ABSTRACTS

of publications

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Of the publications presented as a part of an application for the academic position „Assoc. Prof.“, Scientific field 4.4. Earth Sciences, Research field „Physical Geography and Landscape ecology“, announced in State Newspaper, issue 86 /15.10.2021

Group №	Publications and abstracts
B4_1	***Stoyanova, V.***, T. Kotsev, R. Kretzschmar, K. Barmettler. Concentration of arsenic in the soils of the Danube floodplain between the Timok River and the Vit River. SGEM2018 Conference Proceedings, ISBN 978-619-7408-43-0/ ISSN 1314-2704, 30 June - 9 July, 2018, Vol. 18, Issue 3.2, 13. Soils, DOI: 10.5593/SGEM2018/3.2, pp 71-78, 2018, SJR – 0,21, https://www.sgem.org/index.php/peer-review-and-metrics/jresearch?view=publication&task=show&id=950 (SCOPUS - https://www.scimagojr.com/journalsearch.php?q=21100274701&tip=sid&clean=0) Abstract: The aim of the current research is to present an actual and overall picture of the arsenic (As) contamination of the soils in the Bulgarian part of the Danube floodplain between the Timok River and the Vit River including the following lowlands: Bregovo-Novoselska, Vidinska, Archaro-Orsoiska, Dolnotsibarska, Kozloduyska, Ostrovska and Chernopolska. One sampling campaign was carried in October 2017. The concentrations of As (mg/kg) were measured in <0.063 mm size fractions of 102 soil samples (56 samples from 0-20 cm; 43 samples from 20-40 cm; 3 samples from 40-60 cm) using X-ray fluorescence analysis (XRF). The content of arsenic in the topsoil (0-20 cm) of the Danube floodplain ranged between 7 - 61 mg/kg, while in the subsoil (20-40 cm) it varied from 8 to 95 mg/kg. Bregovo-Novoselska lowland turned out to be the most arsenic polluted floodplain section in the region followed by the Vidinska lowland. while the Kozloduyska. Archaro-Orsoyska. Dolnotsibarska. Ostrovska and Chernopolska lowlands were found to be less contaminated. In all samples, arsenic exceeded its average concentration in floodplain sediment (6 mg/kg) according to the Geochemical Atlas of Europe. Nearly 12% of the samples were found to be over the maximum admitted concentration (25 mg/kg), and one sample was over the intervention value (90 mg/kg). The main point sources of As pollution were suggested to be located in the Timok and Ogosta drainage sub-basins.
B4_2	***Stoyanova, V.***, Kotsev, T., Zhelezov, G., Sima, M., Levei, E-A. Copper concentration in the soils of the Danube floodplain between the Timok River and the VIt River, Northwestern Bulgaria. The European Association of Geographers, Vol. 10, Number 2, 134-149 pp., 2019, ISSN:1792-134 SJR - 0,29, http://www.eurogeographyjournal.eu/articles/17_Stoyanova_et_al_2019_final_revised%20(1).pdf (SCOPUS - https://www.scimagojr.com/journalsearch.php?q=21100301417&tip=sid&clean=0 Abstract: This paper presents an actual and overall picture of soil contamination with copper in the Bulgarian part of the Danube floodplain between the rivers Timok and Vit. Three sampling campaigns in October 2012, April 2013, and October 2017 are carried out in the

	frame of two studies. The total content of copper is determined by atomic spectrometry in the soil fraction < 0.100 mm in the first study, and by X-ray fluorescence spectrometry in the soil fraction < 0.063 mm in the second survey. The copper concentration in the collected topsoil and subsoil samples ranges between 9.5 – 742.7 mg/kg with a median of 34.4 mg/kg. About 94 % of the samples exceed the background reference value, 10 % are above the maximum admissible concentration, and 3 % violate the intervention threshold. The copper content peaks in the Timok Valley and decrease downstream the Danube to nearly steady levels east of the Vidin Lowland.
B4_3	***Stoyanova, V.***, Kotsev, Ts., Tcherkezova, E., Zhelezov, G., Koleva, N. Land cover changes in the Ogosta Valley for the period 1993-2019. International Multidisciplinary Scientific GeoConference Surveying Geology and Mining Ecology Management, SGEM, 20, 2.2, 2020, ISSN:1314-2704, DOI:10.5593/sgem2020/2.2/s10.028, 233-240. SJR (Scopus):0.23, Q4 (Scopus), https://www.sgem.org/index.php/peer-review-and-metrics/jresearch?view=publication&task=show&id=7067 Abstract: The current research aims to present land cover changes for the period 1993-2019 in the arsenic contaminated Ogosta River valley in the context of the contaminant dispersal in the soils of the river floodplain caused by the agricultural practices and land use. The investigation is conducted for two test sites situated in the upper and lower stretch of the valley near the villages of Gorna Kovatchitsa and Mihaylovo, respectively. The changes are established for the fourth level of the CORINE Land Cover nomenclature, which is developed for the PHARE countries. Nineteen classes are defined in the study areas. As expected, the classes which indicate arable lands are most common in the valley ‘s bottom due to its flat topography and fertile soils, followed by the orchards and built-up areas of the settlements. The land cover changes have a similar pattern in the two test sites. Vegetable gardens, orchards and vineyards have significantly reduced their area or disappeared completely. The assumed reason is the lack of labour force because of the depopulation of this region of Bulgaria. They are abandoned or replaced by crops which allow mechanized cultivation. Some of the arable lands are also left not cultivated and are gradually grassed or covered with bush vegetation. Because of the higher share of orchards and abandoned arable lands in the upper stretch of the Ogosta Valley, the land cover changes there are deeper compared to its lower part. The transformation of the land cover cause reduction of the irrigated lands like vegetable gardens and orchards, thus decreasing the transfer of arsenic and heavy metals from the contaminated Ogosta River to the soil in the floodplain via irrigation.
B4_4	***Stoyanova, V.***, Kotsev, Ts., Tcherkezova, E., Zhelezov, G., Lubenov, T., Hristova, D., Semerdzhieva, L. Land use and land cover change in the lom valley for 60 years period as an indicator for accumulation of heavy metals in the soils of the Lower Danube basin. FOREST SCIENCE, 2022, ISSN:0861-007X, Scopus Abstract: The study aimed to identify land cover and land use transformations in the Lom River valley to reveal how the pressure of agriculture on the environment in the southwestern part of the Lower Danube basin has changed over the last 60 years. The classes at the fourth level of the CORINE Land Cover nomenclature were mapped using aerial photographs of 1961, 1985 and 1998, complemented with a detailed orthophoto mosaic of 2019. While the changes in the main classes were relatively small over the years, the transformations of the land cover in the lower classes reached up to 60% of the study area at the end of the investigated period. We have identified constant trends of expanding pastures and shrinking labour-intensive crops such as vegetables, fruits, and vines over the past 60 years. The land

	cover classes were classified into four groups according to pesticides use and the related load of heavy metals for soil. Changes in land use suggest a reduction in the use of pesticides and less intensive accumulation of contaminant metals in the soil of the southwestern part of the Lower Danube Basin.
B4_5	Tcherkezova, E., Kotsev, Ts., Zhelezov, G., ***Stoyanova, V.*** Applying UAV Photogrammetry Data for High-resolution Geomorphological Mapping of a Part of the Lom River Valley near the Village of Vasilovtsi (Bulgaria). International Multidisciplinary Scientific GeoConference Surveying Geology and Mining Ecology Management, SGEM, 2020, ISSN:1314-2704, DOI:10.5593/sgem2020/2.2/s10.022, 183-190. SJR (Scopus):0.23, Q4 (Scopus), https://www.sgem.org/index.php/peer-review-and-metrics/jresearch?view=publication&task=show&id=7061 Abstract: Floodplains are complex systems which include a wide number of socio-economic activities like agriculture, freshwater fisheries, electricity from power plants and others. They have often highly dynamic property, due to the alternation of fluvial processes, floods, and ongoing sediment transport, as well as of environmental specifics and natural or anthropogenic processes. In the context of the investigation of soil pollution with heavy metals in the riverine floodplains, the availability of geomorphological maps at large scale is of great importance. The rapid development of new remote sensing and computer technologies offers nowadays the possibility for acquisition of high-resolution topographic and land surface data which can serve as basis for digital terrain analysis and geomorphologic mapping. This paper outlines the preliminary results of applying unmanned aerial vehicle (UAV) data for geomorphological mapping of the study area. The methodological approach is based on the two key data products of UAV photogrammetry the digital terrain model (DTM) and the orthophoto mosaic. The digital terrain model is used for calculation of terrain derivatives such as altitude above the channel network and topographic ruggedness index (TRI), using Geographic Information Systems (GIS). The orthophoto mosaic, on the other hand, is used to calculate local statistical measures, enabling detection of textural and structural properties, as well as for differentiation of features with similar spectral responses but different surface structures. The obtained results show that UAV photogrammetry is a powerful and inexpensive tool for fluvial remote sensing analysis and has the potential for high-resolution geomorphological mapping.
B4_6	Gerginov, P., Antonov, D., Benderev, Al., ***Stoyanova, V.***, Kotsev, Ts. Analysis and prognosis of the aqueous migration of arsenic based on complex study of Ogosta river valley's hydrogeological elements (at specific floodplain site). Comptes rendus de l'Acad´emie bulgare des Sciences, 73, 10, 2020, ISSN:1310–1331 (Print), 2367–5535 (Online), DOI:10.7546/CRABS.2020.10.10, 1409-1415. SJR (Scopus):0.218, JCR-IF (Web of Science):0.343, Q3 (Scopus), http://www.proceedings.bas.bg/ Abstract: The presence of arsenic in the Ogosta River Valley`s alluvial sediments is subject to historical contamination due to upstream located ore-factories, tailing ponds, and even industrial accidents from the past. In recent years, there are several types of research focused on different aspects of the contaminated alluvial sediments in the floodplain of Ogosta River Valley. The present study is based on a complex investigation of a particular floodplain site between Beli Mel village and Ogosta Dam site to get insights into the transport of arsenic in a "soil-groundwater-river" system. The performed investigations include local area analysis of geomorphologic conditions, Ogosta River fluctuations, and meteorological data. The specific site investigations performed in situ include geophysical VES prospecting; several

	trial pits with accompanied grain-size distribution analyses of the presented soils in the vadose zone of the study area. These investigations allowed specifying the parameters of the main hydrogeological elements. Based on the latter, two hydrogeological models are performed to clarify the movement of groundwater and the arsenic migration in the floodplain terrace.
B4_7	Antonov, D., K. Nakamura, T. Kotsev, ***V. Stoyanova***, R. Kretzschmar. Application of HYDRUS-1D for evaluation of the vadose zone saturation state in connection with arsenic mobilization and transport in contaminated river floodplain - Ogosta Valley case study, NW Bulgaria. SGEM2018 Conference Proceedings, ISBN 978-619-7408-36-2/ ISSN 1314-2704, 30 June - 9 July, 2018, Vol. 18, Issue 1.2, DOI: 10.5593/SGEM2018/1.2, 83-90 pp, 2018, SJR – 0,21 (SCOPUS - https://www.scimagojr.com/journalsearch.php?q=21100274701&tip=sid&clean=0) Abstract: The Ogosta Valley downstream the town of Chiprovtsi, NW Bulgaria, was subject to long-lasting contamination with arsenic and other toxic elements due to mining and ore-processing activities in the second half of the last century. Although the exploitation of lead-silver and iron ores was ceased in the end of the 90`s, the soil in particular sections of the Ogosta's river floodplain remained highly contaminated with arsenic, lead and other heavy metals. Arsenic mobilization and transport in the vadose zone is highly dependent on the redox potential. Since the redox reactions are influenced by the degree of water saturation of the soil, the depth of the groundwater level (GWL) and the inflow flux are key factors to determine the conditions in the vadose zone. The aim of the study is to evaluate how much the two factors affect the moisture content in the unsaturated zone and thus also the conditions for arsenic mobilization and transport. The studied area covered a floodplain area of 12.7 km2 where piezometers at nine sites were installed. Three modeling scenarios were implemented for each site: the maximum, minimum and the mean values of the GWL were used as the lower boundary conditions. The annual inflow, calculated by the Turc`s method, was used as upper boundary condition. All the scenario simulations were performed with HYDRUS-1D software. The results showed complete water saturation of the floodplain deposits at some of the arsenic polluted spots, while only the upper layers were saturated at other sites. Thus, temporal anoxic conditions could be expected to appear at certain contaminated sections of the Ogosta's river floodplain, potentially leading to arsenic reduction and mobilization.
B4_8	Antonov, D., Kotsev, T., Benderev, A., Van Meir, N., Gerginov, P., ***Stoyanova, V.***, Tcherkezova, E. Estimating the moisture regime in variably saturated arsenic contaminated alluvial sediments by using Hydrus-1D with daily meteorological data. The European Association of Geographers, Vol. 10, Number 2, 42-55 pp, 2019, ISSN:1792-1341, SJR – 0,29 http://www.eurogeographyjournal.eu/articles/3_Antonov_etal_EJG_final_07_08_2019.pdf (SCOPUS - https://www.scimagojr.com/journalsearch.php?q=21100301417&tip=sid&clean=0) Abstract: As a result of historical mining activities, some layers in the Ogosta Valley`s floodplain sediments are highly enriched in arsenic (As). Reductive release of iron (Fe) and As in the floodplain soil could be expected under reducing conditions, which would lead to an increase of the more toxic As species in the soil pore water. Therefore, it is important to understand whether the vadose zone in the Ogosta's floodplain a subject to water saturation during intensive rainfalls is. The study provides a model based on the HYDRUS-1D code,

	along with the mathematical description of processes implemented into, especially those used to estimate the daily evapotranspiration rates and water flow from the soil surface to the groundwater level during ten-days scenarios including intensive rainfalls. The results from the simulations for April and July are compared to reveal the moisture regime of the vadose zone in the river floodplain of the Ogosta Valley.
B4_9	Tchorbadjieff, A., Kotsev, T., ***Stoyanova, V.***, Tcherkezova, E. K-means clustering of a soil sampling scheme with data on the morphography of the Ogosta valley, NW Bulgaria. The European Association of Geographers, Vol. 10, Number 2, 27-41 pp, 2019, ISSN:1792-1341, SJR – 0,29, http://www.eurogeographyjournal.eu/articles/2_Tchorbadjieff_et_al_edited_final_1.pdf (SCOPUS - https://www.scimagojr.com/journalsearch.php?q=21100301417&tip=sid&clean=0) Abstract: The spatial distribution of 665 soil sampling sites in the arsenic contaminated floodplain of the Ogosta River in the Northwest of Bulgaria is analysed against geomorphological parameters computed from a precise digital terrain model. The study aims at partitioning and classifications of hidden patterns of the morphographic features of the river floodplain, which to be used for the explanation of the arsenic dispersal in the polluted soils at a further stage. The field sites are split into 4 clusters using K-means algorithm with the following variables: elevation, distance to the river, vertical distance to channel network, multiresolution index of valley bottom flatness and a modified topographic SAGA wetness index. It is found that each cluster is related to a distinct area in the valley and is in good agreement with the distribution of the previously determined geomorphological units, as well as with the extent of a simulated historic flood.
B4_10	Gerginov, P., ***V. Stoyanova***, M. Varbanov, R. Kretschmer, Al. Benderev. Impact of the river level regime on the groundwater dynamics and physicochmical characteristics of the alluvial aquifer in the Ogosta valley, SGEM2017 Conference Proceedings, ISBN 978-619-7105-99-5 / ISSN 1314-2704, 29 June - 5 July, 2017, Vol. 17, Issue 12, 2. Hydrogeology, Engineering Geology and Geotechnics, 429-438 pp, DOI: 10.5593/sgem2017/12/S02.055, https://www.sgem.org/index.php/call-for-papers/conference-proceedings-sgem, SJR – 0,21, https://www.sgem.org/index.php/peer-review-and-metrics/jresearch?view=publication&task=show&id=2521, (SCOPUS - https://www.scimagojr.com/journalsearch.php?q=21100274701&tip=sid&clean=0) Abstract: In relation with a study of arsenic pollution of groundwater in the Ogosta Valley, NW Bulgaria, a monitoring station was built in the floodplain in the upper reaches of the Ogosta River, not far from the town of Chiprovtsi. The observations took place at three adjacent sites including a hydrometric river gauge and two tube wells located closer and further from the river. River stages, groundwater level, water temperature and electrical conductivity were measured automatically at the three sites. Water pH, dissolved oxygen and redox potential were measured also in the well situated closer to the river. Collected data for a period of one year was statistically processed and major statistical characteristics were obtained. A relationship between the observed parameters was found and used to characterize the impact of river flow dynamics on the quantitative and qualitative indicators of groundwater. The delay of the groundwater level response to the fluctuations of the river stages was determined. An assessment of the impact of high river flow events on the magnitudes of the observed physical and chemical indicators was made. The results provide

	a better insight into the water fluxes within the river-floodplain system and into the conditions for arsenic migration in the aquifer in the Ogosta Valley.
Г7_1	***Stoyanova, V.***, T. Kotsev. GIS-based assessment of groundwater vulnerability to arsenic contamination in the floodplain of the Ogosta River, NW Bulgaria", Proceedings, 6th International Conference on Cartography and GIS, 13-17 June, Albena, Bulgaria, p. 668-677, 2016, https://cartography-gis.com/docsbca/iccgis2016/ICCGIS2016-69.pdf, ISSN: 1314-0604, (Web of Science - http://apps.webofknowledge.com/full_record.do?product=WOS&search_mode=GeneralSearch&qid=1&SID=D3XpvH2TjvPBZGiji77&page=1&doc=1) Abstract: The aim of this study is to evaluate the specific groundwater vulnerability of arsenic contamination in the specific environmental conditions of river floodplains. For this purpose, DRESPI modification of DRASTIC index is elaborated and tested in the arsenic polluted Ogosta Valley, NW Bulgaria. The assessment considers the following six parameters: depth to groundwater table, net recharge, soil texture, impact of the thickness of soil, redox potential, and pH of soil. The respective layers are generated in ArcGIS (ESRI, 2015) and the DRESPI index is computed to generate the final vulnerability map. The values of the vulnerability index for the floodplain of the Ogosta River are in the range of 55 - 182 points. The most vulnerable areas are associated with the lowest sections of the floodplain close to the river, while the less threatened are the lands of the high floodplain in the valley.
Г7_2	***Stoyanova, V.***, Kotsev, Ts., Tcherkezova, E. Hazard of heavy metal pollution of soil by flooding from Danube in the Tsibarska lowland. Comptes rendus de l'Acad´emie bulgare des Sciences/"Доклади на БАН", 73, 8, Издателство на БАН "Проф. Марин Дринов" 2020, ISSN:1310–1331 (Print), 2367–5535 (Online), DOI:10.7546/CRABS.2020.08.08, 1100-1105, SJR (Scopus): 0.22, JCR-IF (Web of Science): 0.38, https://www.scimagojr.com/journalsearch.php?q=31728&tip=sid&clean=0 Abstract: In this paper, we assess the hazard of heavy metal pollution of soil in the Tsibarska Lowland (Bulgaria) in the case of inundation from the Danube. The assessment considers the following two parameters: a degree of heavy metal pollution of river sediment (Me) and topography (To). The elaborated map shows levels of hazard which are closely associated with the morphology of the lowland. The calculated values of the MeTo index for the Tsibarska Lowland are within the range 7-10 and fall into three classes of a hazard: low hazard (10.23% of total area), moderate hazard (80% of total area), and high hazard (9.77% of total area).
Г7_3	***Stoyanova, V.***, T. Kotsev. Relationship between landforms and heavy metal contents in the soil of the Ostrovska lowland along Lower Danube. International Multidisciplinary Scientific GeoConference Surveying Geology and Mining Ecology Management, SGEM, 2021, SJR (Scopus):0.23, Q4 (Scopus), in print Abstract: This study aimed to reveal the dependence of the spatial distribution of heavy metals in soil on the morphography of the Lower Danube floodplain in the Ostrovska Lowland in Bulgaria. The field campaign was conducted in 2017, and the concentration of Zn, Ni, Pb and Cr were measured in the fine fraction (<0.063 mm) of 10 soil samples using X-ray fluorescence analysis. The average content of Cr in the topsoil (0-20 cm) was 127 mg/kg ranging between 98 – 171 mg/kg. It was followed by Zn – 81 mg/kg (60 – 128 mg/kg), Ni – 54 mg/kg (40 – 85 mg/kg) and Pb – 30 mg/kg (18 – 53mg/kg). The metal levels exceeded the mean values for floodplain sediment in Europe in most samples. Chromium violated the quality target threshold for sediment applied by the Joint Danube Surveys in 90% of the

	samples and Ni in 60%. The concentrations of all the heavy metals except for Cr showed a relationship with the geomorphographic units. The elements Zn, Pb and Ni tended to accumulate mostly in the marshes and less in the active floodplain and sandy ridges. A negative correlation between vertical distance to the Danube and the concentration of elements was found for Zn (R^2 0.73), Pb (R^2 0.66) and Ni (R^2 0.51). The results confirmed the more intensive accumulation of the three metals in the lowest parts of the floodplain, where the fine sediment was deposited during floods. The individual pattern of the spatial distribution of Cr indicated a specific source of origin of the element. The landforms had little control over the dispersal of the element in the floodplain of the Lower Danube. The obtained results showed that marshes were most threatened by metal contamination if flooded, and this should be consi dered if restoration of wetlands is conducted in the lowland. In contrast, the sandy ridges and high floodplain were naturally protected against the accumulation of hazardous substances via inundation by the Danube.
Г7_4	Tcherkezova, E., ***V. Stoyanova***, T. Kotsev. A concept of an integrated geodatabase for surface water, soil, and groundwater pollution with arsenic in the upper part of Ogosta Valley, Northwestern Bulgaria. The European Association of Geographers, Vol. 10, Number 3, 6-23 pp, 2019, ISSN:1792-1341 http://www.eurogeographyjournal.eu/articles/1_Tcherkezova_et_al.pdf Abstract: This paper presents a concept of an integrated geodatabase for surface water, soil and groundwater pollution with arsenic in the upper part of the Ogosta Valley (Northwestern Bulgaria) using ArcGIS™ (ESRI®) file geodatabase. A geodatabase model diagram is created to enable data storage and to meet research requirements ensuring clear geodatabase structure. Further research and activities in this area will focus on the extension and upgrade of the geodatabase to a web format with different levels of data access to support the long-term monitoring and analysis of surface water and groundwater contamination with heavy metals in the investigated area.
Г7_5	Zhelezov, G., ***V. Stoyanova***. Determination of the coastal zone of Danube River in Bulgaria. International Multidisciplinary Scientific GeoConference Surveying Geology and Mining Ecology Management, SGEM, 2021, SJR (Scopus):0.23, Q4 (Scopus), in print Abstract: The determination and modelling of the territory are common scientific instrument for presentation of the state of the nature and human systems. The present research is based on the morphological and hydrological peculiarities in the river catchment. It observed of the Danube coastal zone in Bulgaria sector of the river. The differentiation and determination of the coastal area is key element in the process of the management of the territory and development of the regions. The general results of the research are related with differentiation and determination of the Danube coastal zone in Bulgaria, based on morphographic peculiarities of the region. The key element of the investigation is outlining of the south border line of the coastal zone. The second aspect of the investigation is generation of basic spatial model of the Danube coastal zone in Bulgaria. Using and applying GIS technologies is leading part of the research. Geographical and geospatial analysis of the coastal zone give opportunities for determination of three basic substructures - lowlands, regions of river mouths, including flooding areas and plateaus. They are base for the differentiation and classification of the landscape diversity of the region. Landscape diversity of the coastal zone can be used for the determination of the general directions in the development of the region. The clear definition and determination of coastal zone is important stage in the process of evaluation of the potential of Danubian region in Bulgaria. The applying aspects of the

	research are related with sustainable use of the recourses and nature protection in the regions. The results of the research can be use in the decision-making processes and management of different activities and politics in the region.
Г8_1	Kotsev Ts, ***V. Stoyanova***, Y. Petkova, N. Dyakova. CONCENTRATION OF HEAVY METALS AND METALLOIDS IN THE RIVER SEDIMENT OF THE LOWER STRETCHES OF VARDAR, STRUMA, MESTA, AND MARITSA RIVERS CLOSE TO THE AEGEAN SEA. 1-2, pp. 133-153, 2015, ISSN 0204-7209, ISSN 2367-6671 (Online), http://geoproblems.eu/wp-content/uploads/2015/12/2015_12/15_kotsev_2015_12.pdf Abstract: The aim of the current research is to present an actual and overall picture of the heavy metal contamination of the river channel and floodplain sediment in the lower stretches of the four biggest international rivers which flow into the North of the Aegean Sea. Two sampling campaigns were carried out in 2010 and 2014. Concentrations (ppm) of As, Pb, Cd, Zn, Cu, V, Cr, Co, Ni, Mo, Sn, Sb, Mn, Fe and Al are measured in < 0.063 mm fraction of 28 river sediment samples using XRF spectroscopy. The measurements of heavy metals are performed at the premises of the Soil Chemistry Group to the Institute of Biogeochemistry and Pollutant Dynamics, ETH-Zurich. Vardar River turns out to be the most heavily polluted river in the region followed by the Maritsa River, while the Struma and Mesta rivers are determined to be less contaminated. Most of the measured heavy metals and metalloids are found to exceed their average background levels in river channel and floodplain sediment reported in the Geochemical Atlas of Europe. Values of As, Pb and Cr are higher than the TEC threshold of USEPA in all the sampling sites. PEC threshold of USEPA is exceeded by Cr and Ni in nearly the half sediment samples and by Cd and Pb in a few cases. Levels of Cr, Ni and Zn over the Dutch intervention values are found in the Greek section of Vardar and in the Maritsa Delta. Contaminats of the highest concern in the studied stream and floodplain sediment samples from the Vardar River are the following trace elements (number of samples/aver/min/max, ppm): Cd (7/2.2/1.2/4.3), Cr (7/386/270/497), Ni (7/102/82/151), As (7/20/16/30), Pb (70/59/81), Co (7/22/<14/30), Sb (7/1.8/1.0/3.3), Mo (7/1.5/0.4/3.8) and Cu (7/41/31/57). The main point sources of pollution are located in the former Yugoslav Republic of Macedonia (FYROM), e.g. the Cr mine Radusha and the "Jugohrom Ferroalloys" smelter near Jegunovce, Pb-Zn mines near Zletovo, Sasa and Taronica and the Pb-Zn smelter near Veles, the Cu mine near Buchim, the Cr-Sb-As mine Loyane in the North of the country and the Ni mine and smelter near Kavadarci. According to the E-PRTR data, the well-developed industry of the city of Thessaloniki enriches the Vardar sediment with Zn, Cu, Ni, Cr, Pb, Cd and As. Most of the heavy metal pollution sources in the Maritsa River basin are located on Bulgarian territory. Specific contaminants for the lower stretch of the Maritsa River are Cd (10/4.1/2.2/6.8), Sb (10/3.3/2.5/4.4) and Pb (10/100/66/151) sourced by the Pb-Zn mines in the Rhodopy Mountain and by the Pb-Zn smelter near the town of Plovdiv. Loads of Cr (10/135/69/248) and Ni (10/50/30/70) to the Maritsa River system are reported by E-PRTR for the Waste water treatment plant of Plovdiv, the coal power plant "Maritsa Iztok 3" and the textile factories in the towns of Sliven and Yambol. Major sources of Cu (10/65/29/107) and As (10/17/12/30) are the mines in the Sredna Gora mountain and the Cu smelter near the town of Pirdop. Stream and floodplain sediment of the Struma River upstream the Butkovsko (Kerkini) lake and near the river mouth into the Strimonian gulf are enriched mostly in Co (8/34/<7/43) and Mo (8/2.2/<1.2/3.2) considering the European background. Concentrations of As and Sb in the sediment near the river mouth are found to be higher than in the area upstream the Butkovsko lake. Sediment of the Mesta River

	upstream its delta shows the lowest levels of heavy metals compared with the Vardar, Maritsa, and Struma rivers. Cadmium (3/1.0/0.8/1.2) and antimony (3/2.1/1.9/2.3) exceed nearly three times the European background, while the rest of the microelements fall in the range 1-2.6 times over their natural levels. River sediment quality assessment against the PEC (probable effect concentration) threshold of USEPA determines Cr and Ni to be the most serious threat to the ecosystems related with the studied rivers. Average values of both elements are 2-3 times over the PEC thresholds in the stream and floodplain sediment of the Vardar and Maritsa rivers and reach 80–90% of the limits in the Struma's and Mesta's sediments. The two pollutants exceed also the relevant Dutch intervention values for soil and sediment in the samples from the Vardar Valley and from the Maritsa Delta. The authors would like to thank the Prof. Ruben Kretzschmar, Kurt Barmettler and Petar Mandaliev from the IBPD, ETH-Zurich for their help with the XRF analysis of the collected sediment samples.
Г8_2	***Stoyanova V.*** CLASSIFICATION OF LANDSCAPES IN BULGARIA (OVERVIEW) Proceedings of the Fifth International Conference "Geographical Sciences and Education", University of Shumen "Bishop Konstantin Preslavski", ISBN 978-619-201-172-7, с. 154-158, 2016, https://www.researchgate.net/publication/322224120_KLASIFIKACIA_NA_LANDSAFTITE_V_BLGARIA_PREGLEDCLASSIFICATION_OF_LANDSCAPES_IN_BULGARIA_OVERVIEW Abstract: The article provides an overview of the existing classification of landscapes in Bulgaria. To date no universally accepted classification landscapes of Bulgaria. In Bulgaria using three classification systems of landscapes: Petrov (1979, 1997), Velchev, Todorov, Asenov and Berochischivili (1989, 1992) and Popov (2001). They are composed landscape maps for the whole of Bulgaria. There was numerous independent research landscape for different regions, which are based entirely on individual research approach to landscape features of the area of interest. So, an important question to the development of contemporary landscape is the creation of a classification system of landscapes.
Г8_3	***Stoyanova V.***, T. Kotsev, A. Benderev. Concepts and methods for assessment of the risk for chemical contamination of groundwater with arsenic in river floodplain (Overview). Proceedings of the scientific conference "Geographical aspects of planning and land use in the context of global change, September 23-25, Varshets, Bulgaria, pp. 165-173, 2016, www.geography.bg, ISBN: 978-619-90446-1-2, http://geography.bg/images/dokladi/8.pdf Abstract: The article provides an overview of the concepts and methods applied for evaluation of the risk for chemical contamination of groundwater and their consistency with the concept of ecological risk assessment. The aim of this study is selection of indicators for estimation of the specific risk for arsenic pollution of groundwater in contaminated river floodplains on future work. A procedure for calculation of the specific risk is suggested. The concepts of ecological risk assessment are rather in good consistency with the concepts of the groundwater pollution risk assessment. Depending on the target end-point receptor of the hazard impact, the groundwater contamination risk assessment would consider or not the aspects of toxicity and exposure. In case of contaminated sites, the risk related probability is associated with the likelihood that the concentration of a certain pollutant in groundwater may exceed a given threshold. Development of index methods for groundwater risk assessment has not provided specific procedures for certain contaminants of the group of inorganic persistent hazardous substances, e.g., arsenic, and heavy metals, as well as for

	environment or landscape. Thus, modification of the available methods and elaboration of new ones are needed for more accurate assessment of risk of environmental pollution under variety of chemical substances and environmental conditions. The proposed modified assessment procedure integrates new indices to provide more accurate evaluation of groundwater risk to As contamination in river floodplains.
Г8_4	Mokreva, A., N. Jordanova, D. Jordanova, ***V. Stoyanova***, P. Petrov. Evaluation of soil contamination degree in the region of Maritza-east thermal power plants using magnetic methods, Journal of International Scientific Publications, Ecology and Safety, ISSN 1314-7234, Volume 11, 70-84 pp, 2017, www.scientific-publications.net, https://www.scientific-publications.net/get/1000022/1496304909821070.pdf Abstract: Pilot study on soil contamination degree around the Maritza East thermal power plants, evaluated through applying magnetic methods, is presented. The magnetometry method is based on the well-established fact that anthropogenically contaminated with fly ashes soils display enhanced magnetic susceptibility, as well as other specific magnetic characteristics. Results from the magnetic investigations carried out in our study evidence significant soil contamination near the pollution sources and decreasing degree of anthropogenic load further away. The method applied is economically more efficient compared to classical physical and chemical methods for evaluation of soil contamination.
Г8_5	Mokreva, A., ***V. Stoyanova***, N. Yordanova. Anthropogenic pollution of urban green in Sofia – magnetometric study of soils from the park Borisova Gradina, BULGARIAN GEOLOGICAL SOCIETY, National Conference with international participation "GEOSCIENCES 2017, ISSN 1313-2377, 07-08.12.2017, pp. 115-116, 2017, http://bgd.bg/CONFERENCES/Geonauki_2017/Sbornik/frames_Geonauki_2017.html Abstract: Urban pollution plays a key role in the quality of life in big cities and assessment of degree of anthropogenic load is of upmost importance. In this study, magnetometry is applied for fast, effective, and sensitive method for evaluation of urban pollution in the biggest green zone in Sofia. The highest degree of anthropogenic pollution is obtained in zones of roads proximity and the major sport and entertainment facilities in the Borisova Gradina area. The main anthropogenic sources are identified and analyzed.
Г8_6	Gerginov, P., A. Benderev, D. Antonov, Ts. Kotsev, V. Asenova. Groundwater dynamics and Arsenic migration in the saturated zone of Ogosta River terrace. Engineering Geology and Hydrogeology, 31, 53-64, ISSN 0204-7934, 2017, http://igh-bg.com/Vol/Vol_31_2017/5_Gerginov%20et%20al_EGHG_Book_31.pdf Abstract: The Ogosta River floodplain is a subject of research related to the increased arsenic concentration in soils and groundwater. Previous mining activity in the Chiprovtsi ore region is the main source of pollution in the area. Mechanism and the degree of pollution are related to the lithological features of the environment, river regime and rainfall in the area. Three representative sections close to the villages of Beli Mel, Gorna Kovachitsa, Gavril Genovo are considered for estimation of arsenic migration in groundwater in alluvial aquifer. The movement of main forms of arsenic in the area was predicted under different scenarios. For the study, numerical modeling methods were used. The results show that AsIII migrates significantly faster in the aquifer compared to AsV, but the predominant form of arsenic in the area is AsV, which is poorly mobile. The Ogosta River is the major source of pollution with arsenic of the alluvial terrace.
Г8_7	Antonov, D., Kotsev, Ts., Meir, N., ***Stoyanova, V.***, Aydarova, Z. ARSENIC MIGRATION ANALYSIS IN POLLUTED RIVERINE TERRACES DURING FLOODING EVENT –

	INNOVATIVE MODELING APPROACH USING HYDRUS-1D CODE. PROBLEMS OF GEOGRAPHY, 3-4, pp. 19-40, 2018, ISSN 0204-7209, ISSN 2367-6671 (Online), http://geoproblems.eu/wp-content/uploads/2019/01/2018_34/2_antonov.pdf Abstract: The paper presents an algorithm for modeling the vertical water transport of arsenic As in contaminated river floodplain deposits using the software product HYDRUS-1D. A scenario of river flooding is prepared with sample data from a model plot in the Ogosta River valley, northwestern Bulgaria. Meteorological and hydrological data were also used for the historical flood, which happened in April 1964. The soils in the valley are heavily polluted with arsenic and heavy metals because of historical extraction and flotation of Fe- and Au-ores in the region of the town of Chiprovtsi. The study site of P13 is situated in the valley section between the village of Belimel and the Ogosta dam lake at 13 meters from the riverbank in the low floodplain with a vertical distance to the riverbed of 169 cm. The concentration of arsenic in the soil ranges between 625-11450 mg/kg for individual layers to a depth of 170 cm. The sediments are built of loamy sand, and gravel with loam sandy to sandy filler. The simulation of water and As transport encompasses a seven-day period in which the soil is flooded on the fourth day. The flooding event itself is implemented into the model as a water flux leading to 74 cm flood above the surface. Separate transport simulations of As (V) and As (III) were made for the same soil profile. The values used for the distribution coefficient K_d are determined according to the literature and are respectively $K_{d\ As(V)}$ = 2000 l/kg and $K_{d\ As(III)}$ = 5 l/kg. The modeling results show that the flood water flow passes for one day across the entire depth of the profile. The soil layers are water-saturated during the flood. The amount of water which passed through the profile for the modeling period is 2500 l/m_2. The transport simulation of As (V) calculates an entry of 800 mg/m_2 of the pollutant at a depth of 170 cm for the whole seven day period at an average concentration of As (V) in the porewater of 0.409 mg/l. The calculated amount of As (III) which infiltrated to the bottom of the profile for the same period is 870 g/m_2. It is more than 1000 times higher than the estimated quantity for As (V). Constraints of modeling are the constant groundwater level during the flood, the use of an average K_d distribution coefficient of arsenic for a wider set of soil varieties, and the precondition of only As (V) or As (III) existence in the soil solution during the transport simulation. Despite the limitations and conventions of the As transport modeling with HYDRUS-1D, the results show the significant role of the river floods for the arsenic infiltration from the contaminated soil layers into the groundwater. The presented detailed algorithm for water and mass modeling enables the use of HYDRUS-1D for scenarios with different flooding duration and different depth of ground water table.
Г8_8	***Stoyanova, V.*** Corresponding Member of Bulgarian Academy of Sciences Professor Kiril Mishev Ivanov –Life and Scientific Activity Journal of the Bulgarian Geographical Society Volume 42 (2020) 52–60 ISSN 0375-5924, ISSN 2682-986X, http://geography.bg/images/Izv_BGD/tom%2042/JBGS_vol42_2020_Stoyanova_V.pdf Abstract: The present paper is dedicated to the life and scientific work of Corresponding Member of the Bulgarian Academy of Sciences Professor Kiril Mishev Ivanov because of the 15th anniversary of his death in 2020. The article focuses on his background and family, his education and professional career. An overview of his renowned and significant scientific publications is made.

Г8_9	***Stoyanova, V.***, Kotsev, Ts. INDEX MeTo FOR HAZARD ASSESSMENT OF HEAVY METAL POLLUTION OF SOIL IN THE DANUBE LOWLANDS IN BULGARIA. PROBLEMS OF GEOGRAPHY, 1-2, 2020, pp. 63-78, ISSN:0204-7209 ISSN 2367-6671 (Online), http://geoproblems.eu/wp-content/uploads/2020/07/2020_12/5_stoyanova.pdf Abstract: The article presents the index *MeTo* which is elaborated to assess the hazard of heavy metal pollution of riverine floodplain soils in the Danube lowlands in Bulgaria. The index *MeTo* includes the following parameters: degree of heavy metal pollution of river sediment (Me) and topography (To). Each parameter is characterized by the following elements: weight (W), ranges, and ratings (R). Each parameter is evaluated by comparison with the others to determine its relative importance. The highest weight is given to the indicator 'degree of heavy metal pollution of river sediment' followed by the 'topography'. Their weight coefficients are 2 and 1, respectively. The ranges of the parameters characterize the variety of environmental settings throughout the wetlands for the accumulation of heavy metals in the soils of the floodplain. Ratings (R) from 1 to 4 is assigned to each of the ranges of the individual variables. The degree of pollution of the river sediment is calculated by the index C_d proposed by Backman et al. (1998) as follows: $Cd = \sum_{i=1}^{n} Cfi$, $Cfi = \sum \frac{Cai}{Cni} - 1$, where C_{fi} is for the contamination factor for the i–th component, C_{ai} is for the analytical value of the i–th component, and C_{ni} is for the upper permissible concentration of the i–th component. The target values for sediment used in the consecutive Joint Danube Surveys organized by the International Commission for the Protection of the Danube River are applied as contaminant thresholds for calculating the index C_d. The ranges of C_d are determined as follows: C_d=0, no pollution; C_d (0, 1], low pollution; C_d (1, 3], moderate pollution; C_d>3, high pollution. The intervals have scores 1, 2, 3, and 4, respectively. The topography is assessed by the major geomorphological forms identified in the lowlands, which are rated as follows: high floodplain, R=1; sandy ridges, R=1; low floodplain, R=2; old river channels, R=3; marshes, R=4. The *MeTo* index is calculated as the sum of the products of ratings (R) and weights (W) assigned to each of the parameters: $MeTo=Me_W*Me_R+To_W*To_R$. The minimum value of the *MeTo* index is 3 and the maximum is 12. The whole range is divided into six classes: 3 (negligible hazard), 4-5 (very low hazard), 6-7 (low hazard), 8-9 (moderate hazard), 10-11 (high hazard), and 12 (very high).
Г8_10	Kotsev, Ts., ***Stoyanova, V.***, Aidarova, Z., Genchev, St. Concept of arsenic monitoring in the soil-groundwater-river water system in the mining affected Ogosta river valley. PROBLEMS OF GEOGRAPHY, 1-2, 2020, pp. 101-129, ISSN:0204-7209 ISSN 2367-6671 (Online), http://geoproblems.eu/wp-content/uploads/2020/07/2020_12/7_kotsev.pdf Abstract: The monitoring system in the Ogosta River valley is specifically designed to investigate the dependence of spatial distribution of arsenic in groundwater on the environmental settings of a floodplain which is contaminated with sulphides from mine tailings. The location of 25 piezometers takes into consideration the geomorphological features of the floodplain and the level of arsenic contamination of the soil. A testing ground for studying the impact of high river flow events on arsenic mobilization and migration from the soil to the alluvial aquifer and the river, has been organised in the active floodplain. It combines two piezometers in lower and higher sections of the active floodplain, a set of sensors and suction cups installed in the soil profile, a hydrometric station, as well as a weather station, all equipped with telemetry systems. The organised monitoring system is the basis for turning the Ogosta River valley into a testing area for studying and modelling the arsenic fate in polluted river floodplains.

Г8_11	***Stoyanova, V.***, Kotsev, Ts., Tcherkezova, E. GIS-based Assessment of the Hazard of Heavy Metal Pollution of Soil by Flooding from Danube in the Ostrovska Lowland. Proceedings Vol. 1. 8th International Conference on Cartography and GIS., 1, Bulgarian Cartographic Association, 2020, ISSN:1314-0604, 267-277, https://iccgis2020.cartography-gis.com/8ICCGIS-Vol1/8ICCGIS_Proceedings_Vol1_(29).pdf Abstract: The aim of this study is GIS-based assessment of the hazard of heavy metal pollution of soil in the Ostrovska lowland (Bulgaria) in case of inundation from the Danube. For this purpose, a GIS-based model is elaborated and applied to the study area. The assessment considers the following two parameters: degree of heavy metal pollution of river sediment (Me) and topography (To). The first step produces files into raster format for each of the two parameters of the MeTo index. The second step of data processing includes a reclassification of the resulting maps of the two factors considering the rating of the predefined intervals for each factor. The third step uses the Spatial Analyst Tools - Map Algebra - Raster Calculator of ArcMap to combine all the factor maps into one preliminary map. The latter is reclassified in the last step of data processing considering the predefined hazard classes. Index Cd is calculated to be 1.29 for the Danube overbank sediment in the Ostrovska Lowland. This value falls in the range 1-3 of the index and is rated to 3. The limited number of sites with information on the trace elements in overbank sediment in the lowland did not allow us to do interpolation, and the score of 3 is set for the entire study area. The raster file for the degree of heavy metal pollution of river sediment (Me) is created with the tool Spatial Analyst Tools - Conversion Tools - To Raster - Polygon to Raster. To delineate the limits of the lowland and the geomorphographic landforms, we extracted the slope, aspect, curvature contour, and hillshade from the DTM using the Spatial Analyst Tools - Surface in ArcGIS. After classifying and analyzing these indicators and comparing them with topographic maps, the following geomorphographic units are defined: marshes, low floodplain, high floodplain, and sandy ridges. The categories of the geomorphographic units are defined according to the classification of Mishev (1959). The calculated values of the MeTo index for the Ostrovska Lowland are within the range 7-10 and fall into three classes of a hazard: low hazard (34% of total area), moderate hazard (48% of total area), and high hazard (18% of total area). The elaborated map shows levels of hazard which are closely associated with the morphology of the lowland. The marshes are highly threatened by metal contamination if flooded, while the hazard of metal contamination of the sandy ridges and high floodplain is determined to be low. The Danube floods represent a moderate threat to the predominant part of the lowland in which the low floodplain is developed. The evaluation elaborated with MeTo can be incorporated as a step in the risk assessment of soil pollution with heavy metals and metalloids in the Danube lowlands. The produced map of the hazard will be provided to local authorities to optimize land use and reduce the health risk to the local population following a flood.
Г8_12	Zhelezov, G., ***Stoyanova, V.*** SPATIAL MODELING OF THE MORPHOHYDROGRAPHIC PECULIARITIES IN THE CATCHMENTS OF LOM AND OGOSTA RIVERS. Proceedings Vol. 1. 8th International Conference on Cartography and GIS., 1, Bulgarian Cartographic Association, 2020, ISSN:1314-0604, 110-115, https://iccgis2020.cartography-gis.com/8ICCGIS-Vol1/8ICCGIS_Proceedings_Vol1_(11).pdf Abstract: The spatial modeling of the nature system is common scientific instrument for presentation and interpretation of the basic ecological state and problems of the systems. The

	present research is related with the modeling of morphological and hydrological peculiarities in the river wetland systems. It observed two main river systems in the geographical space of Northwestern Bulgaria – the catchments of Lom and Ogosta rivers. The interaction between the relief structures and dynamic of the waters is general agent for degradation and evolution of the nature system. The determination of these relations is key element in the process of decision making and management of the territories and regions.
Г8_13	***Stoyanova, V.*** HAZARD OF HEAVY METAL AND METALLOIDS ADMISSION OF SOIL BY FLOODING FROM DANUBE IN THE VIDINSKA LOWLAND. Problems of Geography, 1, 2021, ISSN:0204-7209 ISSN 2367-6671 (Online), DOI:10.35101/prg-2021.1.4, 38-53, http://geoproblems.eu/wp-content/uploads/2021/05/2021_1/4_stoyanova.pdf Abstract: In this paper, we assess the hazard of heavy metal pollution of soil in the Vidinska Lowland (Bulgaria) in the case of inundation from the Danube. The assessment takes into account the following two parameters: degree of heavy metal pollution of river sediment (Me) and topography (To). Each parameter is characterized by the following elements: weight (W), ranges, and ratings (R). Each parameter is evaluated by comparison with the others to determine its relative importance. The highest weight is given to the indicator 'degree of heavy metal pollution of river sediment' followed by the 'topography'. Their weight coefficients are 2 and 1, respectively. The ranges of the parameters characterize the variety of environmental settings throughout the wetlands for the accumulation of heavy metals in the soils of the floodplain. Ratings (R) from 1 to 4 is assigned to each of the ranges of the individual variables. The MeTo index is calculated as the sum of the products of ratings (R) and weights (W) assigned to each of the parameters: MeTo=MeW*MeR+ToW*ToR. The minimum value of the MeTo index is 3 and the maximum is 12. The whole range is divided into six classes: 3 (negligible hazard), 4-5 (very low hazard), 6-7 (low hazard), 8-9 (moderate hazard), 10-11 (high hazard), and 12 (very high). Degree of heavy metal pollution of river sediment (Me). To elaborate on the raster file of the river sediment contamination, we used data on the concentration of As, Cu, Zn, Pb, Cr, and Ni in one representative sample of Danube overbank sediment deposited in the Vidinska Lowland. The index Cd is calculated to be 1.53 for the Danube overbank sediment in the lowland. This value falls in the range 1-3 of the index and is rated to 3. To delineate the limits of the lowland and the geomorphographic landforms, we extracted the slope, aspect, and hillshade from the DTM using the Spatial Analyst Tools - Surface in ArcGIS. The categories of the geomorphographic units are defined according to the classification of Mishev (1959) and Tcherkezova (2019). After classifying and analysing these indicators and comparing them with topographic maps, the following geomorphographic units are defined: low floodplain, high floodplain, and sandy ridges. The calculated values of the MeTo index for the Vidinska Lowland are within the range 3-6 and fall into two classes of a hazard: negligible hazard (26.51% of total area) and low hazard (73,49% % of total area).
Г8_14	Mokreva, A., Yordanova, N., ***Stoaynova, V.*** ASSESSMENT OF ANTHROPOGENIC POLLUTION IN THE SOFIA PARKS BORISOVA GARDEN, ZOO AND HUNTING PARK – SES 2021, Space Research and Technology Institute - Bulgarian Academy of Sciences, 2021, ISSN:2603 – 3313 (Print); 2603 – 3321 (Online), http://space.bas.bg/SES/archive/SES%202021_DOKLADI/4_Ecology/10_Mokreva.pdf Abstract: The purpose of this study is to assess anthropogenic pollution of Sofia Parks - Borisova Garden, Zoo and Loven Park, using the magnetometric method. The analysis of

	samples collected from these parks shows that the highest degree of pollution is observed in the soils, being near large transport arteries passing through or along with the parks. There is also local pollution along some of the main internal alleys, associated with the existing entertainment facilities. The most heavily contaminated samples have a negligible amount of fine super-paramagnetic particles, and their magnetic mineralogy is dominated by large amount of multi-domain magnetic particles. This result is consistent with the hypothesis that the magnetic signal of the transport emissions is mainly due to multi-domain magnetite. Some of the samples with medium magnetic susceptibility are dominated by large particles, while others are a mixture of larger (probably anthropogenic) and smaller (probably lithogenic) particles. The study of soil magnetism from the three Sofia city parks demonstrates the high efficiency of the magnetic method as a sensitive indicator of anthropogenic soil pollution.
Г8_15	Zhelezov, G., ***Stoyanova, V.*** LAND COVER CHANGES IN THE ARCHARO-ORSOYSKA LOWLAND FOR THE PERIOD 1990-2018, SES 2021, Space Research and Technology Institute - Bulgarian Academy of Sciences, 2021, ISSN:2603 – 3313 (Print); 603 – 3321 (Online), http://space.bas.bg/SES/archive/SES%202021_DOKLADI/3_Remote%20Sensing/4_Zhelezov.pdf Abstract: A very topical in recent decades is the issue for studying and mapping the land cover. The European Commission launched the first land cover mapping for the European Union in 1985 with the program Coordination of Information on the Environment (CORINE). The initial data from CORINE goes back to 1990 and have updates in 2000, 2006, 2012, and 2018. The research presented the land cover changes for the period 1990-2018 in the Archaro-Orsoyska lowland between villages Dobri dol, Slivata and Orsoya. The transformations and changes are established for the level of the CORINE Land Cover (CLC) system of classification and organization of the data. Eleven classes are defined in the study area. As expected, the classes which indicate arable lands are most common in the valley's bottom due to its flat topography and fertile soils, followed by the forest and semi natural areas and built-up areas of the pastures.