РЕЗЮМЕТА НА НАУЧНИТЕ ТРУДОВЕ, ПРЕДСТАВЕНИ ЗА УЧАСТИЕ В КОНКУРСА ЗА ПЕРИОДА 2007–2018 Г. НА ГЛ. АС. ДР. ИВА БОНЕВА ИВАНОВА

I. СЪЗДАВАНЕ И РАЗВИТИЕ НА МЕТОДИКА ЗА ИДЕНТИФИЦИРАНЕ И РАЗПОЗНАВАНЕ НА СПЕЦИФИЧНИ ТИПОВЕ МЕСТООБИТАНИЯ ВЪВ ВЛАЖНИ ЗОНИ С ИЗПОЛЗВАНЕ НА ДАННИ ОТ ДИСТАНЦИОННИ ИЗСЛЕДВАНИЯ (ПЛАВАЩИ ТРЪСТИКОВИ ОСТРОВИ И ТРЪСТИКОВИ МАСИВИ) ВЪВ ВЛАЖНИ ЗОНИ (ЕЗЕРОТО СРЕБЪРНА И ЗАЩИТЕНА МЕСТНОСТ „ПОДА“)

2. Иванова И., Станкова Н.. Динамика на плаващите тръстикови острови в езерото Сребърна за периода пролет – лято 2017 г. с използването на SAR данни, (2017), PROCEEDINGS SES 2017, ISSN:1313 – 3888, 269-274

ДИНАМИКА НА ПЛАВАЩИТЕ ТРЪСТИКОВИ ОСТРОВИ В ЕЗЕРОТО СРЕБЪРНА ЗА ПЕРИОДА ПРОЛЕТ – ЛЯТО 2017 Г, С ИЗПОЛЗВАНЕТО НА SAR ДАННИ

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Ключови думи: *радарни изображения, екомониторинг, местообитания, плаващи тръстикови острови*

Абстракт: *Във връзка със загубата на местообитания вследствие антропогенни и неантропогенни фактори, което води до изчезване на световно застрашени видове животни и растения е необходимо непрекъснато извършване на мониторингови изследвания. Основна цел на изследването е насочена към оценка и мониторинг на приоритетни типове местообитания в защитени територии, каквито са плаващите тръстикови острови в езерото Сребърна, Целта на настоящето изследване е да покаже как такъв мониторинг може да бъде извършван сезонно с помощта на използването на радарни изображения. като изследванията се базират на извършените с помощта на оптични изображения наблюдения през годините, с цел установяване на динамика на местообитанията. Мониторингът е извършен за периода пролет-лято на 2017 г. Което показва динамиката на местообитанията през пролетта, когато езерото е пълноводно, и през лятото – при ниско ниво на водата в езерото. Резултатите показват значителни изменения в тяхната площ и местоположение, което може да се вземе под внимание с цел тяхното опазване за в бъдеще.*

4. Ivanova I., Nedkov R., Borisova D., Application of SAR data for seasonal monitoring of floating reed islands dynamic in Srebarna Lake, (2017), Proc. SPIE 10428, Earth Resources and Environmental Remote Sensing/GIS Applications VIII, SPIE, 2017, ISSN:0277-786X, DOI:http://dx.doi.org/10.1117/12.2278542, 104280M-1-104280M-8. SJR:0.228

Application of SAR data for seasonal monitoring of floating reed islands dynamic in Srebarna Lake

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ABSTRACT

The aim of this paper is seasonal monitoring of floating reed islands dynamic in Srebarna Lake (Bulgaria), using SAR data. In order to study the seasonal dynamic of floating reed islands (such as absolute and relative movement) the only opportunity which provides high-tech methods based on space remote sensing was used. Sensors by suitable parameters for data registration for this type of unsystematic landscape units were used. SAR data (Synthetic Aperture) are powerful high-tech tool for monitoring from the ground objects. SAR data images are privileged to register data at any time of the day or night and in adverse weather conditions, which are the main limiting factor in optical images. Seasonal monitoring of floating reed islands using SAR data was performed – winter – when the water in the lake is frozen, then a relative movement of these islands was observed, spring – melting snow cover and rising water level in the Danube River and Srebarna Lake was observed, when the water level is raised. Obtained results give a quantitative assessment of the ecological dynamics of these types of specific habitats in Srebarna Lake. They show the movement of the islands through the seasons in the period of six mounts, the changes in their shape and size. Regular seasonal monitoring of the floating reed islands dynamic is very important for their preservation as a specific habitat.

Keywords: floating reed islands, SAR data, dynamic, wetland

6. Ivanova I., Nedkov R., Stankova N., 2017: Studying the process of vegetation in Poda Proteted Area using aerospace data, (2017), Proceedings of the Fifth International Conference "Ecological Engineering and Environment Protection" (EEEP'2017) Plovdiv, June 5-7, 2017, p. 191-200, ISSN: 2535 – 0773

STUDYING THE PROCESS OF VEGETATION IN PODA PROTETED AREA USING AEROSPACE DATA

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Abstract: In this study development of vegetation overgrowth in Poda Protected Area for sufficiently long period of time - 1992 - 2016 was investigated. This allows a quantitative assessment of a typical wetland ecosystem to be done for a period of 24 years. The proposed methodology is a sequence of several procedures that are related to quantitative and qualitative assessment of the vegetation change in Poda Protected Area. The combination of satellite data in the optical and radio spectrum increases the objectivity and precision of vegetation cover, water and soil moisture monitoring. In order to distinguish the vegetation from the water and another non-vegetation surfaces the vegetation index NDVI was used. This index is a good indicator that there is land in the wetland of Poda Protected Area which is the basis for this vegetation to grow and this helps for the correct identification and classification of the different objects in this site. Normalized Differential Water Index (NDWI) was used for assessing the presence of moisture in the leaves. On the basis of the obtained results, vegetation monitoring in the Poda Protected Area was made, which is an important factor for the protected area management. From this assessment, recommendations can be made as to whether and during which season human intervention is needed to preserve the main habitats in the protected area.

Keywords: *wetlands, habitats, vegetation, dynamics, satellite data*

12. Nedkov R., **Ivanova I**., Zaharinova M., Stankova N., Actual state of Poda Protected Area using SAR data, (2016), Proceedings of the Third European SCGIS Conference ”Geoinformation technologies for natural and cultural heritage conservation”, October 11-12, 2016, Sofia, Bulgaria, Space Research and Technology Institute – Bulgarian Academy of Sciences, ISSN 1314-7749, p.192-198

ACTUAL STATE OF PODA PROTECTED AREA USING SAR DATA

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ABSTRACT

Poda Protected Area is a marshy wetland, which is a part of the Bourgas-Mandra firth, located at the seacoast. Management of the vegetation and reedbeds is needed to preserve the area as a key site for the Black Sea coast and the country. In this paper the actual state of Poda Protected Area is shown using combinations of optical and SAR data for the period of three different seasons of the year (winter, spring and summer). NDVI values for each of the seasons were calculated. The aim of the study is to create new approaches and data-processing methods for analyses. The results show spatial distribution of vegetation NDVI and water in Poda Protected Area.

Keyworlds: *satellite, SAR data, wetland, monitoring, reedbeds*

14. Ivanova I., Study of the dynamics of floating reed islands dynamic in Srebarna lake for the period 1992-2014 based on satellite, ground and GPS data, (2016), Ecological engineering and environment protection, ISSN 1311-8668, 1/2016, p. 18-25

STUDY OF THE DYNAMICS OF FLOATING REED ISLANDS IN SREBARNA LAKE FOR THE PERIOD 1992-2014, BASED ON SATELLITE, GROUND AND GPS DATA

Iva Ivanova

Abstract. This study is about the dynamics of floating reed islands in Srebarna Lake during the period 1992 - 2014. Srebarna Lake is part of Natura 2000, European ecological network. Srebarna Lake is declared as Srebarna Biosphere Reserve by UNESCO, and categorized as a supported reserve.

Floating reed islands are important for the breeding of different water bird species, some of which are endangered species. They are unique for Europe as water bird habitats and they are presented only in Srebarna Lake and the Danube Delta. Focused research on the area and spatial variability of the floating reed islands have not been performed yet due to their difficult accessibility and the lack of data about their dynamics. Study of the floating reed islands dynamics (absolute and relative motion) could be done only by high-tech methods, based on remote sensing from space, using appropriate sensors to register parameters of this unique kind of unsystematic landscape units. The results from this research have been grouped in specialized geodatabase. A methodology for studying the dynamics of area, size, and location changes of the floating reed islands has been proposed. Based on this methodology the quantitative results for habitat’s ecodynamics in Srebarna Lake have been received. A coefficient of relative area (KM), showing the attitude of the habitats to the area of central water body have been introduced which is used as quantitative assessment of this habitat’s dynamics. The results of the study have been used in monitoring management plans of Srebarna Biosphere Reserve. Tracking the floating reed islands attitude is essential for investigating the dynamics of these specific habitats for endangered bird species nesting.

Key words: floating reed islands, dynamics, satellite data, monitoring.

15. Иванова И., Недков Р., Сезонна динамика на плаващите тръстикови острови в езерото Сребърна на базата на спътникови, наземни и GPS данни, за периода март 2014

г. – март 2015 г., Eleventh Scientific Conference with International Participation, (2015), SES2015, 286-291

СЕЗОННА ДИНАМИКА НА ПЛАВАЩИТЕ ТРЪСТИКОВИ ОСТРОВИ В ЕЗЕРОТО СРЕБЪРНА НА БАЗАТА НА СПЪТНИКОВИ, НАЗЕМНИ И GPS ДАННИ, ЗА ПЕРИОДА МАРТ 2014 г. – МАРТ 2015 г.

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Ключови думи: *дистанционни изследвания, динамика, плаващи тръстикови острови, местообитания*

Резюме: *В настоящата работа се проследява сезонната динамика на плаващите тръстикови острови в езерото Сребърна за период от една година. Плаващите тръстикови острови имат изключително важно значение за гнездането на различни видове водолюбиви птици, някои от които световно застрашени видове. За изследване динамиката (като абсолютно и относително движение) на плаващите острови е използвана единствената възможност, която предоставят високотехнологичните методи, базирани на дистанционни изследвания от космоса с помощта на сензори с подходящи за целта параметри на регистрираните от тях данни за този вид несистемни ландшафтни единици. Това показва как островите се променят през сезоните за една година , какви движения и промени във формата и площта им се наблюдават и дали това се отразява върху използването им от някои световно застрашени видове птици като място за гнездене. Сезонния мониторинг дава представа как да бъдат опазени плаващите тръстикови острови като важно местообитание.*

21. Vasilev V.P., Kalchev R.K., Diadovski I.K., Kalcheva H., **Ivanova I.B.,** Filkova R.P., Spatial and temporal morphometric changes, Ecosystems of the Biosphere Reserve "Srebarna Lake", Sofia, (2012), Prof. Marin Drinov Academic Publishing House, p. 185-196 (монографичен труд)

Spatial and temporal morphometric changes

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II. WEB-БАЗИРАН КОСМИЧЕСКИ МОНИТОРИНГ НА АТМОСФЕРНИ ЗАМЪРСЯВАНИЯ, ПОЖАРИ И НАВОДНЕНИЯ НА БАЗАТА НА ДАННИ ОТ ДИСТАНЦИОННИ ИЗСЛЕДВАНИЯ

1. Radeva K., **Ivanova I**., Borisova D., APPLICATION OF REMOTE SENSING FOR ECOSYSTEMS MONITORING AND RISK ASSESSMENT, (2018), 'Fifth International Conference on Remote Sensing and Geoinformation of Environment' 20-23 March, 2018 - Cyprus, RS100 - 29 V. 2 , приета за печат: 2018, SJR:0.228

APPLICATION OF REMOTE SENSING FOR ECOSYSTEMS MONITORING AND RISK ASSESSMENT

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ABSTRACT

In recent years on the territory of Bulgaria it has been observed the existence of events with extreme character – floods, forest fires, etc.- that have a negative effect on ecosystems and ecosystem services. The purpose of the present research is the application of remote sensing for ecological monitoring implementation for the ecosystems upon the appearance of natural hazards. In this paper a methodology for ecological monitoring in different temporal intervals has been proposed and additionally the results from the application of remote sensing for the purpose of ecosystem monitoring and risk assessment in case of events that induce negative effect on ecosystems have been presented. The methodology and criteria have been implemented in observing different types of ecosystems. For the purpose of the present investigation satellite data with different spatial, temporal and spectral resolution from Sentinel 2, Landsat and air photo images have been used. Terrestrial data have been used for results verification and validation. The introduced results have been obtained for different temporal intervals from ecological monitoring, on which base criteria for optimization of the temporal characteristics of the ecological monitoring have been suggested. The present research is with conformance of Directive 92/43/EEC on the conservation of natural habitats and of wild fauna and flora and Directive 2009/147/EC on the conservation of wild birds. The results from the completed research can be of benefit for defining concrete actions for the implementation of measurements appointed in the Action Plan for nature, people and the economy of 27.4.2017 COM(2017) 198.

Keywords: Remote sensing, Ecosystem monitoring, Risk assessment, Ecosystem Services, Space-temporal characteristics

3. Станкова Н., **Иванова И**.. Оценка на степента на увреждане на горски екосистеми след пожар, (2017), PROCEEDINGS SES 2017, ISSN:1313 – 3888, 275-279

ОЦЕНКА НА СТЕПЕНТА НА УВРЕЖДАНЕ НА ГОРСКИ ЕКОСИСТЕМИ СЛЕД ПОЖАР

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Ключови думи: *дистанционни изследвания, пожар, NBR, burn severity, Sentinel*

Резюме: *Целта на настоящата работа е оценка на степента на увреждане на горски екосистеми след пожар на базата на дистанционни аерокосмически методи и данни. Използвани са спътникови изображения от Sentinel-2A и Terra MODIS. За целта на изследването се извършва проследяване на състоянието и степента на увреждане на горски екосистеми след пожар на територията на пожара от 24/08/2017г. в района на с. Стара Кресна. Благодарение на подходящата пространствена разделителна способност на Sentinel-2A е направено прецизно дефиниране на границите на изгорялата от пожара територия. Използвани са композитни изображения от сензора Sentinel 2A от следните дати – преди пожара (07/08/2017г.) и след пожара (06/09/2017г.). За целта на изследването е направена класификация на базата на dNBR или т. нар. „burn severity map" на територията на цялата опожарена площ като са дефинирани четири класа според степента на изгаряне – висока, средна, ниска и незасегнати.*

7. Stankova N., Nedkov R., **Ivanova I.,** Avetisyan D., 2017: Integration of multispectral and SAR data for monitoring forest ecosystems recovery after fire, (2017), Fifth international conference on remote sensing and geoinformation of environment, RSCy 2017 – 20-23 March, 2017, Paphos, Cyprus, ISBN 978-9963-697-24-3, 104441J-1 104441J, 10444, SPIE, ISBN:978-9963-697-24-3, DOI:10.1117/12.2277313, SJR:0.216

Integration of Multispectral and SAR Data for Monitoring Forest Ecosystems Recovery after Fire

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ABSTRACT

The aim of this study is assessing the impacts and monitoring the condition and recovery processes of forest ecosystems after fire based on remote aerospace methods and data. To achieve this goal, satellite imagery in microwave and optical range of the spectrum were used. A hybrid model for assessing the instantaneous condition of forest ecosystems after fire that uses parallel data from optical and Synthetic Aperture Radar (SAR) was developed. Based on the three Tasseled Cap components (Brightness-BR, Greenness-GR and Wetness-W), a vector describing the current condition of the forest ecosystems was obtained and used as input data from the optical range. Results obtained by implementation of the proposed approach show that the integrated composite images of VIC and SAR represent the degree of recovery.

Keywords: remote sensing, recovery after fire, Synthetic Aperture Radar (SAR), Vector of Instantaneous Condition (VIC)

13. Stankova N., Nedkov R., **Ivanova I**.. Изследване на последствията и състоянието на горски екосистеми след пожар чрез използване на дистанционни аерокосмически методи и данни.(2016), Proceeding SES 2016, ISSN:1313 – 3888, 314-320

ИЗСЛЕДВАНЕ НА ПОСЛЕДСТВИЯТА И СЪСТОЯНИЕТО НА ГОРСКИ ЕКОСИСТЕМИ СЛЕД ПОЖАР ЧРЕЗ ИЗПОЛЗВАНЕ НА ДИСТАНЦИОННИ АЕРОКОСМИЧЕСКИ МЕТОДИ И ДАННИ

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Ключови думи: *дистанционни изследвания, възстановяване след пожар, вегетационни индекси, Disturbance Index*

Резюме: *Целта на настоящата работа е оценка на последствията и мониторинг на състоянието и възстановителните процеси на горски екосистеми след пожар на базата на дистанционни аерокосмически методи и данни. Използвани са спътникови изображения от Landsat 5 TM, Landsat 7 ETM+, Landsat 8 OLI и Sentinel-2A. За целта на изследването се извършва проследяване на състоянието и последствията на горски екосистеми след пожар на територията на три големи пожара, възникнали през лятото на 2007 г. в югоизточна България.Направена е количествена оценка на състоянието на горските екосистеми за изследвания период (9 години след настъпване на пожарите) чрез пресмятане стойностите на различни вегетационни индекси на територията на подбрани тестови участъци.На базата на Tasseled Cap трансформация е изчислен Disturbance Index за оценка на смутеността на горските екосистеми за изследвания период.*

16. Станкова Н., **Иванова И**., Павлова Н., Недков Р., Захаринова М., 2015, Екологични въздействия и последствия от наводнения в района на р. Марица чрез използване на спътникови, GPS и наземни данни за периода 2005 – 2014 г., (2015), Екологично инженерство и опазване на околната среда, 4/2015, с. 5-14, ISSN 1311-8668

ЕКОЛОГИЧНИ ВЪЗДЕЙСТВИЯ И ПОСЛЕДСТВИЯ ОТ НАВОДНЕНИЯ В РАЙОНА НА Р. МАРИЦА ЧРЕЗ ИЗПОЛЗВАНЕ НА СПЪТНИКОВИ, GPS И НАЗЕМНИ ДАННИ ЗА ПЕРИОДА 2005 – 2014 Г.

Наталия Станкова, Ива Иванова, Надя Павлова, Румен Недков, Мариана Захаринова

ENVIRONMENTAL EFFECTS AND CONSEQUENCES OF FLOODS IN THE REGION OF MARITSA RIVER DURING THE PERIOD 2005 – 2014 BY USING SATELLITE, GPS AND TERRESTRIAL DATA

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Abstract. The aim of this study is monitoring of environmental impacts after the flood from 2005 in the region of Maritsa river by monitoring the consequences, the recovery of the vegetation and the current condition of the region in 2014. Four significant floods were registered in Bulgaria during 2005 caused by torrential rains, rising of groundwater and overflow of rivers and dams. The proposed methodology was applied to part of the flood area from 08-12 August, 2005 in the region of Parvomay municipality. The methodology is based on satellite, GPS and terrestrial data. Satellite images with high resolution were used and an accurate assessment of the water bodies location and the river system which may be one of the main reasons for floods. By applying GIS as a tool for analysis and monitoring of floods results with sufficient accuracy concerning the impacts on the environment were obtained. Based on the results and after applying the methodology vegetation restoration was observed which provides conditions for development of new habitats. A process of vegetation canopy recovery was observed in areas which are characterized with high drought and increases in NDVI values which indicate better conditions and increase the volume of leaf biomass.

Keywords: flood, consequences, satellite data, remote sensing, GIS

18. Dimitrova M., **Ivanova I.**, Nedkov R., Zaharinova M., 2013, APPLICATION OF AEROSPACE METHODS FOR MONITORING OF FOREST FIRES AND EVALUATION OF BURNED AREA IN HASKOVO REGION IN THE SUMMER OF 2011, (2013), Aerospace Research in Bulgaria, 25,Sofia, 2013, Bulgarian Academy of Sciences, ISSN 1313 – 0927, 194-205

APPLICATION OF AEROSPACE METHODS FOR MONITORING OF FOREST FIRES AND EVALUATION OF BURNED AREA IN HASKOVO REGION IN THE SUMMER OF 2011

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Abstract

The most significant forest and field fires in Haskovo region in the summer of 2011 are looked through. Information about physico-geographic characteristics of the area, land cover, etc. are gathered and analyzed in GIS. The location and the area affected by the largest fire are being determined based on sattelite data. An analysis of the affected area is done.

19. Filchev, L., 2. Roumenina, E., Jelev, G., **Ivanova. I**., Dimitrov, P., Nedkov, R.,. Naydenova, V., Slabakova, V., Remote sensing activities in Bulgaria 2012, (2013), June 2013, EARSeL Newsletter, EARSeL, 94, ISSN 1024-4557, p. 6-16 (.pdf)

National Reports

Remote Sensing Activities in Bulgaria, 2012

This report is based on information provided by Georgi Jelev, Eugenia Roumenina, Iva Ivanova, Lachezar Filchev, Petar Dimitrov, Roumen Nedkov, Vanya Naydenova, and Violeta Slabakova.

The Bulgarian EARSeL members are represented by two EARSeL groups at two of the institutes at the Bulgarian Academy of Sciences (BAS). They are namely: the Space Research and Technology Institute (SRTI-BAS) and the *Fridtjof Nansen* Institute of Oceanology (IO-BAS). These groups have been EARSeL

members since 2009, when the two groups, consisting mainly from young scientists, applied to and were accepted to EARSeL.

The EARSeL group at the SRTI-BAS consists of 10 researchers: 7 from the *Remote Sensing and GIS (RS&GIS)* department and 3 from the *Aerospace Information (AI)* department. Present report was presented before Dr. I Manakos - the EARSeL Chairman - during a meeting with the Bulgarian EARSeL members (1).

22. Тренчев П., Недков Р., Димитрова М., Христов П., **Иванова И.**, Захаринова М., Гочев Д.; Интегрирани web-базирани системи за мониторинг на околната среда, (2012), SES 2012, Eighth Scientific Conference with International Participation, 369-370

ИНТЕГРИРАНИ WEB-БАЗИРАНИ СИСТЕМИ ЗА МОНИТОРИНГ НА ОКОЛНАТА СРЕДА

Пламен Тренчев, Румен Недков, Мария Димитрова, Пламен Христов, Ива Иванова, Марияна Захаринова, Деян Гочев

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Ключови думи: *ГИС-слоеве, мета-данни, уеб-базирани приложения*

Резюме*: За да бъдат максимално ефективни, уеб-базираните системи за мониторинг трябва да бъдат лесни и удобни за използване от широк кръг потребители, да осигуряват точен анализ и визуализация с помощта на взаимодействащи си инструменти и приложения чрез интернет.*

23. Иванова И., Недков Р., Станкова Н., Захаринова М., Димитрова М., Николова С., Радева К.; Анализ на наводнението от месец Февруари 2012 на територията на с. Бисер на базата на спътникови и GPS данни в ГИС среда; (2012), SES 2012, Eighth Scientific Conference with International Participation, 432-442

АНАЛИЗ НА НАВОДНЕНИЕТО ОТ МЕСЕЦ ФЕВРУАРИ 2012 Г. НА ТЕРИТОРИЯТА НА С. БИСЕР НА БАЗАТА НА СПЪТНИКОВИ И GPS ДАННИ В СРЕДА НА ГИС

Ива Иванова, Румен Недков, Наталия Станкова, Мариана Захаринова, Мария Димитрова, С. Николова, К. Радева

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Ключови думи: *ГИС, дистанционни аерокосмически методи, спътникови данни, GPS, наводнения*

Резюме: *В работата е показано съвременното приложение на геоинформационни технологии и използването им в при анализ на от най- опасните бедствия – наводнението. Възможностите на съвременните геоинформационни технологии позволяват прилагане на нови методи при обработката и интерпретацията на различни пространствени данни. Предложена е методика, която изисква използването на спътникови, наземни и GPS данни. В качеството на спътникови данни са използвани изображения с висока разделителна способност. Те дават възможност за прецизна оценка на*

местоположението на водните тела, разположени на територията, които са основната причина за възникване на наводнението.

26. Недков Р., Христов Пл., **Иванова И.**, Димитрова М., Захаринова М.., Желев Г., Бонева Д., Екологично мониторингово изследване в района на полигон Змейово на базата на спътникови и наземни данни, (2011), Екологично инженерство и опазване на околната среда, книжка 4/2011, с.72-78

ЕКОЛОГИЧНО МОНИТОРИНГОВО ИЗСЛЕДВАНЕ В РАЙОНА НА ПОЛИГОН ЗМЕЙОВО НА БАЗАТА НА СПЪТНИКОВИ И НАЗЕМНИ ДАННИ

Р. Недков, Пл. Христов, И. Иванова, М. Димитрова, М. Захаринова, Г. Желев, Д. Бонева

WEB-BASED ECOLOGICAL MONITORING STUDY IN THE REGION OF A POLYGON ZMEYOVO, USING SATELLITE AND GROUND DATA

R. Nedkov, P. Hristov. I. Ivanova, M. Dimitrova, M. Zaharinova, G. Jelev, D. Boneva

Abstract: In this paper we describe the methodology and results of a web-based environmental monitoring study of air pollution in the region of a polygon Zmeyovo – Stara Zagora municipality. Monitoring is conducted by early 2010. The results are published daily in specialized web-page. The analyses of the results don't show atmospheric pollution in the region from polygon Zmeyovo.

Key words: web-monitoring, satellite images, ecological monitoring, air pollutions.

28. Стоянова П., Димитрова М., Недков Р., Панайотова Д., Апостолова В., Захаринова М., **Иванова И**., Екомониторинг на атмосферните замърсявания на община Димитровград, на базата на спътникови и наземни данни за периода 2005-2009 година, (2010) „Екологични инженерство и опазване на околната среда", книжка2/2010, 21-26

ЕКОМОНИТОРИНГ НА АТМОСФЕРНИТЕ ЗАМЪРСЯВАНИЯ НА ОБЩИНА ДИМИТРОВГРАД НА БАЗАТА НА СПЪТНИКОВИ И НАЗЕМНИ ДАННИ ЗА ПЕРИОДА 2005-2009 ГОДИНА

П. Стоянова, М. Димитрова, Р. Недков, Д. Панайотова, В. Апостолова, М. Захаринова, И. Иванова

ECOMONITORING OF ATMOSPHERIC POLLUTION IN THE MUNICIPALITY OF DIMITROVGRAD AREA ON THE BASIS OF SATELLITE AND GROUND DATA FOR 2005-2009 YEARS

P. Stoyanova, M. Dimitrova, R. Nedkov , D. Panayotova, V. Apostolova, M. Zaharinova, I. Ivanova

Abstract. The purpose of the study is tracking the dynamics of atmospheric pollution over the town of Dimitrovgrad municipality for the period July 2005 - May 2009 based on satellite and terrestrial data. To achieve the objective satellite data suitable for investigation of atmospheric pollution in the area are selected, processed and analyzed Based on visual interpretation a degree of contamination of the atmosphere and scale

of its distribution is assessed.A comparative analysis of the results obtained from satellite and terrestrial data available from the Ministry of Environment and Water (MEW) for part of the period is produced.

Key words: atmospheric pollution, satellite and ground data

29. Филипов Л., Христов П., Недков Р., **Иванова И.**, Димитрова М., Захаринова М., Желев Г., Бонева Д., Панайотова Д., Web- мониторинг на атмосферни замърсявания в района на община Бургас на базата на спътникови, наземни и GPS даннни, (2009) SENS2009, 187-191

WEB- МОНИТОРИНГ НА АТМОСФЕРНИ ЗАМЪРСЯВАНИЯ В РАЙОНА НА ОБЩИНА БУРГАС НА БАЗАТА НА СПЪТНИКОВИ, НАЗЕМНИ И GPS ДАННИ

Лъчезар Филипов, Пламен Христов, Румен Недков, Ива Иванова, Мария Димитрова, Мариана Захаринова, Георги Желев, Даниела Бонева, Дора Панайотова

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Ключови думи: *атмосферно замърсяване, еко- мониторинг, спътникови данни*

Резюме: *В настоящата статия е разгледан проблема с атмосферните замърсявания на територията на област Бургас. Резултатите от замърсяванията се основават на ежедневно еко-мониторингово изследване на Центъра за аерокосмическа информация, ИКИ–БАН. Анализът на резултатите от изследването на района сочи сравинително нисък брой на дни със замърсявания за периода от септември 2008 г. до септември 2009 г., като се забелязват разлики в отчетения брой дни със замърсявания през различните сезони*

31. Панайотова Д., Недков Р., Димитрова М., **Иванова И.**, Захаринова М., Изследване потенциалния риск от разлив на язовир Малазма, разположен в региона на община Тунджа на територията на Република България, на базата на спътникови и данни, (2008) Екологично инженерство и опазване на околната среда, книжка книжка 4/2008, с. 12 -19

ИЗСЛЕДВАНЕ ПОТЕНЦИАЛНИЯ РИСК ОТ РАЗЛИВ НА ЯЗОВИР „МАЛАЗМА” НА БАЗАТА НА СПЪТНИКОВИ И GPS ДАННИ

Дора Панайотова, Румен Недков, Мария Димитрова, Ива Иванова, Мариана Захаринова

STUDY OF THE POTENTIAL RISK OF FLOOD FROM THE MALAZMA RESERVOIR USING SATELLITE AND GPS DATA

Dora Panayotova, Roumen Nedkov, Maria Dimitrova, Iva Ivanova, Mariana Zaharoniva

Abstract: In the paper, a study of the ecological status of the Malazma reservoir (the Tundzha municipality, Buldaria) for the potential flood risk, using remote sensing methods, aerospace and GPS information, is presented. This study is accomplished on the basis of the fluctuations of the lake's water

level and the watersides' slope size. The water level's area correlates with the fluctuations of the water's capacity and that presents the potential flood risk. The slopes help to determine the flood risk and possible damaged areas.

Key words: aerospace information, flood risk, reservoir, GPS, DEM, GIS

32. Yordanova A., Nedkov R., Dimitrova M., **Ivanova I.**, Zaharinova M., Мониторинг на атмосферните замърсявания в региона около град София през зимния период на 2006 и 2007 година, (2008) SENS 2008, 4-7 Юни 2008, Варна, България , 141-148

МОНИТОРИНГ НА АТМОСФЕРНИТЕ ЗАМЪРСЯВАНИЯ В РЕГИОНА ОКОЛО ГРАД СОФИЯ ПРЕЗ ЗИМНИЯ ПЕРИОД НА 2006 И 2007 ГОДИНА

Албена Йорданова, Румен Недков, Мария Димитрова, Ива Иванова, Марияна Захаринова

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Ключови думи: *атмосферни замърсявания, мониторинг, дистанционни изследвания, динамика, аерокосмически данни*

Резюме: *Бързото развитие на промишлеността, енергетиката и транспорта поставиха редица екологични проблеми по отношение замърсяването на въздуха и промяната на неговия качествен състав. От средата на 20-ти век в състава на атмосферата настъпиха съществени промени, явяващи се като резултат на бурното развитие на научно-техническия прогрес и глобализация на общественото производство.*

В настоящата работа е показана динамиката на атмосферните замърсявания през периода есен-зимата 2006 – 2007 година в района над и около град София, проследена с помощта на аерокосмически и GPS данни.

33. Nedkov R., Dimitrova M., Zaharinova M., **Ivanova I.**, Web monitoring of fires on Balkans based on satellite data during July and August 2007, (2008), Ekological engineering and environment protection, 1/2008, p. 13-17

WEB-BASED MONITORING OF THE FIRES IN THE BALKANS USING SATELLITE DATA DURING JULY AND AUGUST 2007

R. Nedkov, M. Dimitrova, M. Zaharinova, I. Ivanova

Abstract: A space data-based monitoring of the massive forest and agrarian fires which sprang up in the Balkans in 2007 are presented. This monitoring has been performed by the Aerospace Information Center of the Space Research Institute at the Bulgarian Academy of Sciences since the summer of 2007. On the basis of satellite and GPS data, it is shown how to perform the localisation of the fire zones as well as to estimate the consequences from the fires. The fires sprung up in July 2007 around Stara Zagora and Topolovgrad were observed. Òhe results of the satellite monitoring of the fires which took place in Macedonia and the Peloponnesian peninsula of Greece are shown too.

Keywords: satellite monitoring, ecology, fires, image processing.

III. ИЗПОЛЗВАНЕ НА СПЪТНИКОВИ ДАННИ И ТЯХНОТО ПРИЛОЖЕНИЕ ЗА ОЦЕНКА НА ЗЕМНОТО ПОКРИТИЕ.

20. Panayotova, D., Nedkov, R., Dimitrova, M., **Ivanova, I**., Zaharinova, M., Eco-monitoringal investigation of forest end land-used area and agro-climate characteristics in the land of the municipality of kardzhali, using aerospace and gps data (2009) Journal Biotechnology & Biotechnological Equipment Volume 23, 2009 – Issue sup1: XI ANNIVERSARY SCIENTIFIC CONFERENCE, 23, Issue sup1, Taylor & Francis, 2009, ISSN:1310-2818, DOI:10.1080/13102818.2009.10818400, 200-2003. ISI IF:1.059

ECO-MONITORINGAL INVESTIGATION OF FOREST END LAND-USED AREA AND AGRO-CLIMATE CHARACTERISTICS IN THE LAND OF THE MUNICIPALITY OF KARDZHALI, USING AEROSPACE AND GPS DATA

D. Panayotova, R. Nedkov, M. Dimitrova, I. Ivanova, M. Zaharinova Space Research Institut – Bulgarian Academy of Sciences, Correspondence to: D. Panayotova

ABSTRACT

Municipality of Kardzhali is located in the southeastern part of Bulgaria. It is the largest municipality in the eastern Rhodope mountain massif. In climatic terms Rhodope mountain massif falls entirely in continental-Mediterranean climate region of Bulgaria and in particular in its southern Bulgarian climate.

Kardzhali municipality covers 117 towns and villages covered in 45 mayoralties. Bordered by the municipalities – Haskovo, Stambolovo, Momchilgrad, Ardino and Chernoochene.

Keywords: agro-climate characteristics,Kardzhali,aerospace data,GPS data

30. Nedkov R., **Ivanova I**., Panayotova D., Dimitrova M., Zaharinova M.; Ecomonitoring investigation of land cover of the municipality of Kardzhali, using aerospace and GPS data, (2013), Екологично инженерство и опазване на околната среда, No 1, 2013, ISSN 1311 – 8668, 5-9

ECOMONITORING INVESTIGATION OF LAND COVER OF THE MUNICIPALITY OF KARDZHALI, USING AEROSPACE AND GPS DATA

R. Nedkov, I. Ivanova, D. Panayotova, M. Dimitrova, M. Zaharinova

Abstract: In this paper a land cover and agro-climatic characteristics is done in the land of the municipality of Kardzhali. Kardzhali municipality comprises of 117 settlements covered in 45 municipalities. A characteristic of agro-climatic conditions is done in the region – relief, agro-climatic resources, rainfall, temperature conditions during the vegetation period and soil types. For a description of the types of land cover are used a data from CORINE Land Cover. Forests and agricultural areas are the main land cover classes in the region. The aim of this paper is to assess the terrain and its ability to be used in agricultural activities.

Key words: land cover, satellite and GPS data, agro-climatic characteristics

IV. ИЗПОЛЗВАНЕТО НА СПЪТНИКОВИ ДАННИ И ТЯХНОТО ПРИЛОЖЕНИЕ ЗА ИДЕНТИФИЦИРАНЕ НА МЕСТАТА ЗА ДЕПОНИРАНЕ НА ОТПАДЪЦИ.

5. Kazaryan M., Shakhramanyan M., Nedkov R., Richter A., Borisova D., Stankova N., **Ivanova I.**, Zaharinova M., Borisova D., Research of generalized wavelet transformations of Haar correctness in remote sensing of the Earth, (2017), Proc. SPIE 10427, Image and Signal Processing for Remote Sensing XXIII, 10427, SPIE, 2017, ISSN:0277-786X, DOI:http://dx.doi.org/10.1117/12.2278572, 104271U-1-104271U-13. SJR:0.228

Research of generalized wavelet transformations of Haar correctness in remote sensing of the Earth

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ABSTRACT

In this paper, Haar's generalized wavelet functions are applied to the problem of ecological monitoring by the method of remote sensing of the Earth. We study generalized Haar wavelet series and suggest the use of Tikhonov's regularization method for investigating them for correctness. In the solution of this problem, an important role is played by classes of functions that were introduced and described in detail by I.M. Sobol for studying multidimensional quadrature formulas and it contains functions with rapidly convergent series of wavelet Haar. A theorem on the stability and uniform convergence of the regularized summation function of the generalized wavelet-Haar series of a function from this class with approximate coefficients is proved. The article also examines the problem of using orthogonal transformations in Earth remote sensing technologies for environmental monitoring. Remote sensing of the Earth allows to receive from spacecrafts information of medium, high spatial resolution and to conduct hyperspectral measurements. Spacecrafts have tens or hundreds of spectral channels. To

process the images, the device of discrete orthogonal transforms, and namely, wavelet transforms, was used. The aim of the work is to apply the regularization method in one of the problems associated with remote sensing of the Earth and subsequently to process the satellite images through discrete orthogonal transformations, in particular, generalized Haar wavelet transforms. General methods of research. In this paper, Tikhonov's regularization method, the elements of mathematical analysis, the theory of discrete orthogonal transformations, and methods for decoding of satellite images are used. Scientific novelty. The task of processing of archival satellite snapshots (images), in particular, signal filtering, was investigated from the point of view of an incorrectly posed problem. The regularization parameters for discrete orthogonal transformations were determined.

Keywords: orthogonal transformations, generalized wavelet - Haar transformations, efficiency, satellite images and signals, regularizing factor, Tikhonov regularization method

8. Richter A., Kazaryan M., Shakhramanyan M., Nedkov R., Borisova D. , Stankova N., **Ivanova I.**, Zaharinova M., Quality enchancement of satellite images and its application for indentification of surroundings of waste disposal sites, (2017), Fifth international conference on remote sensing and geoinformation of environment, 10444, SPIE, 2017, DOI:http://dx.doi.org/10.1117/12.2277309, 104441N-1-104441N-7. SJR:0.228

Quality enhancement of satellite images and its application for identification of surroundings of waste disposal sites

Andrey Richter[a], Maretta Kazaryan[b], Mihail Shakhramanyan[a], Roumen Nedkov[c], Denitsa Borisova*[c], Nataliya Stankova[c], Iva Ivanova[c], Mariana Zaharinova[c]

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ABSTRACT

The paper proposes a method for fuzzy interactive enhancement of objects identification in the image which allows identifying hidden or no defined details and objects in the images. The application of the method and its difference from other image enhancement techniques are shown. The paper presents the algorithm and describes the basic processing procedures (sampling, scaling, convolution, contrast). The main processing parameters (increasing and reduction of dimensions, convolutions, brightness, and thresholds contrast) are demonstrated. The results from the applied algorithm are explained on an example related to landfill Kutchino in the Moscow region, on the satellite images with low and high spatial resolution.

Keywords: satellite images, waste disposal facilities, landfills, pattern recognition, image quality, 3D-modeling

9. Richter A., Kazaryan M., Shakhramanyan M., Borisova D., Stankova N., **Ivanoval I**., INFORMATION MODELING OF WASTE DISPOSAL SITES, (2017), Ekological engineering and environment protection, ISSN 1311-8668, EEEP 1/ 2017, p. 15-21

INFORMATION MODELING OF WASTE DISPOSAL SITES

Andrey Richter, Maretta Kazaryan, Mihail Shakhramanyan ,
Denitsa Borisova, Nataliya Stankova, Iva Ivanova

Abstract. The paper proposes a methodology for developing information model or database of waste disposal sites /WDS/ or landfill sites, applying received remotely and in-situ data from Earth surface monitoring, especially including procedures of morphological processing, data normalization and visualization models. The overall structure and composition of the information model, described subsystems, classes, objects, and attributes (properties) of the data, are presented. The possibility of formation of new information relations, that arise between different kinds of information, through morphological (in particular, the morphemic) processing "raw" information at the input, for example, between the classifiers (waste products, settlements, economic activities, etc.), is described. The paper used methods of system analysis, methods of mathematical linguistics, space monitoring methods. For example a structure of constructing the database, the archive and the classifier of unauthorized waste disposal facilities (solid waste landfills, waste piles, municipal landfills, and others) is presented. The scheme of data model describes the components (tables) as part of the model: general information, geometric and geographic parameters of geo-referenced data, including data for adjacent territorial-administrative facilities, etc.

Kewwords: waste disposal sites, landfills, information model, database, classifier, waste disposal object classification, state register, object attribute data

10. Shakhramanyan M., Richter A., Kazaryan M., Nedkov R., Borisova D., Stankova N., **Ivanova I**., Zaharinova M., EVALUATION OF CHEMICAL PROCESS PARAMETERS IN WASTE DISPOSAL SITES BY SATELLITE IMAGES, (2017), Ekological engineering and environment protection, ISSN 1311-8668, EEEP 1/ 2017, p. 22-28

EVALUATION OF CHEMICAL PROCESS PARAMETERS IN WASTE DISPOSAL SITES BY SATELLITE IMAGES

Mihail Shakhramanyan, Andrey Richter, Maretta Kazaryan, Roumen Nedkov, Denitsa Borisova, Nataliya Stankova, Iva Ivanova, Mariana Zaharinova

Abstract. The presented paper proposes a method for estimating parameters and characteristics of the chemical processes in large municipal landfills and solid waste disposal sites according to the waste monitoring from space. The model of chemical transformations in the waste disposal sites is described based on the idea of waste biochemical degradation in the form of the "transformations tree". The presentation of chemical transformations in the form of statistical integrated chemical equations allows us to describe the chemical system "a waste disposal facility" in the analytical form. The paper presents the main types of physical (volume and mass, thermal) and chemical (filtrate) characteristics which assessment could be made by data from satellite images. As an example the obtaining of the volume and mass characteristics of landfills in their 3D-models is described. Results of the algorithm on the example of a polygon of solid municipal and industrial waste in Salaryevo (Leninsky district of the Moscow region) are presented. As an example the assessment of volume and mass of landfill gas and its main component – methane is shown. An airborne image from year 2000 is compared with the satellite images in visible spectral range closed to its date. The main sources of errors in the evaluation of volume and mass characteristics are defined. The error which source is the spatial and spectral resolution of the satellite image is calculated.

Keywords: waste disposal facility, landfills, satellite images, chemical processes, chemical parameters, 3D-model

11. Richter A., Kazaryan M., Shakhramanyan **M.,** Nedkov R.**,** Borisova D.**,** Stankova N.**, Ivanova I.**, Zaharinova M**.**. Estimation of thermal characteristics of waste disposal sites using Landsat satellite images (2017), Comptes rendus de l'Académie bulgare des Sciences(Proceedings of the Bulgarian Academy of Sciences), 70, 2, Издателство на БАН "Проф. Марин Дринов", 2017, ISSN:1310–1331, 253-262. SJR:0.207, ISI IF:0.251

ESTIMATION OF THERMAL CHARACTERISTICS OF WASTE DISPOSAL SITES USING LANDSAT SATELLITE IMAGES

Andrey Richter, Maretta Kazaryan*, Mihail Shakhramanyan, Roumen Nedkov**, Denitsa Borisova**, Nataliya Stankova**, Iva Ivanova**, Mariana Zaharinova**

(Submitted by Corresponding Member P. Velinov on December 15, 2016)

Abstract

The aim of this work is to develop a thermal model of waste disposal sites /WDS/ as a part of the complex analysis of the WDS using Landsat satellite images. In the paper an integrated thermal model of WDS is proposed. In the model a lot of thermal parameters such as temporal temperature variations of WDS surface, thermal risks, epicenters and thermal isolines, temperature forecasting, and thermal stabilization are included. The temporal temperature variations as seasonal and chronological changes are presented. The following approaches are proposed: assessment of the fire risk and the decay risk in WDS through calculating the surface temperatures; detection of the thermal isolines and the thermal epicenters; estimation of the temperature stabilization and the time stabilization in the WDS. An algorithm for applying the images as time-series of temperatures in the surroundings of the specified WDS for the specified thermal characteristics of the WDS and displays the thermal model of the landfill. A method of converting the sensor data into the temperature values, the methods of regression analysis (the estimation of the regression line, the estimation of periodic and trend components of the temperature time-series), the limit filtering method, method of risk assessment of fires and decay in WDS are presented and applied. The proposed methods and algorithms are tested for two WDS near Moscow – Kutchino and Torbeevo. The general classification of the thermal characteristics of the WDS is presented.

Key words: remote sensing, satellite image, landfill, waste disposal site, temperature, thermal characteristics, thermal model

V. ЕКОЛОГИЧНО ПРОСТРАНСТВЕНО МОДЕЛИРАНЕ НА ГОРСКИТЕ ЕКОСИСТЕМИ И ТЯХНАТА ДИНАМИКА ЧРЕЗ ИЗПОЛЗВАНЕТО ЗА СПЪТНИКОВИ ДАННИ

17. Lyubenova M., Nedkov R., **Ivanova I**., Chikalanov Al., Georgieva N., Ivanova E., Lyubenova V., Space Models of Oak Vegetation Dynamics in Protected Zone, Bulgaria, (2014), July 2014, Indian Journal of Applied Research 4(7):23-29

Space Models of Oak Vegetation Dynamics in Protected Zone, Bulgaria

Lyubenova M., Nedkov R., Ivanova I., Chikalanov Al., Georgieva N., Ivanova E., Lyubenova V.

ABSTRACT : *The information for spatial and temporal variation in the distribution of forest ecosystems is essential for determining tendencies in alteration of the forest area size and structure under the conditions of climate changes and existing management of the forest. The paper presents spatial models of xerothermic oak ecosystems distri-*

bution in SCI "Zapadna Stara Planina i Predbalkan" in 1977, 1992 and 2007, as a result of the conducted simulation on the base of the studied forest vegetation reflective characteristics. The modification of occupied areas by altitude, exposure, slope, soil type and bedrocks has been analyzed. The climatic fluctuations are characterized by deviations of de Marton index. The ecological status of communities is determined by calculating of state vector and the output factors having the greatest weight to the established state are obtained. The comparative spatial analysis of ecological status presented in the paper and the dynamics of the forest vegetation is the result from the application of a combined investigation method
– processing of satellites, aerial photo (orthophoto), GPS and overground data in the using of aerospace technologies and modeling in GIS environment. The created spatial models can be used in the monitoring of the forest ecosystems, for conservation of the forest flora and vegetation, for sustainable management of the forest areas, as well as and for investigation of xerothermic oak forest vegetation in other regions and protected zones.

24. Lyubenova M., Georgieva N., Lyubenova V.,Nedkov R., **Ivanova I**., Ivanova E., ECOLOGICAL SPACE MODELLING AS A PATTERN OF FOREST VEGETATION INVESTIGATION (EXAMPLE WITH BELASITSA MT., BULGARIA) (2012), Доклади на Българската академия на науките, Comptes rendus de l'Acad´emie bulgare des Sciences, Tome 65, No 4, 2012, с.483-490, SJR:0.206, ISI IF:0.233

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

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

Abstract

The paper presents the results of pilot spatial modelling of forest vegeta-tion 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

27. Lubenova M., Nedkov R., **Ivanova I.,** Shikalanov A., Georgieva N., Zaharinova M., Dimitrova M., Ivanova E., Yanchev V., Radeva K., Stankova N., Tsoneva R., STUDY ON ECOLOGICAL DYNAMICS OF FOREST VEGETATION IN THE REGION OF EAST RHODOPI ON THE BASE OF SATELLITES,GPS AND GROUND DATA, (2011), Екологично инженерство и опазване на околната среда, книжка 1/2011, с. 45-51

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

VI. МОРФОХИДРОЛОГИЧЕН АНАЛИЗ НА ЧЕРНО МОРЕ

25. Ivanova E., Hristova N., Nedkov R., **Ivanova I.**, Radeva K., Morpho hydrographic analyze of Black sea catchment area in Bulgaria, Landscape, Environment; European Identity, 4-6 November, (2012), Bucharest, Romania; Procedia Environmental Sciences 14 (2012), pp. 143-153

Morpho-hydrographic analyze of Black Sea Catchment Area in Bulgaria

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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.

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