

## ANNOTATIONS

OF THE MATERIALS UNDER ART. 65. FROM PRASPU

**of chief assistat professor SLAVEYA TENCHEVA PETROVA, PhD**

participant in a competition for the academic position "**associate professor**"  
to the Department of Ecology and Environmental Protection, Faculty of Biology,  
University of Plovdiv "Paisii Hilendarski"

announced in SG no. 32/09/04/2024

Field of higher education:

**4. Natural sciences, mathematics and informatics**

Professional field:

**4.3. Biological Sciences (Ecology and Ecosystem Conservation)**

The candidate participates in the current competition for the academic position "associate professor" with published 2 author's monographs, 1 book based on a PhD thesis, 3 book chapters, 34 scientific publications that do not repeat the materials used for acquisition of the PhD and for occupying the academic position "chief assistant professor", as well as published 4 textbooks and 9 handbooks for students.

The scientific publications are indexed in the two biggest world databases with scientific information (Web of Science and Scopus), as follows: 5 publications with Q1; 7 publications with Q2; 8 publications with Q3; 14 publications with Q4.

The monographs and scientific works are the result of research in three main scientific areas:

*1) Ecology of urbanized ecosystems*

*2) Ecology of natural ecosystems*

*3) Organic farming*

The textbooks and handbooks are related to the teaching activity at the Faculty of Biology of the University of Plovdiv "Paisiy Hilendarski".

### **I. Annotations of the materials in the field of ecology of urbanized ecosystems**

Urbanization is an important factor in land use, land cover changes, and its importance will undoubtedly continue to grow as the majority of the Earth's population continues to concentrate in large cities. Urbanization has a significant impact on the functioning of local and global ecosystems and the conditions they provide for humans and other organisms on Earth. Urbanization concentrates people, materials and energy in relatively small geographical areas, such as large cities

and megacities, to facilitate the functioning of society, resulting in natural ecosystems being altered and replaced by anthropogenic ones. With the development of the city, the natural habitats are fragmented, isolated and destroyed, the species composition is impoverished and homogenized, the hydrological regime is disturbed, the flow of energy and the biogeochemical circles of substances, the geochemistry of the landscape, the quality of air, the quality of soils, etc. are modified.

Vegetation is an important structural element of the planning design and volume-spatial construction of settlements, as it is used in the creation of areas of different nature and purpose in urbanized landscapes. Greenery in the peri-urban territory serves to connect the settlement with the surrounding natural environment, while greenery in populated areas aims to unite individual zones, ensembles and complexes into a compositional and harmonious whole. That is why green areas occupy a significant share and are an important compositional element in the structure of settlements.

We are witnessing the dynamic changes in temperatures, the amount of precipitation, the intensity of extreme weather events, which raises a number of questions about what will be their impact on urban green systems and how well they will be able to adapt to the new conditions. Such concerns are justified, since the main part of the green infrastructure of the cities in Bulgaria was realized in the interval 1950-1990, and in the period after that the care for the green infrastructure gradually decreased. In combination with the increase in temperatures and the drying of the air, the strengthening of urbanization processes (densification, construction, change of purpose of green areas), deterioration of the quality of atmospheric air, soil pollution, etc. factors, a deteriorated health condition and death of the more sensitive types of urban trees have already been found, and a number of the tolerant species have been found not to develop optimally. It is necessary to carry out a complex analysis and assessment of the state of the green system, especially that of the tree species widely used for landscaping, as well as their biological characteristics and adaptation potential to the specific conditions of the urban environment.

This area includes the materials presented in the following scientific works: **Г.5.1.** (monography), **Г.6.** (book), **Г.8.1.** (book chapter) and publications **B.4.1., B.4.2., B.4.3., B.4.4., B.4.5., Г.7.3., Г.7.4., Г.7.5., Г.7.6., Г.7.7., Г.7.8., Г.7.9., Г.7.17., Г.7.18., Г.7.19., Г.7.22., Г.7.25., Г.7.27., Г.7.29.**

In the presented book **Г.6.**, on the basis of a protected PhD thesis, it is stated that the data from the two automated instrument stations (part of the National System for Monitoring the State of the Environment), which monitor the quality of the atmospheric air (AQ) in the city of Plovdiv, are grossly inadequate in view of its specific location and topography. For this reason, the methods of passive and active biomonitoring of AQ have been applied. For the purposes of passive phytomonitoring on the territory of the city, 8 zones were selected for collecting representative samples of 3 types of deciduous trees and 3 types of herbaceous plants. Collectors with dried plant material have been placed in 4 of these areas for active phytomonitoring. At the same time, honey samples were taken in four of the zones to monitor bioemulsion along the food chains. The content of 26 chemical elements in the collected samples was analyzed, as well as the amount of

photosynthetic pigments in the leaves of the studied plant species. As a result, the main air pollutants in the city of Plovdiv and their distribution by zones based on concentration in the studied biomonitors were established. This is the first study in Bulgaria in an urban environment, including 8 species of plants belonging to 4 systematic groups, combining passive and active biomonitoring. The advantages of biomonitoring are demonstrated and a methodological development is presented for the implementation of systematic observations in order to assess the state and forecast possible changes in the components of the environment.

A more in-depth analysis of the results of the active biomonitoring of atmospheric pollution in the city of Plovdiv using moss-bags and lichen-bags is presented respectively in publication **Г.7.7.** and **Г.7.9.** The collectors were placed in selected points and the bioaccumulation of potentially toxic elements in the plant material was followed for an exposure period of 1, 2 and 3 months. The relationships between the measured content and the duration of impact, the dependence on the location and on the plant species are commented. The effectiveness of the species used for biomonitoring purposes is clearly highlighted.

A more in-depth analysis of the results of passive biomonitoring with herbaceous and woody species is presented in publications **Г.7.8** and **Г.7.5.**, respectively. In herbaceous species, the bioaccumulation of potentially toxic elements from the soil and air has been tracked with a view to discover the path of penetration of pollutants and their origin. The measured concentrations were compared with the permissible hygiene standards, as a result of which a risk to human health was established upon consumption (medicinal plants). In the case of tree species, a comparison of their bioaccumulation potential was made and suitable biomonitors were recommended depending on the type of pollutants in the atmospheric air. The factors influencing the accumulation of the studied chemical elements by plants are ranked.

Publication **Г.7.18.** examines the dynamics in the amounts of photosynthetic pigments in some tree species in response to the impact of the urbanized environment. It has been confirmed that changes in pigment content are among the first signs of the impact of pollutants on plants, as toxic gases entering the leaf tissues through the stomata combine with water from the intercellular spaces and form anions of the corresponding acids. Penetrating into the cytoplasm, they accumulate mainly in the chloroplasts and lead to a disruption of the structure and a decrease in their pigment content. These parameters can be successfully applied as indicators of tolerance to specific urban conditions.

The adaptation of some tree species to the urbanized environment is analyzed in publication **Г.7.6.** After planting saplings in 4 stationary plots on the territory of the city of Plovdiv, their development and physiological status were periodically monitored. Some taxonomic characteristics such as increase in stem diameter, growth, biomass accumulation were monitored. The changes in the amount of photosynthetic pigments and enzyme activities, as well as the appearance of chlorosis and necrosis on the leaf petiole under the influence of the urbanized environment, were monitored. The complex mechanism of adaptation, including physiological, biochemical and anatomical responses, has been confirmed.

The following studies are aimed at clarifying these answers, as in publication **B.4.4.** the antioxidant defense response in *Tilia tomentosa*, *Fraxinus excelsior* and *Pinus nigra* was followed. Three types of biochemical markers were investigated, revealing plant response through three different mechanisms, namely photosynthetic pigment content and ratios, free proline content and guaiacol peroxidase enzyme activity. After statistical processing of the results obtained from the 6-year study in a real urbanized environment (the city of Plovdiv), an original reference scale was constructed for early diagnosis of the level of anthropogenic pressure (air pollution) on urban tree species based on different levels of biochemical stress markers. This scale provides a scientific basis that can be applied to sustainable green system management and selection of landscaping species.

In publication **B.4.3.** the studies of adaptation processes in *Tilia tomentosa*, *Fraxinus excelsior* and *Pinus nigra* continue after their planting in the city of Plovdiv. The bioaccumulation of potentially toxic elements and their impact at the anatomical-morphological level (occurrence of damage), physiological level (intensity of photosynthesis, intensity of transpiration, stomatal conductance, photosynthetic pigments) and molecular level (polymorphism) were monitored. A strong correlation was demonstrated between the factors degree of urbanization (building) and traffic intensity, on the one hand, and the reported responses for the three tree species at all investigated levels, on the other.

The latest publications in this field, summarizing the experimental results of already 15 years of studies on urban tree species, are in sync with the very current topic on the sustainable development and management of urban ecosystems - the application of nature-based solutions (NBS) to address environmental problems. Publication **B.4.1.** compared the efficiency of different groups of plants in terms of purifying atmospheric air from pollutants and proposed an original conceptual framework for the integration of NBS in this aspect. Publication **B.4.5.** reveals the potential of *Pinus nigra* to accumulate potentially toxic elements from soil and air. Publication **B.4.2.** compared the potential of *Tilia tomentosa*, *Fraxinus excelsior* and *Pinus nigra* to accumulate pollutants from the air, inferring the species-specific features and advantages regarding the removal of a specific chemical element. A simulation model was also created in it, demonstrating the potential of urban tree vegetation to purify the air from fine dust particles and nitrogen dioxide. Three scenarios are considered and recommendations are made to optimize the species composition of the green system in order to increase its potential to provide these ecosystem services.

The monography **Г.5.1.** is a kind of continuation and deepening of the above-mentioned studies on some species of the green system of the city of Plovdiv, started in 2009 during the development of the author's PhD thesis entitled "Passive and active phytomonitoring of atmospheric pollution in the city of Plovdiv". It presents a thorough analysis of the natural and anthropogenic factors in the settlement, which have the most significant impact on the phytosanitary status and the development of the green system. The analysis of the climatic, soil and atmospheric features of the city of Plovdiv necessitates the use of ecologically adapted species (xeromesophytes) that fulfill the following more important requirements: to be highly gas resistant;

withstand high summer temperatures and drying air; to be undemanding to the insufficient amount of moisture. Based on the monitoring, analysis and assessment of the condition of the main tree species of the green system of the city of Plovdiv, the first systematic studies were made in the real conditions of the city of Plovdiv on the physiology and phenology of widely distributed species of the city's dendroflora. Thanks to the 15-year period of research, a revision of some of the classic tree species recommended for urban landscaping has been carried out in the context of intensifying urbanization and climate change, and a species composition suitable for the specific conditions has been proposed. This critical analysis approach to the existing situation will enable the development of ideas for planning the green system in the future, refining its biological basis and assessing the real consequences for the quality of the environment and the ecosystem services provided.

The published chapter of book **Г.8.1.** is a brief overview of some of the autochthonous tree species preserved on the three hills, some emblematic tree species for the city of Plovdiv, as well as the introduced exotics in more recent times. The biological characteristics of *Ziziphus jojoba* Mill, *Koelreuteria paniculata* Laxm, *Catalpa bignonioides* Walter, *Aesculus hippocastanum* L., *Celtis australis* L., *Cercis siliquastrum* L., *Cupressus sempervirens* L., *Gingko biloba* L., *Platanus* sp., *Magnolia* sp., *Liriodendron tulipifera* L., *Metasequoia glyptostroboides* Hu and W. Cheng.

Due to the importance of soil as an environmental factor, the accumulation of heavy metals and potentially toxic elements in urban soils was analyzed, and part of these results are included in publication **Г.7.17.** and in the monograph **Г.5.1.** The impact of pollutants on the soil microbiome and the processes of decomposition of dead organic matter is analyzed in publication **Г.7.29.**

The construction of buffer green patches around transport arteries is recommended as an approach to protect soil properties and functions in publication **Г.7.3.** This article also proposes a methodology for their construction, validated in the conditions of the city of Plovdiv. It contains guidelines both for the selection of the species composition, as well as for calendar terms and agrotechnical practices.

Possibilities for implementing NBS for sustainable management of urban soils are discussed in publication **Г.7.4.** The potential for phytoremediation of different types of grasses in constructed stationary sites on the territory of the city of Plovdiv in zones with different intensity of anthropogenic load was analyzed. Interrelationships in the soil-microbiome-plant system were also tracked, looking for synergistic interactions.

The relevance of research in the field of ecosystem services is reflected in publications **Г.7.22** and **Г.7.25.** The first of these presents a systematic analysis of the available scientific literature on the ecosystem services that urban soils provide to the population. A total of 20 services have been identified, which are assigned to one of the four groups – material, relational, supportive and cultural. The importance of each to human health and well-being is assessed and commented on. In the second article, an algorithm and methodological framework for the assessment of ecosystem services in urbanized areas is presented. The approach has several sequential steps and selected

indicators to allow the acquisition of the necessary information for the assessment of ecosystem services.

In publication **Г.7.19.** the influence of external factors on human health and reproductive abilities has been analyzed, and it has been proven that some harmful habits, as well as deteriorated conditions of the working environment, reliably lower reproduction in men.

In publication **Г.7.27.** attention has been paid to another significant problem in urban areas, namely noise pollution of the environment. A noise monitoring system was developed and validated, which was tested in the conditions of the town of Smolyan.

## **II. Annotations of the materials in the field of ecology of natural ecosystems**

The problem of protecting and restoring natural ecosystems is a key issue for the survival of man and the biosphere. The growing pollution of all components of the environment leads to a decrease in biodiversity, reduction of species ranges, degradation of habitats, as well as the potential of ecosystems to provide ecosystem services, deterioration of the state of the environment, and hence - to risks for human health. To solve these environmental problems, it is important to identify the levels and sources of pollution, and then look for opportunities to reduce and limit them.

This area includes the materials presented in the following scientific works: **Г.7.10., Г.7.11., Г.7.12., Г.7.13., Г.7.21., Г.7.26., Г.5.2.** (monography), **Г.8.2.** and **Г.8.3.** (book chapter).

The contamination of the Topolnitsa dam with heavy metals and potentially toxic elements is a long-standing problem that would be very difficult to find a solution. Hydrobionts are exposed to the chronic effects of these elements and are very likely manifestations of bioaccumulation and biomagnification. At the same time, the fish in the dam are subject to fishing and consumption by people, which poses a risk to their health. For this reason, the content of heavy metals in various tissues and organs of two of the most common fish species was analyzed (publication **Г.7.12.**), and the biological response to the impact at different levels - anatomical, histological, biochemical - was also sought (publication **Г.7.11.**).

In order to clarify the mechanisms of the response to stress induced by the presence of heavy metals in the environment, a series of laboratory experiments were conducted. The influence of different metals (individually and in combinations) on survival, oxygen consumption (respiration intensity) in carp during acute (publication **Г.7.10.**) and chronic exposure (publication **Г.7.13.**) was tested.

In publication **Г.8.2.** the geology and morphotectonics of Sredna Gora are examined, the main structural complexes are presented and the development of this massif in the geological past is analyzed. The rich deposits of ore and non-ore minerals are commented on as a consequence of the volcanic and sedimentation processes in the geological evolution of the area, a large part of

which are located in the watershed of the Topolnitsa River. An attempt was also made to reveal the composition and paleoecology of the organismal world based on the data for described fossil ensembles.

Publication **Г.8.3.** examines the soils in the region of Sredna Gora and their relationship with geological and climatic factors. The horizontal and vertical distribution of the main soil types and subtypes was analyzed.

An attempt was made to reconstruct the geological history and paleoecology of organismal communities in a part of the Eastern Rhodopes (Perunika village area) based on the fossil finds discovered and described there (monograph **Г.5.2.**). It is a valuable contribution to the elucidation of the geology and biology not only of our country but also on a wider scale.

With regard to the protection of ecosystems and biodiversity, field studies and measurements of some abiotic parameters, surveys and interviews with various interested parties have been carried out in PP "Strandja". The collected information is divided into two large groups - environmental and social indicators, after which it is analyzed using a SWOT analysis. Strengths and weaknesses are highlighted, sensitive areas are outlined and recommendations are made for their sustainable management (publication **Г.7.26.**).

In publication **Г.7.21.** special attention was paid to one species endemic to Strandzha Mountain - *Cicer montbretii* Jaub. & Spach with a fairly limited distribution. Some characteristics of the soils on which it develops, as well as the associated rhizosphere microbiome, were analyzed.

### **III. Annotations of the materials in the field of organic farming**

Intensive agricultural production disrupts the natural cycle of nutrients in the agroecosystem, leading to a decrease in soil organic matter vital to soil organisms and soil fertility, increased energy export in the form of nutrients, and ultimately soil depletion. Organic farming is an integrated system of agricultural management and food production that combines the best practices in terms of environmental protection, maintains a high degree of biological diversity, preserves natural resources, applies high standards of humane treatment to the animals and production methods, consistent with the preferences of some consumers for products produced using natural substances and processes.

This area includes the materials presented in the following scientific works: **Г.7.1., Г.7.2., Г.7.14., Г.7.15., Г.7.16., Г.7.20., Г.7.23., Г.7.24. and Г.7.28.**

The soil is a basic resource in agriculture, therefore the impact of various types of agrotechnological practices on the composition of the soil fauna (publication **Г.7.15.**) in conventional and organic agriculture was analyzed.

Due to the growing problem of widespread environmental pollution with microplastics, a systematic review of the scientific literature was made and some potential biomarkers in

agricultural crops were highlighted (publication Г.7.23.). To clarify the potential risk of bioaccumulation of microplastics in agricultural production, an experiment was conducted with pea plants. It has been proven that microplastics from the three studied fractions are absorbed by the root system and accumulate in the underground and aboveground organs (publication Г.7.24.).

In recent years, endophytic microorganisms have been viewed as one of the promising directions in biological production. In publication Г.7.1. demonstrated the stimulatory effect of three endophytic yeast strains on development and disease resistance in tobacco.

Possibilities for using allelopathic relationships in organically grown vegetable crops are analyzed in publication Г.7.16. The effects of monoculture and mixed cultivation of three species were tested, and recommendations with practical application were made.

Additional tests of allelopathic relationships were carried out in laboratory conditions, in order to refine the methods for conducting similar biotests. In publication Г.7.28. the potential of *Tagetes* species as test objects was evaluated in comparison with one of the classical ones - *Lactuca sativa* L. Some advantages were found, such as faster water absorption and seed swelling, which is important in such experiments. The use of nano silver as a carrier of allelochemicals in biotests, presented in publication Г.7.2., can be defined as innovative. In this way, they would find a solution to a number of difficulties such as difficult storage of allelopathic extracts, their contamination with microorganisms, penetration into the seeds, etc.

In the context of global climate change, agriculture is expected to be one of the sectors seriously affected, and this will first of all affect the possibilities of growing traditional crops. In this connection, an attempt was made to select genotypes of the genus *Sorghum*, possessing high temperature tolerance and adaptation potential, to serve as donors in relevant selection programs (publication Г.7.14.). The possibilities of stimulating the germination of seeds and the initial development of sorghum species, which would increase their competitiveness against weeds, were additionally studied (publication Г.7.20.).

#### **IV. Annotations of the textbooks and handbooks**

1) Georgiev D., I. Velcheva. G. Gecheva, S. Petrova, I. Mollov. 2012. Water pollution and impacts on ecosystems. "Paisii Hilendarski" University Publishing House, 190 pages. ISBN 978-954-423-721-9

*The presented textbook was developed in accordance with the curricula for "Water Pollution" and "Water Pollution and Impact on Ecosystems", included in the bachelor's program "Ecology and Environmental Protection" at the Faculty of Biology of University of Plovdiv "Paisiy Hilendarski". The textbook presents the characteristics of water as a living environment and natural resource, the types of pollution and the impact they have on aquatic ecosystems. Special attention is paid to actual Bulgarian legislation and water monitoring in*



*Bulgaria. The textbook is intended for students from the Faculty of Biology of the "Paisii Hilendarski" PU. It can also be used by all students studying environmental specialties in other higher education institutions in the country, as well as by specialists in the field of water ecology.*

2) Popov V., I. Velcheva, S. Petrova, I. Mollov. 2017. Organic farming and agrobiodiversity. "Paisiy Hilendarski" University Publishing House, Plovdiv, 171 pages. ISBN 978-619-202-274-7

*The presented textbook is intended for all students, researchers and teachers who dare to use their knowledge, skills and experience to protect the past, present and future of the planet - biodiversity.*

*The diversity of plant and animal species differs significantly in natural and agrarian terrestrial and aquatic ecosystems. Therefore, the study of biodiversity is of particular importance in order to provide tools to the stewards of nature in rural areas - farmers - to preserve, protect and increase it. So that they can be proud of their local biodiversity, use it to produce healthy products and preserve rural areas for future generations.*

3) Petrova S., B. Temelkov. 2019. Geology and Petrography. "Paisii Hilendarski" University Publishing House, 348 pages. ISBN 978-619--202-455-0

*The textbook on "Geology and petrography" aims to present in a synthesized and accessible form the most important information about our home - the planet Earth, the hypotheses about its origin, the regularities in its development, composition and construction, as well as about the continuous processes in the interior and on its surface. Information is included on the main characteristics of the minerals and rocks that make up the earth's crust, with attention paid to the more widespread of them.*

4) Georgiev, D., Velcheva, I., Gecheva, G., Petrova, S., Yancheva, V., Mollov, I. 2023. Water pollution and impact on ecosystems. Paisii Hilendarski University Publishing House, 176 pages, ISBN: 978-619-202-883-1

*Second revised edition of the textbook from 2012.*

5) I. Velcheva, A. Tsekov, A. Irikov, I. Mollov, S. Petrova. 2013. Laboratory Exercises in Ecology. "Paisii Hilendarski" University Publishing House, 99 pp. ISBN 978-954-423-857-5

*The presented handbook "Laboratory Exercises in Ecology" has as its main goal, through a series of practical exercises, to visualize some ecological processes and phenomena studied*

*in the lecture course in "Ecology", as well as to present some basic methods in ecological research in laboratory conditions.*

*The proposed topics are the work of all members of the Department of Ecology and Environmental Conservation at the Plovdiv University and reflect their accumulated experience in teaching and scientific work in the relevant field. They are tailored to the possibilities for their real implementation by the students, both of the Faculty of Biology, and those of other higher schools training future ecologists. Laboratory exercises can also be successfully used by teachers teaching environmental lessons in secondary school.*

*The topics developed cover the main sections of modern ecological science. Methods studying the influence of abiotic factors, population characteristics, biotic relationships in communities, processes in ecosystems are presented. Processing the results enables students to use an analytical approach and is a prerequisite for discussions and drawing specific or generalizing conclusions.*

*An advantage of the present handbook is its model character, which enables the topics to be modified, according to the conditions and available objects in their application.*

- 6) I. Velcheva, A. Tsekov, A. Irikov, G. Gecheva, D. Georgiev, I. Mollov, S. Petrova, B. Nikolov, B. Todorova, B. Temelkov. 2013. Field exercises in general and conservation ecology. "Paisii Hilendarski" University Publishing House, 157 pages. ISBN 978-954-423-840-7

*The presented handbook "Field exercises in general and conservation ecology" is the first of its kind in the Bulgarian ecological literature. Its main purpose is, through a series of selected field exercises, to provide an opportunity for practical application and understanding of some ecological processes and phenomena studied in the lecture course on "Ecology", as well as to present some basic methods in ecological research applied when working in field conditions. It also offers a model for studying from an ecological point of view different categories of protected areas, considered in the lecture courses on "Protection of the Natural Environment" and "Conservation Ecology".*

*The topics proposed in this textbook are the work of all members of the Department of Ecology and Environmental Conservation of Plovdiv University and reflect their accumulated experience in their teaching and scientific work. They are tailored to the possibilities for their real implementation by the students, both of the Faculty of Biology, and those of other higher schools training future ecologists. Last but not least, the topics can also be used by teachers teaching lessons with environmental content in secondary school.*

*Model topics covering the main sections of modern environmental science are presented in this study aid. Methods studying the influence of abiotic factors, population characteristics, relationships in communities, peculiarities and properties of ecosystems, conservation significance of species and habitats are presented. Processing the results enables students to use an analytical approach and is a prerequisite for discussions and drawing specific or generalizing conclusions.*

*We believe that the advantage of this teaching aid is precisely its model nature, which makes it possible to modify the topics according to the conditions and available objects in their application. This also determines the wider range of readers for whom it can be useful.*

7) Petrova S., I. Velcheva, B. Nikolov. 2013. Soil Science and Soil Pollution Exercise Guide. University Publishing House "Paisii Hilendarski", 92 pp. ISBN 978-954-423-873-5

*The presented handbook "Soil Science and Soil Contamination" aims to introduce some basic methods in soil research, both in laboratory and field settings.*

*The topics are structured in 3 modules, two of which are related to learning practical skills for analyzing the physico-mechanical parameters of soils, as well as the impact of pollutants on the soil and its properties. Attention was also paid to the anthropogenically influenced soils, and two classes were included to test the level of pollution in them. The third module is dedicated to the classification of soils in Bulgaria, their distribution and develops skills for characterizing the structure of the soil profile in different soil types and the main processes under the influence of which the given soils are formed and evolve.*

8) Valcheva E., S. Petrova. 2015. A Guide to Pollution, Water Conservation and Impact on Ecosystems". University Publishing House "Paisiy Hilendarski", Plovdiv, 106 pages. ISBN 978-619-202-016-3

*The presented handbook "Pollution, water protection and impact on ecosystems" is intended for conducting practical classes in two academic semesters for the students of the Agricultural University - Plovdiv from the undergraduate majors "Ecology and Environmental Protection", "Agroforestry Systems and Mountain Agriculture" ", "Biological Agriculture" and the Master's course "Ecology of Settlement Systems". The guide can also be used by all students studying environmental majors in other higher education institutions in the country.*

*The presented thematic units aim to build students' skills in applying sampling methods, determining the ecotoxicity of pollutants, familiarization with modern instrumental methods for the analysis of pesticides, heavy metals and ionic groups in water. The content of the course is tailored to the modern methods of quality control of polluted waters and the features of management and control of water resources. In the development of the guide, the recommendations of teachers from AU - Plovdiv and Plovdiv University were taken into account. Hilendarski".*

9) Velcheva I., A. Tsekov, A. Irikov, I. Mollov, D. Georgiev, S. Petrova. 2015. Laboratory Exercises in Ecology (Second Revised Edition). "Paisii Hilendarski" University Publishing House, ISBN: 978-619-202-085-9, 98 pages.

*Second revised edition of the 2013 manual.*

10) Petrova S., I. Velcheva, B. Nikolov. 2018. Soil Science and Soil Pollution Laboratory Manual. "Paisiy Hilendarski" University Publishing House, Plovdiv, 106 pages. ISBN 978-619-202-353-9

*Second revised and updated edition of the handbook from 2013.*

11) Velcheva I., I. Mollov, D. Georgiev, A. Irikov, A. Tsekov, S. Petrova. 2021. Ecology Laboratory Manual. "Paisii Hilendarski" University Publishing House, ISBN:978-619-202-713-1, 106 pages.

*Revised and updated 2015 edition of the handbook.*

12) Mollov, I., Georgiev, D., Velcheva, I., Irikov, A., Petrova, S., Gecheva, G. 2022. Guide for field exercises in general and conservation ecology. Paisii Hilendarski University Publishing House, 197 pages, ISBN: 978-619-202-771-1.

*Second revised edition of the 2013 handbook.*

13) Udristioiu, M.T., Dudáš, A., Michalíková, A., Kilic, F., Tutsoy, O., Škrinárová, J., Puiu, S., Petrova, S. 2023. Advanced technologies of big data processing and analysis. Университетско издателство "Паисий Хилендарски", Пловдив, 190 стр., ISBN 978-619-7663-80-8

#### English version

Udristioiu, M.T., Dudáš, A., Michalíková, A., Kilic, F., Tutsoy, O., Škrinárová, J., Puiu, S., Petrova, S. 2023. Advanced technologies of big data processing and analysis. Ankara, Akademisyen Yayınevi Kitabevi, 170 p., ISBN: 9786253992668

*This handbook is the result of project No. 2021-1-RO01-KA220-HED-000030286 under the Erasmus+ program, the work of four partners (Matej Bell University in Banska Bystrica, Slovakia, University of Craiova, Romania, PU Paisii Hilendarski", Bulgaria, and the University of Science and Technology in Adana-Turkey). It aims to help STEM educators improve students' data skills.*

01.07.2024

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