЛЕНИЕ НА РЕЧНИЯ
ОТТОК ПРЕЗ 2000/2001 ГОДИНА**

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Nelly Hristova, Ekaterina Ivanova. ASSESSMENT AND GEOGRAPHY OF ANNUAL STREAMFLOW FOR 2000/2001 IN BULGARIA

Assessment of severity level of mean annual streamflow and their spatial distribution is an important task for scientific hydrology and geography, steps in the development of drought management plans. Current study analyzed the annual streamflow for 2000/2001 (the driest hydrological year for the period 2000–2014). The work is based on mean annual streamflow for 160 drainage basins which cover all territory of Bulgaria. Assessment is completed on two approaches: in comparison with the thresholds levels – Q50 (50% probability – normal year), Q75 (75% probability – dry year) and Q95 (95% probability – severe dry year) and into three categories – moderately drought ($Q50 \geq Qi \geq Q75$), severely drought ($Q75 \leq Qi \leq Q95$) and extremely drought ($Qi \leq Q95$); according to Standardized Runoff Index (SRII2) and classified the annual streamflow into four categories. Results attest wide areas in categories severely and extremely drought according to accepted thresholds and much drier than normal and severely drier than normal according to values of SRI. Moderately drought covers several drainage basins in Northwest, Eastwest and Southeast Bulgaria. Hydrological 2000/2001 year is not driest for all river basins, but it is one of the driest years in the country for the whole period of hydrometric observation. There are not any spatial regularities of distribution of hydrological drought. This study supplement hydrological picture for driest hydrological years in Bulgaria and it is important for preliminary drought risk assessment.

Key words: annual streamflow, SRI, hydrological drought, 2000/2001 hydrological year, Bulgaria.

9. Чолакова З., Аветисян Д., **Иванова Е.**, Недков Р. (2012) Съвременни ландшафти и степен на тяхната антропогенизация в част от горното поречие на р. Лом, картографирани с ГИС на базата на GPS, спътникови и наземни данни. Екологично инженерство и опазване на околната среда, Кн. 4/2012, с. 4–12, ISSN 1311-8668

<http://www.ecoleng.org/>

Екологично инженерство и опазване на околната среда, No 4, 2012, с. 4-12

I. ЧОВЕК И БИОСФЕРА

СЪВРЕМЕННИ ЛАНДШАФТИ И СТЕПЕН НА ТЯХНАТА АНТРОПОГЕНИЗАЦИЯ В ЧАСТ ОТ ГОРНОТО ПОРЕЧИЕ НА Р. ЛОМ, КАРТОГРАФИРАНИ С ГИС НА БАЗАТА НА GPS, СПЪТНИКОВИ И НАЗЕМНИ ДАННИ

Зорница Чолакова, Даниела Аветисян, Екатерина Иванова, Румен Недков

CONTEMPORARY LANDSCAPES AND THEIR ANTHROPOGENIC STAGE IN PART OF THE UPPER LOM RIVER BASIN, MAPPED BY GIS ON THE BASE OF GPS, SATELLITE AND GROUND DATA

Zornitza Cholakova, Daniela Avetisyan, Ekaterina Ivanova, Roumen Nedkov

Abstract: Cartographic methods, satellite data and GIS resource, used in this paper are especially valuable for establishing the direction and trends in the anthropogenic landscape changes. Geo-data base in GIS was created. Thematic map of contemporary landscapes in part of the upper Lom River Basin was composed and anthropogenic stage of the landscapes was classified on the base of those data. A territorial analysis of the level of human impact on the individual landscapes in the region was made on the base of the cartographic results.

Key words: contemporary landscapes, anthropogenic stage, GIS, satellite data, Upper Lom River basin

10. Lubenova M., Nedkov R., Ivanova I., Shikalanov A., Georgieva N., Zaharinova M., Dimitrova M., **Ivanova E.**, Yanchev V., Radeva K., Stankova N., Tsoneva R. (2011) Study on ecological dynamics of forest vegetation in the region of East Rhodopi on the base of satellites, GPS and ground data. *Ecological Engineering and Environment Protection*, Issue 1/2011, pp. 45–51, e-ISSN 2367-8429

<http://ecoleng.org/2011/45-50.pdf>

Екологично инженерство и опазване на околната среда, No I, 2011, с. 45-50

**STUDY ON ECOLOGICAL DYNAMICS OF FOREST VEGETATION
IN THE REGION OF EAST RHODOPE ON THE BASE OF SATELLITES
AND TERRESTRIAL DATA**

M. Lubenova, R. Nedkov, I. Ivanova, A. Shikalanov, N. Georgieva, M. Zaharinova,
M. Dimitrova, E. Ivanova, V. Yanchev, K. Radeva, N. Stankova, R. Tsoneva

Abstract: In this paper a study of forest vegetation in the territory of East Rhodope based on satellites, GPS and other terrestrial data is presented. The local areas of forest communities in classes and their distribution depending on the topography are defined. In this study we analyzed the Normalized Deferential Vegetation Index (NDVI) between forest classes. The study is the result of cooperation between specialists from SSTRI-BAS and Sofia University. This study is the initial stage of a comprehensive research on the dynamics and development of natural systems in Bulgaria.

Key words: ecological dynamics, forest community, satellites data, terrestrial data, East Rhodope Mountains

11. Кирилова С., Недков Р., Модев С., Радева К., **Иванова Е.** (2011) Екохидроложки мониторинг за водосбора на река Марица от изворите до град Белово в среда на ГИС на базата на спътникови, GPS и наземни данни. *Екологично инженерство и опазване на околната среда*, Кн. 4/2011, с. 5–13, ISSN 1311-8668

<http://www.ecoleng.org/>

Екологично инженерство и опазване на околната среда, No 4, 2011, с. 5-13

I. ЧОВЕК И БИОСФЕРА

**ЕКОХИДРОЛОЖКИ МОНИТОРИНГ ЗА ВОДОСБОРА НА РЕКА МАРИЦА
ОТ ИЗВОРИТЕ ДО ГРАД БЕЛОВО В СРЕДА НА ГИС НА БАЗАТА НА
СПЪТНИКОВИ, GPS И НАЗЕМНИ ДАННИ**

Силвия Кирилова, Румен Недков, Стефан Модев, Камелия Радева, Екатерина Иванова

**ECOHYDROLOGICAL MONITORING ON THE RIVER MARITSA BASIN,
LIMITED FROM SOURCES TO BELOVO CITY, USING GIS ON THE BASE
OF SATELLITE, GPS AND GROUND DATA**

Silvia Kirilova, Roumen Nedkov, Stefan Modev, Kamelia Radeva, Ekaterina Ivanova

Abstract: Development of methods for space interpolation of values of hydrological elements is very important for hydrological researches. Those methods are based on two approaches generally: outputting of two or more factoring dependence between orohydrographical characteristics of watershed catchments and numerical valuations of hydrological characteristics which are realized on the base of contemporary geoinformation technologies. Those research and analyzes was made by modeling in GIS, using satellites, GPS and ground data. GIS give possibilities quickly and easy to collect and analyze data in space environment. It supports decision of some engineering problems of hydrology and minimize influence of subjective factor into authenticity and precision of the results.

Key words: ecohydrological characteristics, GIS, GPS, Digital Elevation Model, Maritsa river basin

12. **Ekaterina Ivanova** (2008) Erosion of soils and the ground desertification in Southwest Bulgaria (Ograzhden and Maleshevo mountains). Proceedings of the Bulgarian Geological Society “Geosciences 2008”, pp. 127–128, ISSN 1313-2377
http://www.bgd.bg/CONFERENCES/Geonauki_2008/Sbornik/Materiali_2007.html

GEOSCIENCES 2008



Erosion of soils and the ground desertification in Southwest Bulgaria (Ograzhden and Maleshevo mountains)

Ерозия на почвата и загуба на земеделски земи в Югозападна България (Огражден и Малешевска планина)

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Key words: erosion, relief, soils.

One of the most important problems in temporary ecology is to examine the development of the erosion processes in under-analyzed territories, as well as the destruction and desertification of the lands associated with the erosion.

Ograzhden and Maleshevo mountains are situated in Southwestern part of Bulgaria near the state boundary between Bulgaria and Macedonia. According to most scientists who had carried out research in this region (Kitanov, 1982; Panov, 2000; Zakov, 2000, 2002) it is one of the most denuded and liable to erosion mountains in Bulgaria. The main reasons for this are its isolation from the various large scale forestation efforts done on the various territories of Bulgaria as well as the local traditions related with irregular maintenance and the mismanagement of the forests. All these have led to an activation of very strong erosion and denudation processes on the slopes of the mountain.

The goal of this research is to study the erosion forms in the region as well as the erosion processes which are occurring on the slopes of the mountains and which led to aggravation of the quality of the agricultural land, to destruction of the soils and ultimately to desertification of the region.

Most of the rivers and the tributaries, all of which form the hydrology system in this region, are temporary and they usually dry up throughout the summer period. The vertical erosion in river beds predominates because of the steep slopes, so the rivers are usually forming deep carved valleys. The erosion forms that had been generated by temporary streams on the river's slopes are young forms of the relief. They have been formed through single, double or few carving of the erosion streams which in the most cases are also associated with the intensive precipitation (Baltakov, 1986).

These kind of erosion forms are furrows, gulches ore gullies and waterless valleys. All of them are very widespread in Ograzhden Mountain because of the optimal conditions for their development (rocks, steep slopes and availability of intensive precipitations). Some of those forms were observed by Grain-metric analysis including sieve analysis and drawing up cumulative curves and histograms (Fig. 1).

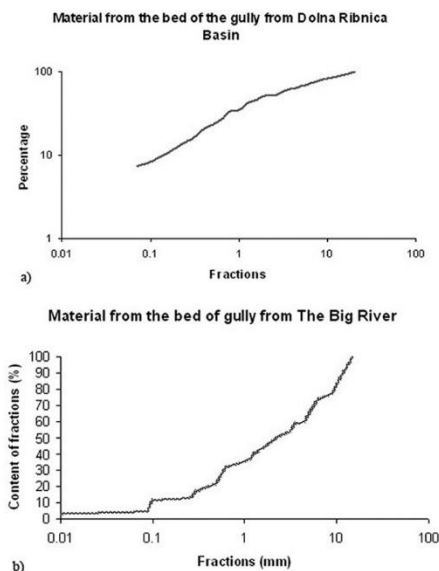


Fig. 1. Comparing alluvium material from gulches in Ograzhden and Maleshevo mountains: a) Dolna Ribnica Basin in Ograzhden Mountain; b) The Big River in Maleshevo Mountain

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13. **Ivanova E., Kiryakova M. (2016) Water balance modeling for hydrological ecosystem services assessment in Ogosta River Basin (NW Bulgaria) using GIS and remote sensing.** Сборник доклади от научна конференция „Географски аспекти на планирането и използването на територията в условията на глобални промени“ Вършец, България, 23.09–25.09.2016 г., с. 156–164, ISBN 978-619-90446-1-2
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Water balance modeling for hydrological ecosystem services assessment in Ogosta River Basin (NW Bulgaria) using GIS and remote sensing

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Abstract: The demand of fresh water is one of the key issue against the global warming and growing population of the world. The assessment and valuation of water resources as a natural capital is a new comprehensive powerful tool for better understanding the relationship "society-nature" and elaboration effective policies for sustainable development. A possible approach for assessing water resources in a given area is calculating the balance between incoming water from precipitation and outgoing water by evapotranspiration, groundwater recharge and runoff. A water balance calculation was applied in this study on the area of Ogosta River Basin, using GIS and remote sensing. Thornthwaite and Mather method (TM model) was chosen for this purpose in order to compute seasonal and geographical patterns of water availability. The technique uses spatial data for monthly precipitation, temperature, topography, land cover, soils and river network. Various thematic layers were integrated mathematically to provide a grid-based spatial patterns of monthly and annual surface runoff of the entire river basin taking into account evapotranspiration, soil retaining capacity and vegetation cover. The resulting digital maps, which indicate the water supply functions of the ecosystems, were transform in monetary valuated map of the ecosystem services flow, based on the price of drinking water.

Keywords: water balance, ecosystem services, GIS, Ogosta River Basin

14. **E. Ivanova (2014)** Landslide Susceptibility Mapping using Frequency Ratio and Analytic Hierarchy Process (AHP): Comparative study of two areas in Bulgaria. Proceedings of the International Conference “Analysis and Management of Changing Risk for Natural Hazards”, 18–19 November, 2014, Padua, Italy, pp. AP23-1–AP23-9, ISBN 9788867873074

http://www.changes-itn.eu/Portals/0/Content/2014/Final%20conference/abstracts/AP23_Abtract_Ivanova.pdf

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Landslide Susceptibility Mapping using Frequency Ratio and Analytic Hierarchy Process (AHP): Comparative study of two areas in Bulgaria

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Keywords

GIS, landslide susceptibility, frequency ratio model, analytic hierarchy process

Extended Abstract

INTRODUCTION

Local governments in many countries would support the development of landslide prediction models, as landslides annually cause significant material and human losses. Various methods are used: empirical, heuristic, statistical, and physically-based. The physically-based methods have a strong spatial restriction and require a large amount of hard-to-access information (Ruelle *et al.*, 2011). Therefore, increasing popularity acquire another type of predictive models – the so-called statistical (or probabilistic) models based on the assumption that future landslides may occur under conditions in which have already occurred and their properties are already known. They use the correlation between landslide occurrence and landslide causal factors – explanatory variables or parameters (Ruelle *et al.*, 2011). The development of GIS technologies allows easy implementation of these models for landslide prediction, while remote sensing provides many advantages in this respect. The most commonly used probabilistic models are Logistic Regression Analysis (Süzen and Doyuran, 2004; Lee and Talib, 2005; Greco *et al.*, 2007; Nefeslioglu *et al.*, 2008; Pradhan, 2010; Pradhan and Lee, 2010; Ruelle *et al.*, 2011; Yalcin *et al.*, 2011), Frequencies Ratio Model (Süzen and Doyuran, 2004; Lee and Talib, 2005; Yilmaz, 2009; Yalcin *et al.*, 2011; Song *et al.*, 2012), Artificial Neural Networks (Lee and Talib, 2005; Neaupane and Piantanakulchai, 2006; Nefeslioglu *et al.*, 2008; Melchiorre *et al.*, 2008; Mondino *et al.*, 2009; Yilmaz, 2009; Pradhan and Lee, 2010; Song *et al.*, 2012), Analytic Hierarchy Process (Yalcin *et al.*, 2011; Pourghasemi and Pradhan, 2012), Fuzzy Logic (Gorsevski and Jankowski, 2010) and others. These methods of landslide hazard analysis are up to now not widely used in the region of the Balkan Peninsula. The Fuzzy Logic method was used in natural risk assessment in some areas of Southwest and Southeast Bulgaria (Zlateva *et al.*, 2011; Желев, 2013). The disadvantage of most of those methods is that they require empirical data on past landslide events within the study area that are not always available.

This study has adopted the broader meaning of the term "landslide hazard" as a synonym of "landslide susceptibility", i.e. probability of landslide occurrence in a given area for a certain time interval. The purpose of this paper is to apply the Frequency Ratio Model for landslide susceptibility mapping for two relatively comparable territorial units – the Simitli and Satovcha municipalities. The results will then be used for creating a system of Multi-criteria Decision Analysis (MCDA) and calculating the weights of the landslide causal factors in the generation a model of Analytic Hierarchy Process (AHP), applicable to areas where landslide data is not available. The areas were selected on the basis of the administrative principle.

15. **Ivanova E., Milevski I.** (2014). Landslide Susceptibility Mapping of the Territory of Municipalities Pehchevo and Simitli by Means of GIS Modeling. Proceedings of the Ninth Scientific Conference with International Participation “Space, Ecology, Safety” (SES-2013), Sofia, pp. 434–443, ISSN 1313–3888

<http://www.space.bas.bg/BG/magasin/SES/PROCEEDINGS%20SES%202013.pdf>

S E S 2 0 1 3
Ninth Scientific Conference with International Participation
SPACE, ECOLOGY, SAFETY
20 – 22 November 2013, Sofia, Bulgaria

**КАРТОГРАФИРАНЕ НА СВЛАЧИЩНАТА ЧУВСТВИТЕЛНОСТ
НА ТЕРИТОРИЯТА НА ОБЩИНИТЕ ПЕХЧЕВО И СИМИТЛИ
ЧРЕЗ МОДЕЛИРАНЕ В GIS**

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Ключови думи: GIS, свлачищна чувствителност, модел за отношение на честотите (FRM)

Резюме: Инструментите на ГИС и статистическите методи за симулация и моделиране позволяват прилагането на количествените методи и в изследванията на свлачищните процеси. Целта на това изследване е да се картографира свлачищната чувствителност на територията на трансграничния регион на общините Пехчево и Симитли по модел, анализиращ съотношението на относителната честота на свлачищните събития във всеки един клас от предварително определена група от фактори. Избраните в това изследване фактори, които оказват най-силно влияние върху свлачищната активност са геологията, наклона на склоновете, надморската височина, изложенията на склоновете, растителната покривка, разстоянието от реки, пътища и тектонски структури. Използвани са и два индекса, които характеризират условията на овлажнение в зависимост от топографската повърхност (TWI и SPI), извлечени от цифровия модел на релефа. Предимствата на избрания модел са два. Първо използва ясни и логични критерии за анализ и второ се основава на емпирични данни за реални свлачищни събития. Ето защо считаме, че картата на индекса на свлачищна чувствителност, създадената в резултат от прилагането на модела, дава една сравнително обективна оценка на опасността от проява на свлачища в границите на изследваната територия.

16. Milevski I., **Ivanova E.** (2014). Erosion potential modeling of the territory of municipalities Pehchevo and Simitli using Remote Sensing Data. Proceedings of the Ninth Scientific Conference with International Participation “Space, Ecology, Safety” (SES-2013), Sofia, pp. 444–450, ISSN 1313–3888

<http://www.space.bas.bg/BG/magasin/SES/PROCEEDINGS%20SES%202013.pdf>

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20 – 22 November 2013, Sofia, Bulgaria

**EROSION POTENTIAL MODELING OF THE TERRITORY OF MUNICIPALITIES
PEHCHEVO AND SIMITLI USING REMOTE SENSING DATA**

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Keywords: *GIS modeling, erosion potential, remote sensing, Pehchevo, Simitli*

Abstract: *This work presents an evaluation of soil erosion in the municipalities Pehchevo and Simitli based on digital data integrated in GIS settings, Digital Elevation Model generated on the basis of satellite data - ASTER Global DEM, a modified version of 2012 with spatial resolution of 30 meters and satellite images from Landsat ETM+. In the generation of the model to assess the potential erosion the following factors was reported: erosion resistance of soils and rocks, the influence of vegetation cover, the slope gradient, average annual rainfall and average air temperature. These factors was considered that have the most significant impact on the development and manifestation of erosion. In assessing the average potential of the erosion in the municipalities Pehchevo and Simitli, the model of Gavrilovic 1972 is used. This model have been successfully applied in different parts of the region of the Balkan Peninsula, where it have been compared with actual performance. Therefore we believe created as a result of applying the model thematic map of erosion potential is sufficiently representative of the cross-border region of the two municipalities.*

Публикувани резюмета на участие с доклади на международни форуми в сборници с редактор и издателство:

17. Boian Koulov, **Ekaterina Ivanova**, Bilyana Borisova, Assen Assenov, Aleksandra Ravnachka (2017) Valuation of Ecosystem Services in Karlovo Municipality, Bulgaria. IGU Thematic Conference on Land use/Land cover change, Biodiversity, Health and Environment, Local and Regional Development, 11–15 September 2017, Bucharest–Tulcea, Romania, Book of Abstract [Eds. M.Dumitrascu, I.Grigorescu, L.Dumitrache], p. 36, SD PRESS 2017, ISBN 978-606-528-383-1

<http://igutc2017.geoinst.ro/>

Valuation of Ecosystem Services in Karlovo Municipality, Bulgaria

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This investigation proposes a GIS-based, geospatial model for valuation of the ecosystem services (ES) in the mountainous Karlovo Municipality in Bulgaria. The model is intended as an initial step for future valuation research, real life comparisons of ES values at the local scale, as well as a tool to support sustainable governance. Based on readily available, open source statistical data and indicators, the method integrates biophysical and economic valuation techniques to assess representative ES, which form the current and future basis of the local economy and welfare of the population. The study aims to identify geographic patterns of ES distribution, hotspots and trade-offs, synergies and dysergies. Results include an estimated combined economic value of the selected currently utilized ES in the municipality.

18. Koulov B., **Ivanova E.**, Borisova B., Assenov A., Ravnachka A. (2017) “GIS-based Valuation of Ecosystem Services in Mountain Regions: A Case Study of the Karlovo Municipality in Bulgaria”. International Scientific Conference ”Mapping and Assessment of Ecosystem Services – Science in Action”, 6–8 February 2017, Sofia, Bulgaria, Book of Abstract [Eds. S. Nedkov, S. Bratanova-Doncheva], p. 89, CLORIND 2017, ISBN 978-619-7397-01-3

**GIS-based Valuation of Ecosystem Services in Mountain Regions:
A Case Study of the Karlovo Municipality in Bulgaria**

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Keywords: ecosystem services valuation, sustainable governance, GIS, mountain regions, Bulgaria.

Ecosystems ensure a large proportion of the resources for human well-being, providing multiple ecosystem services. Assessing and mapping natural capital in a local level can be a reliable innovative approach to support sustainable development of the local economy, especially in a mountain areas. This study proposes spatially explicit biophysical and monetary valuation of a set of Ecosystem Services in a typical mountain municipality in Bulgaria, on which the welfare of local population depends. GIS-based approach was applied for modeling appropriate biophysical and economic indicators using local, regional and national data and up-scaling of available global data source. Ecosystem services maps was generated, linking the indicators selected with LC/LU data. A system of methods was employed, which include benefit transfer, market price, and contingent valuation. The structure of the assessment contains 4 ecosystem types (agricultural ecosystems, grasslands, forests, and urban areas) and following key ecosystem services delivered from them: Provisioning (timber production, forest/agricultural products, domestic animals products, freshwater provision, genetic resources), Regulation (global climate regulation/carbon sequestration, water flow regulation, soil erosion prevention), and Cultural (tourism and recreation, landscape aesthetic). The investigation interprets the CORINE Land Cover (2012) classes as spatial units of identification, analysis, and valuation of the ecosystem classes. The results, among which is a map of the total economic value (TEV) of the set

19. **Ivanova E.**, Koulov B., Borisova B., Assenov A., Vassilev K. (2016) GIS-based Valuation of Ecosystem Services in Mountain Regions: A Case Study of the Chepelare Municipality in Bulgaria. Proceedings 4th International Conference on Sustainable Development, 16–17 September, 2016, Book of Abstracts [Ed. Pierangelo Magnini], pp. 79-80, ECSDEV 2016, ISBN 978-12-200-11-198

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79

60. GIS-based Valuation of Ecosystem Services in Mountain Regions: A Case Study of the Chepelare Municipality in Bulgaria

Dr. Ekaterina Ivanova, Dr. Boian Koulov, Dr. Bilyana Borisova,
Dr. Assen Assenov, Dr. Kiril Vassilev

ABSTRACT:

Thesis statement: In the last decade the Ecosystem Services' concept has a growing impact on sustainable landscape management in mountain regions, especially in area of territorial policies integration. The concept imports a new dimension in the economic valuation of the available resources and, thus, creates an added perspective of the natural capital of a given territory.

Methodology: This study applies a GIS-based approach in an attempt to evaluate selected ecosystem services on which the standard of living of local population in Rhodope Mountains depends. The valuation procedure employs a system of methods, including benefit transfer, market price, and contingent valuation, on local survey and regional statistical data for the following key ecosystem services: timber production, forest/agricultural products, and tourism and recreation. The investigation interprets the CORINE Land Cover (2012) classes as spatial units for the purposes of identification, analysis and valuation of ecosystem services.

Results: The Total Economic Value of the ecosystem services in the Chepelare Municipality was estimated to approximately 32.9 million leva (16.4 million euro), 69.7% of which accounts for tourism and recreation services, 18.2% for livestock production, 6.4% for timber production and 5.7% for forest products/crop growing production.

Conclusions and Implications: The suggested GIS-based approach for valuation of ecosystem services is intended to inform the sustainable management of the Chepelare Municipality.

Keywords: ecosystem services valuation, sustainable management, GIS, mountains

Dr. Ekaterina Ivanova is currently Assistant Professor in Department of Aerospace Information at Space Research and Technology Institute, Bulgarian Academy of Science, Sofia, where she works in the research areas of modeling and processing satellite data, environment monitoring and data base algorithms. Ekaterina received B.E., M.E., and PhD in Earth Science (Geomorphology and Paleogeography) degrees from Sofia University "St. Kliment Ohridski", Faculty of Geology and Geography in 2004, 2006 and 2011 respectively. Ekaterina's scientific work has been dedicated to natural hazards and ecological modeling. Her main areas of research interest are environmental modeling, natural hazards, geomorphology, ecosystems, GIS and Remote sensing techniques.

Dr. Boian Koulov is an Associated Professor at the National Institute of Geophysics, Geodesy, and Geography at the Bulgarian Academy of Sciences. He is teaching at Sofia University "St. Kl. Ohridski" and is Program Leader at the "Alma Mater" University Complex for the Humanities at Sofia University. The US National Science Foundation, the John D. and Catherine T. MacArthur Foundation, the US National Research Council, and the Bulgarian National Science Fund have sponsored his research on environmental management and regional development issues.

20. Assenov A., Vassilev K., Padeshenko H., Koulov B., **Ivanova E.**, Borisova B. (2016) Research of the Biotope Diversity for the Purposes of Economic Valuation of Ecosystem Services in Chepelare Municipality (The Rhodopes Region of Bulgaria). Proceedings 4th International Conference on Sustainable Development, 16–17 September, 2016, Book of Abstracts [Ed. Pierangelo Magnini], p. 87, ECSDEV 2016, ISBN 978-12-200-11-198

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87

67. Research of the Biotope Diversity for the Purposes of Economic Valuation of Ecosystem Services in Chepelare Municipality (The Rhodopes Region of Bulgaria)

Dr. Assen Assenov, Dr. Kiril Vassilev, Dr. Boian Koulov,
Dr. Ekaterina Ivanova, Dr. Bilyana Borisova

ABSTRACT:

Thesis statement: The application of the philosophy or the management model for sustainable development has two main shortcomings – the condition of the global environment gets worse and the social inequalities deepen. Regardless of the integrity of UN Sustainable Development Goals 2030, the manifestation of the effect of the false demarcation between ecology and development continues. The integrated philosophy for sustainability and development is enriched with new terms, such as natural capital and ecosystem goods and services, while their assessment and evaluation is crucial for the achievement of sustainable development.

Aim and Methodology: The habitat, biotope and landscape diversity interpreted in GIS environment through evaluation of ecosystem goods and services in Chepelare Municipality is the main aim of the research, illustrated with maps of the biotopes, habitat types and landscapes.

Results: The obtained data through a GIS-based approach for evaluation and assessment of the ecosystem services is of high importance for the well-being of the municipality's population. The results about the economic value of two main ecosystem services – wild fruits and herbs and genetic resources are comparable with results from other similar studies.

Conclusions: An attempt is made for harmonization of information from different scales for examination – land cover classes with habitat types, biotopes and landscapes aiming at the precise evaluation of the interpreted ecosystem goods and services.

Keywords: biodiversity, biotope, habitat type, ecosystem service mapping, environmental management

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21. **Ekaterina Ivanova**, Nelly Hristova, Roumen Nedkov, Iva Ivanova, Kamelia Radeva (2011) “Morpho hydrographic analyze of Black Sea catchment area in Bulgaria”. Proceedings of the International Conference “Environment – Landscape – European Identity”, 4-6 November 2011, Bucharest, Romania, Proceedings of the International Conference Environment – Landscape – European Identity, [Eds. Pătru-Stupariu I., Pătroescu M., Rozyłowicz L., Ioja C.], p. 111, © 2011, University of Bucharest, Faculty of Geography, Department of Regional Geography and Environment

Proceedings of the International Conference Environment – Landscape – European Identity, Bucharest, November 4-6 2011

Morpho hydrographic analyze of Black Sea catchment area in Bulgaria

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This paper proposes dividing of Black Sea catchment area into four morpho hydrographic regions – Dobrudja, East Balkan mountain, lowland of Burgas and Strandzha Mountain. It is based on geomorphologic and hydrographic characteristics of rivers and river basins (altitude, valleys, slopes, drainage density, river length, catchment shape, stream orders, and curve of rivers). The work uses GIS-analyze and data of river basins. There is used also Digital Elevation Model (DEM), created on the base of satellite images.

This is the first morpho hydrographic dividing of main catchment area in Bulgaria. It shows a way to define of main river basins into major catchment areas.