ECOLOGIA BALKANICA

International Scientific Research Journal of Ecology

Volume 13, Issue 1
June 2021

UNION OF SCIENTISTS IN BULGARIA – PLOVDIV

UNIVERSITY OF PLOVDIV PUBLISHING HOUSE

International Standard Serial Number
Online ISSN 1313-9940; Print ISSN 1314-0213 (from 2009-2015)

Aim & Scope

„Ecologia Balkanica" is an international scientific journal, in which original research articles in various fields of Ecology are published, including ecology and conservation of microorganisms, plants, aquatic and terrestrial animals, physiological ecology, behavioural ecology, population ecology, population genetics, community ecology, plant-animal interactions, ecosystem ecology, parasitology, animal evolution, ecological monitoring and bioindication, landscape and urban ecology, conservation ecology, as well as new methodical contributions in ecology. The journal is dedicated to publish studies conducted on the Balkans and Europe. Studies conducted anywhere else in the World may be accepted only as an exception after decision of the Editorial Board and the Editor-In-Chief.

Published by the Union of Scientists in Bulgaria – Plovdiv and the University of Plovdiv Publishing house – twice a year. Language: English.

Peer review process

All articles included in "Ecologia Balkanica" are peer reviewed. Submitted manuscripts are sent to two or three independent peer reviewers, unless they are either out of scope or below threshold for the journal. These manuscripts will generally be reviewed by experts with the aim of reaching a first decision as soon as possible. The journal uses the double anonymity standard for the peer-review process. Reviewers do not have to sign their reports and they do not know who the author(s) of the submitted manuscript are.
We ask all authors to provide the contact details (including e-mail addresses) of at least four potential reviewers of their manuscript. These should be experts in their field of study, who will be able to provide an objective assessment of the manuscript. Any suggested peer reviewers should not have published with any of the authors of the manuscript within the past five years and should not be members of the same research institution. Members of the Editorial Board of the journal can be nominated. Suggested reviewers will be considered alongside potential reviewers identified by their publication record or recommended by Editorial Board members.
Once an article is accepted, it is published in Ecologia Balkanica immediately online first as a PDF file. The paper will subsequently be published in both full text formatted PDF online (open access) and in the print copy of the journal.

Abstracting & Coverage

- Scopus (SJR_{2020} = 0.144; $SiteScore_{2020}$ = 0.2; $SNIP_{2020}$ = 0.207)
- SCImago Journal Rank (SJR, 2016-2020 - Q4)
- Thomson Reuters Master Journal List - Zoological Record (Web Of Science)
- Thomson Reuters BIOSIS Reviews (Web Of Science)
- Thomson Reuters Biological Abstracts (Web Of Science)
- Index Copernicus (ICv2015=84.21; ICv2016=96.15; ICICv2018=109.62; ICv2019=111.46)
- Directory of Open Access Journals (DOAJ)
- EBSCO
- CAB International – CABI Abstracts
- All-Russian Institute of Scientific and Technical Information (VINITI) (Referativnyi zhurnal)
- Elsevier (GEOBASE)
- Ulrich's Web (ProQuest)
- Google Scholar Search Engine and many others.

Contact Publisher

Union of Scientists in Bulgaria – Plovdiv
6 Metropolit Paisii Str., 4000 Plovdiv, BULGARIA
E-mail: ecologia_balkanica@abv.bg

University of Plovdiv Publishing House
24 Tsar Assen Str., 4000 Plovdiv, BULGARIA

IMPORTANT: Since 2016 the journal is published ONLY electronically (**open access)**. You may access the full text of all issues of "Ecologia Balkanica" from our website:

http://eb.bio.uni-plovdiv.bg

Open Access Policy

Ecologia Balkanica provides immediate open access to its content on the principle that making research freely available to the public supports a greater global exchange of knowledge. Open Access in journal publishing means:

* Direct, barrier-free, online dissemination of scientific results at no charge for readers Authors retain the copyright of their articles,
* Open Access papers may be copied, downloaded, and used for text- and data-mining purposes, provided that such uses are fully attributed on a non-commercial basis,
* High visibility of the work – anyone can read your article at no charge,
* Higher citation rates due to higher visibility,
* Quick publishing as pre-prints published immediately upon acceptance,
* Articles are archived and searched through several major OA repositories

Manuscript submission

The following types of manuscripts are accepted: short research notes (up to 4 pages), research articles (up to 10 pages) and review papers (up to 20 pages). Short research notes are shorter submissions of a preliminary nature or those including new records or observed phenomenon etc. Research articles should present significant original research in the various fields of ecology. Review papers should deal with topics of general interest or of contemporary importance, being synthetic rather than comprehensive in emphasis. Authors of Review papers should consult with the Editor before submission.

Submitted manuscripts are sent to two or three independent peer reviewers, unless they are either out of scope or below threshold for the journal. These manuscripts will generally be reviewed by experts with the aim of reaching a first decision as soon as possible. The journal uses the double anonymity standard for the peer-review process. Reviewers do not have to sign their reports and they do not know who the author(s) of the submitted manuscript are.

Once an article is accepted, it is published in Ecologia Balkanica immediately online first as a PDF file. The paper will subsequently be published in both full text formatted PDF online (open access) and in the print copy of the journal. The **rejection rate** of received manuscripts of the journal for 2020 is **39.72%.**

ECOLOGIA BALKANICA – Volume 13, Issue 1 / 2021

CONTENTS

Research Articles

ECOLOGIA BALKANICA
2021, Vol. 13, Issue 1 June 2021 pp. 17-26

Assessment of the Environmental State of North-Western Black Sea Coast Territories, Ukraine using Indicators of Sustainable Development

Angelina V. Chugai[1], Tamerlan A. Safranov[1], Viktor V. Pylypiuk[1], Iryna O. Soloshych[2]*

1 – Odessa State Environmental University, Nature Protection Faculty, Department of Environmental Science and Environmental Protection, 15 Lvivska Street, Odessa, 65106, UKRAINE
2 – Kremenchuk Mykhailo Ostrohradskyi National University, Ecological Safety and Natural Management department, 20, Pershotravneva Street, Kremenchuk, 39600, UKRAINE
*Corresponding author: avchugai@ukr.net

Abstract. The concept of "sustainable development" is interpreted as a process of development of countries and regions based on coordination and harmonization of social, economic, and environmental components in order to meet the needs of present and future generations. The concept of sustainable development aims at the socially desirable, economically viable and environmentally safe development of society. To assess the ecological state of the environment from the standpoint of sustainable development, certain indicators and parameters have been developed. The paper evaluates the state of the environment of the North-Western Black Sea region according to the indicators of sustainable development as factors in assessing the technogenic load. It is discovered that in the category «Ecological systems» of ecological policy the best conditions of sustainable development are noted in the Mykolayiv area, the least good - in the Odessa region. In the category "Environmental load" the best conditions are noted for the Kherson region, the worst – also for the Odessa region. In general, the most unfavorable environmental situation from the standpoint of sustainable development among the territories of the North-Western Black Sea Coast is observed in the Odessa region. Kherson region is characterized by the best conditions. Among all the analyzed indicators, the category of policy "Environmental load" plays a predominant role.

Key words: sustainable development, environmental assessment index, indicator.

Introduction

The inconsistency of economic development and environmental safety requirements, the dominance of industries with a high share of resource- and energy-intensive obsolete technologies, lack of rational consumption of natural resources all have led to the formation of technogenic economic development and environmental degradation (Wan et al., 2020).

Human awareness of the real danger of environmental catastrophe initiated the development of the concept of sustainable development, which should be understood not only in the context of changing human-nature relations to expand economic growth but also as a coordinated global survival strategy aimed at preserving and restoring the environment.

It should be noted that the sustainable development of any country is a controversial issue. Such development can be said only when economic growth, material production and consumption, and other social activities occur within the limits determined by the ability of ecological systems to recover (Geets, 2000).

Today there are many interpretations, and a single point of view on the essence of the concept of "sustainable development" has not been developed. Summarizing the achievements of scientists (United Nations, 2015; Doroguntsov & Ralchuk, 2001; Rudenko, 2001; Pidlisnyuk, 2001) it can be noted that the interpretation of the concept of "sustainable development" extends to the process of change in society, in which the exploitation of resources, scientific and technical development and institutional change are coherent and do not diminish the ability of future generations to meet human needs and aspirations.

The Decree of the President of Ukraine "On the Sustainable Development Goals of Ukraine until 2030" defines certain goals of sustainable development, a third of which relate to environmental security and preservation of a quality environment for future generations (President of Ukraine, 2019). In general, the peculiarities of the strategy of sustainable development in Ukraine in recent years have been considered by many researchers, in particular (Molokanova, 2018; Smirnova & Mykhailyuta, 2018; Haustova & Omarov, 2018). Particularly, the need to develop appropriate measures to consider the issue of further practical implementation, combining all levels of the socio-economic system with mandatory consideration of the environmental component is being given particular attention.

According to the research of leading scientists (Danilov-Danilyan & Losev, 2000; NAS of Ukraine, 2007; Zgurovsky, 2009; Prischepa & Klimenko, 2009; Shapar, 2009; Alexandrov et al., 2010; Klimenko & Klimenko, 2010; Kutsenko et al., 2013; Necos & Soloshych, 2014; Emas, 2015; Mensah, 2019; Powe, 2020), such an assessment should be made based on analysis of the dynamics of changes in certain indices and indicators that most broadly characterize all components of the ecological state of regions. According to the metrics for measuring the processes of sustainable development (MMSD) (Zgurovsky, 2009), sustainable development is assessed from the standpoint of economic, environmental and socio-institutional nature. According to the data (NISS, 2012), the UN Commission on Sustainable Development determines the level of development of countries by 96 indicators, 19 of which characterize the state of the environment. Experts from Yale University (USA) have proposed to determine the Environmental Performance Index, which characterizes the effectiveness of public policy in the field of environmental protection and ecosystem conservation. This index is calculated using 22 indicators, divided into 10 categories that characterize the quality of the environment and the viability of ecosystems. According to the value of this indicator in 2012, Ukraine ranked 102nd among 132 countries (NISS, 2012). This list of indicators largely repeats the parameters of the indicators of the environmental evaluation of sustainable development and from some points of view reflects the technogenic impact on certain components of the environment more objectively.

Materials and Methods

According to the metrics for measuring sustainable development processes proposed in the paper (Zgurovsky, 2009), the environmental evaluation index (*Ie*) can be determined taking into account three categories of environmental policy: 1) ecological systems (I_{SYS}); 2) environmental load (I_{STR}); 3) regional environmental management (I_{REG}). These categories contain 13 parameters and 44 indicators.

An indicator of sustainable development is an indicator that reflects economic, social,

and/or environmental development in a particular region, and has such properties as ease of interpretation, wide range, sensitivity to change, quantification and allows to make forecasts and identify trends in time (Zgurovsky, 2009).

The category "Ecological systems" includes 6 indicators (air I_{AIR}, biodiversity I_{VIO}, land I_{LAN}, water quality I_{WQL}, water quantity I_{WQN}, radiation, and environmental hazard I_{RAD}), as well as 20 parameters in its composition. The category "Environmental load" contains 4 indicators (air emissions I_{EMS}, load on ecosystems I_{ECO}, generation and use of waste I_{WST}, water load I_{WAT}) and 19 parameters. The category "Regional environmental management" contains 3 indicators (participation in I_{COL} environmental projects, greenhouse gas emissions I_{GHG}, transboundary environmental pressure I_{GPC}) and 5 parameters (Zgurovsky, 2009).

It should be noted that these indicators and parameters are in fact indicators of technogenic load on individual components of the environment and the state of ecosystems in general. This applies, first of all, to indicators of emissions and discharges of pollutants, waste generation and accumulation, water consumption, and drainage, land use indicators, etc. Therefore, the assessment of the ecological condition of any territory with the use of the index of ecological measurement according to the MMSD can also be considered a result of the assessment of technogenic load.

The paper (Matviychuk & Sidoruk, 2018) proposes a model of a comprehensive system of environmental safety indicators in Ukraine. It should be noted that the environmental parameters included indicators of natural and technogenic hazards. Besides, the proposed model also includes economic and social indicators, i.e. the authors also consider the environmental safety of the state from the standpoint of sustainable development.

The analysis of literature sources (Zgurovsky, 2009; Prischepa & Klimenko, 2009; Harris, 2000; NISS, 2012) showed that there is no single methodological approach to assessing the ecological status of regions in terms of sustainable development. Thus, from the standpoint of assessing the technogenic load on the environment, the most optimal is the method proposed in the paper (Zgurovsky, 2009). Based on the above, the work aims to assess the state of the environment of the regions of the North-Western Black Sea Coast (NWBSC) on the indicators of sustainable development as factors in assessing the technogenic load.

Results and Discussion

The recommendations for calculating the environmental evaluation index (*Ie*) state that the parameters and indicators of the environmental evaluation are balanced averages (Zgurovsky, 2009). In this case, none of the parameters is assigned a weighting factor. Also, it is noted that assigning certain weights to environmental parameters is a difficult task. Statistical methods have shown almost equivalent weights of individual parameters within the indicators to which they are included.

Analysis of the initial information on the values of individual parameters of the environmental evaluation showed that the above statement (Zgurovsky, 2009) is somewhat erroneous. Thus, in some cases, the parameters have equivalent weights, such as air indicator (I_{AIR}), which is defined as the weighted average of the concentrations of nitrogen dioxide, sulfur dioxide and dust (in units of maximum permissible concentrations). But if the concentrations of pollutants are greater than the maximum allowable concentrations, then when calculating the I_{AIR} in the summation (according to the method of Zgurovsky, 2009) the result may exceed 1. In this case, it is not a confirmation of the best indicators of sustainable development. Similar conclusions can be made for other indicators, which sum up the values with quite different units of measurement. Such illustrative examples are indicators of land (I_{LAN}), load on ecosystems (I_{ECO}), where individual

parameters are measured in points, square kilometers, percentages, hectares per capita, cubic meters per capita, etc.

For the analysis of 44 proposed parameters of the environmental evaluation, we used 27 to assess the sustainable development of the regions of the NWBSC. Note that the assessment was conducted based on analysis of individual parameters and in some cases without calculation of environmental measurement indicators. For analysis, the original data were normalized so that all parameters took values from 0 to 1 using the principle of linear normalization:

$$\tilde{x}_i = \frac{x_i - x_{min}}{x_{max} - x_{min}}. \quad (1)$$

The analysis of the obtained normalized values showed that the minimum indicators in the vast majority characterize the best conditions, and the maximum - the worst. That is, the best conditions for sustainable development indicators, in this case, are characterized by indicators close to 0. Only for some parameters that we took into account (I_{PZF}, I_{EF1}, I_{EF2}, I_{EF3}, and I_{ORG}), it is fair to say that close to 1 values characterize the best conditions of sustainable development (Zgurovsky, 2009). Therefore, to unify the calculations, all parameters were reduced to such a form that their best values are close to 0.

The results of the ranking of the areas of NWBSC by individual indicators of the environmental evaluation of sustainable development are shown in Table 1.

As can be seen from Table 1, most often according to the list of the above parameters, the Odessa region is in the red zone (the one with the worst indicators of the ecological component of sustainable development), Kherson region, however, is in the green zone (the one with the best indicators). Although within certain categories of environmental policy on the worst indicators, such distribution differs.

Considering the principle of calculating environmental indicators and categories of environmental policy (Zgurovsky, 2009), we calculated indices for two categories of policy - environmental systems and environmental load. The spatial representation of these policy categories is shown in Fig. 1, 2.

The analysis of the presented figures shows that in the category of ecological policy "Ecological systems" (see Fig. 1) the best conditions of sustainable development are noted in the Mykolayiv region, the least good - in Odessa. Such an unfavorable situation in the Odessa region is due to such indicators as the content of sulfur dioxide and dust in the air, the spread of exogenous geological processes, high rates of disturbed and exhausted lands, nitrate content in the aquatic environment, the presence of a significant number of environmentally hazardous enterprises.

In the category "Environmental load" (see Fig. 2) the best conditions were observed for the Kherson region, the least good - also for Odessa. In this case, this situation is formed due to higher indicators of polluting emissions into the atmosphere, lower rates of arable land and forests, significant volumes of return water discharges. It was interesting to compare the results of the assessment of the categories of environmental policy for (Zgurovsky, 2009) for the territories of Ukraine, including the regions of the NWBSC with our results (Table 2).

The table shows that without taking into account the obtained numerical values, the general situation has not changed significantly. The most unfavorable situation from the standpoint of sustainable development in both categories of policy among the territories of the NWBSC is observed for the Odessa region. In the category of policy "Ecological systems" indicators for the Kherson area worsened and for the Mykolayiv area improved. In the category of policy "Environmental burden," the distribution of indicators has not changed.

The results of the general assessment of the index of ecological evaluation of sustainable development, considering all the indicators taken into account during the analysis are shown in Fig. 3. The analysis of the presented figure shows that the most unfavorable environ-

Table 1. Ranking of the territories of the North-Western Black Sea Coast according to the indicators of the ecological evaluation of sustainable development (2014 – 2018).

Index	Odessa region	Mykolayiv region	Kherson region
"Ecological systems" I_{SYS} policy category			
I_{NO2} (NO_2 concentration)	0.23	0	1
I_{SO2} (SO_2 concentration)	1	0.14	0
I_{TCP} (dust concentration)	1	0.33	0
I_{PZF} (NRF objects)	0.77	1	0
I_{EGP} (spread of exogenous geological processes)	1	0.79	0
I_{EXH} (worked and re-cultivated lands)	1	0.67	0
I_{NIT} (nitrate concentration)	1	0	0.23
I_{MIN} (mineralization)	0	1	0.45
I_{WAV} (water abstraction from natural sources per 1 person)	0.22	0	1
I_{GAV} (water intake from underground sources per 1 person)	0.16	0	1
I_{RHZ} (potential radiation hazard)	0	1	0
I_{IHZ} (environmentally hazardous enterprises)	1	0	1
"Environmental load" I_{STR} policy category			
I_{NOX} (N_{OX} emissions)	0.67	1	0
I_{SOT} (SO_2 emissions)	1	0.26	0
I_{CAR} (emissions from motor vehicles)	1	0	0.02
I_{EKM} (emissions per 1 km^2)	1	0.09	0
I_{EPC} (emissions per 1 person)	0.81	1	0
I_{EF1} (arable land)	1	0.29	0
I_{EF2} (hayfields and pastures)	0.775	0	1
I_{EF3} (forests and wooded areas)	1	0.64	0
I_{EF4} (built-up land)	0	1	0.23
I_{EF5} (use of freshwater per 1 person)	0	0.09	1
I_{ACC} (waste accumulation)	0.18	1	0
I_{WKM} (generation of wastes of I - III classes of danger on 1 km^2)	0	1	0.63
I_{WPC} (generation of wastes of I - III hazard classes per 1 person)	0	1	0.82
I_{REW} (discharge of return water into surface water entities)	1	0.11	0
"Regional Environmental Management" I_{REG} policy category			
I_{ORG} (public environmental organizations)	0	1	0.18

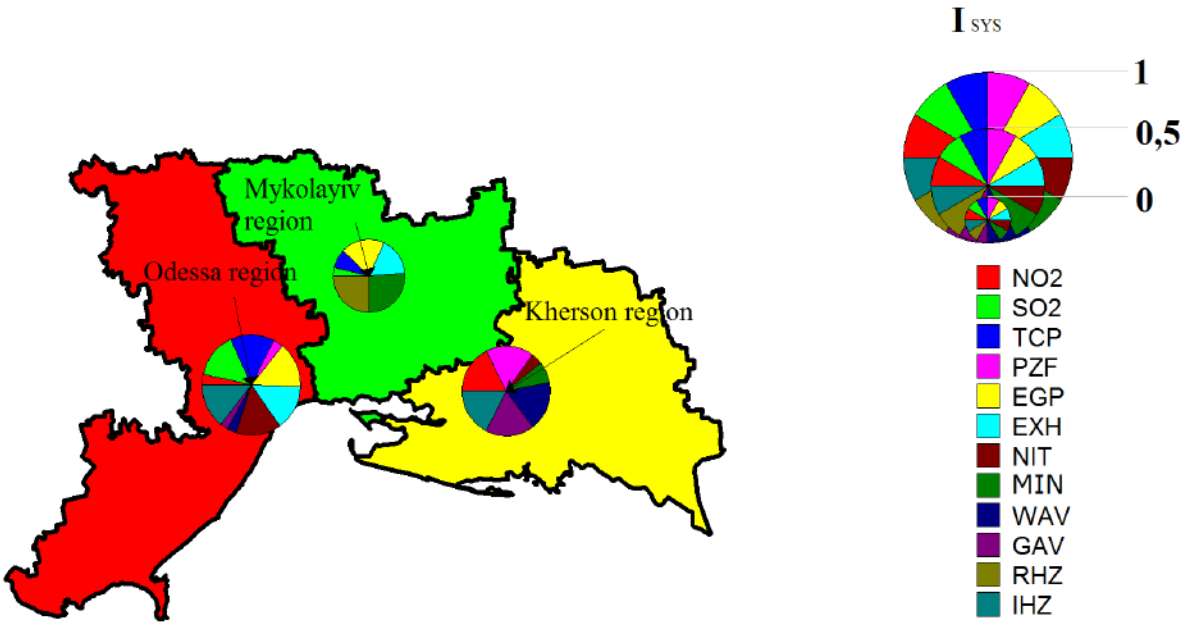

Fig. 1. Spatial distribution of the I_{SYS} index of the category "Ecological systems" for the territories of the North-Western Black Sea Coast (2014 – 2018).

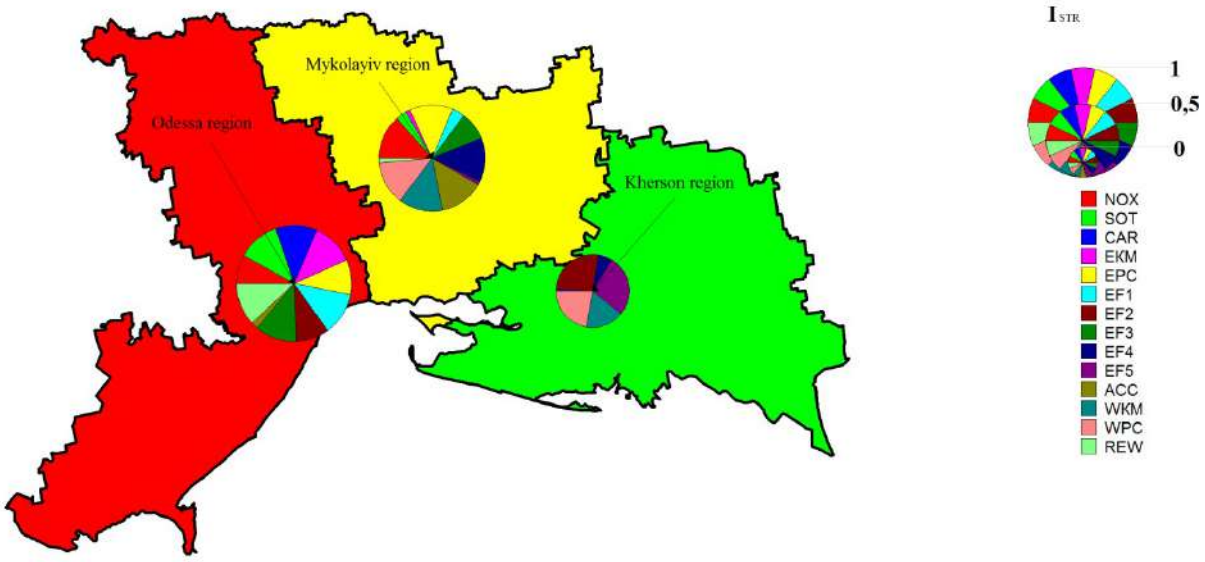

Fig. 2. Spatial distribution of the I_{STR} index of the category "Ecological load" for the territories of the North-Western Black Sea Coast (2014 – 2018).

mental situation from the standpoint of sustainable development is observed in the Odessa region. Kherson region is characterized by the best conditions for sustainable development of the region. It should be noted that among all the analyzed indicators, the category of policy "Environmental load" plays a predominant role.

One of the prerequisites for sustainable development is the minimization of technogenic load on certain components of the environment, the main directions of which can be considered the following measures:

Table 2. Comparative analysis of the assessment of environmental policy categories of the North-Western Black Sea coast.

Region	Category "Ecological systems"		Category "Ecological load"	
	2006 (20 indicators, Zgurovsky, 2009)	2014 – 2018 (12 indicators, from authors)	2006 (19 indicators, Zgurovsky, 2009)	2014 – 2018 (14 indicatorss, from authors)
Odessa region	0.418	0.699	0.753	0.603
Mykolayiv region	0.588	0.327	0.828	0.533
Kherson region	0.602	0.473	0.915	0.265

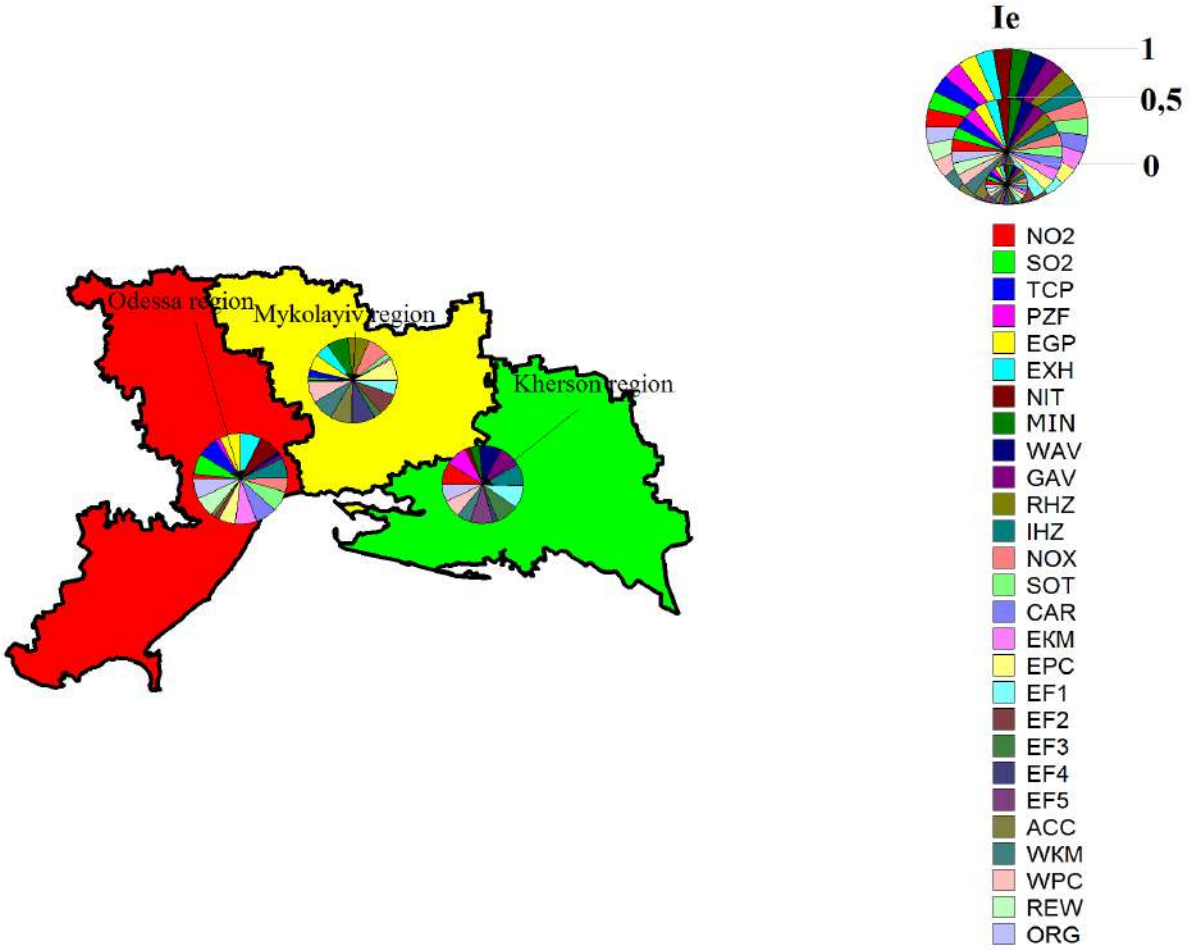

Fig. 3. Spatial distribution of the index of ecological evaluation of sustainable development *Ie* for the territories of the North-Western Black Sea Coast (2014 – 2018).

1) optimization of the monitoring network of the air basin, water entities, soil cover, and geological environment following modern EU requirements, organization of systematic observations of physical pollution under the influence of technogenic objects;

2) increasing the level of environmental safety of stationary sources of air pollution by improving technological processes, air protection measures, streamlining the configuration of sanitary protection zones, creating "green belts" around industrial and urban agglomerations, etc.;

3) given the dominance of mobile sources, the redistribution of traffic flows requires justification from the standpoint of logistics, the creation of a system of high-speed public transport, green boulevards with low traffic;

4) improving the efficiency of wastewater and other return water treatment, creating a system for drainage and treatment of stormwater, which is a powerful source of pollution of the coastal zone of the North-Western Black Sea, improving the technical condition of worn-out main and distribution networks that provoke high levels of secondary drinking water pollution;

5) limitation of the negative impact on the pollution of the soil cover and other natural environments of the accumulators of industrial toxic waste and numerous landfills of solid household waste;

6) creation of necessary capacities for processing, treatment of neutralization, and utilization of hazardous waste;

7) improvement of the system of management and treatment of solid household waste, which accounts for more than 90 % of the sum of all waste in the study area;

8) restriction of forms of economic activity that provoke the development of dangerous exogenous geological processes.

Conclusions

The conducted researches allow us to draw the following conclusions:

1) The analysis of indicators of the index of ecological measurement showed that most of them are used including for an assessment of a condition and technogenic loading on components of the environment;

2) Along with the indicators of the MMSD, the level of sustainable development of countries can be determined by UN recommendations, scientific developments of domestic and foreign scientists;

3) The analysis of the MMSD revealed that the authors' statement about the balance of parameters and indicators of the environmental measurement index is erroneous (analysis of the obtained normalized values showed that the minimum indicators characterize the best conditions and the maximum - the worst, in contrast to these conditions in the MMSD);

4) According to the results of ranking the territories of the North-Western Black Sea coast by individual indicators of ecological evaluation of sustainable development, it was found that most often the zones with the worst indicators of the ecological component of sustainable development included the Odessa region and the zones with the best indicators - Kherson region;

5) In the category of ecological policy "Ecological systems" the best conditions of sustainable development are noted in the Mykolayiv area, the least good - in Odessa region. In the category "Environmental load", respectively, the best conditions were noted for the Kherson region, the least - also for Odessa region;

6) In general, the most unfavorable environmental situation from the standpoint of sustainable development among the territories of the North-Western Black Sea Coast is observed in the Odessa region. Kherson region is characterized by the best conditions for sustainable development of the region, and among all the analyzed indicators, the category of policy "Environmental load" plays a predominant role.

7) In order to ensure the sustainable development of the study areas it is

necessary to implement a set of technical and technological solutions that will minimize the technogenic load on individual components of the environment.

References

Alexandrov, I., Polovyan, O., Konovalov, O., Logacheva, O., & Tarasova, M. (2010). The strategy of sustainable development of the region: monograph. Donetsk, Ukraine: "Noulidzh" Publishing House. (In Ukrainian).

Danilov-Danilyan, V., & Losev, K. (2000). *Environmental challenge and sustainable development.* Moscow, Russia: Publishing house MNEPU. (In Russian).

Doroguntsov, S., & Ralchuk, O. (2001). Sustainable development - a civilizational dialogue of nature and culture. *Bulletin of the NAS of Ukraine*, *10*, 17. (In Ukrainian).

Emas, R. (2015). The Concept of Sustainable Development: Definition and Defining Principles. Retrieved from sustainabledevelopment.un.org.

Geets, V. (2000). *Instability and economic growth.* Kyiv, Ukraine: Institute of Economic Forecasting. (In Ukrainian).

Harris, J. (2000). Basic Principles of Sustainable Development. Retrieved from ase.tufts.edu.

Haustova, V., & Omarov, Sh. (2018). The concept of sustainable development as a paradigm of society. *Problems of Economics*, *1*(35), 265–273. (In Ukrainian).

Klimenko, M., & Klimenko, L. (2010). *Sustainable development strategy.* Textbook. Rivne, Ukraine: NUVGP. (In Ukrainian).

Kutsenko, V., Udovychenko, V., & Ostafiychuk, J. (2013) *Social vector of sustainable development (questions of theory and practice): monograph.* Chernihiv, Ukraine: Publisher Lozovy V.M. (In Ukrainian).

Law of Ukraine. (2018). Draft Law of Ukraine "On the Strategy of Sustainable Development of Ukraine until 2030". Retrieved from search.ligazakon.ua. (In Ukrainian).

Matviychuk, N., & Sidoruk, S. (2018). Formation of a system of indicators of ecological safety of Ukraine. *Sustainable economic development*, 1(38), 113–119. (In Ukrainian).

Mensah, J. (2019). Sustainable development: Meaning, history, principles, pillars, and implications for human action: Literature review. *Cogent Social Sciences, 5*, 1–21. doi: 10.1080/23311886.2019.1653531.

Molokanova, V. (2018). Monitoring the practical implementation of sustainable development strategy in Ukraine. *Aspects of Public Administration*, *6*(11-12), 85-92. (In Ukrainian). doi: 10.15421/151877.

NAS of Ukraine. (2007). The goal is the sustainable development of Ukraine. The concept of Ukraine's transition to sustainable development. *Bulletin of the National Academy of Sciences of Ukraine*, *2*: 14-44. (In Ukrainian).

Necos, A., & Soloshych, I. (2014). A comprehensive evaluation of regional development as a component of the green economy implementation. *Current economic problems, 5,* 247- 251.

NISS. (2012). Indicators of the condition of ecological security of the country. Analytical note. Retrieved from niss.gov.ua. (In Ukrainian).

Pidlisnyuk, V. (2001). Sustainable development of society: 25 questions and answers. Explanatory manual. Pidlisniuk, V.V. (Ed.). Kyiv, Ukraine: Polygraph Express. (In Ukrainian).

Powe, N. (2020). Sustainable development, sustainability and research within the Journal of Environmental Planning and Management. *Journal of Environmental Planning and Management*, *63*(9), 1523-1527. doi: 10.1080/09640568.2020.1753409.

President of Ukraine. (2019). Decree of the President of Ukraine "On the Sustainable Development Goals of Ukraine until 2030". Retrieved from zakon.rada.gov.ua. (In Ukrainian).

Prischepa, A., & Klimenko, L. (2009). *Methodical recommendations for calculating the index of socio-economic and ecological development of the district*. Rivne, Ukraine: NUVGP. (In Ukrainian).

Rudenko, L. (2001). Sustainable development: search for models for Ukraine. In "*Problems of sustainable development of Ukraine*". Kyiv, Ukraine: BMT. (In Ukrainian).

Shapar, A. (2009). Modern large-scale environmental problems in the context of sustainable development. *Ecology and nature management, 12,* 6-9. (In Ukrainian).

Smirnova, I., & Mykhailyuta, E. (2018). Sustainable development in Ukraine: theoretical aspects. *Economic Bulletin of Donbass*, *1*(51), 10-14. (In Ukrainian).

United Nations. (2015). *The 17 Goals*. Retrieved from sdgs.un.org.

Wan, X., Yang, X., Wen, Q., Gang, J. & Gan, L. (2020). Sustainable Development of Industry–Environmental System Based on Resilience Perspective. *International Journal of Environmental Resources and Public Health, 17*(2), 645. doi: 10.3390/ijerph17020645.

Zgurovsky, M. (2009). Sustainable development of the regions of Ukraine / Scientific adviser Zgurovsky M.Z. Retrieved from nung.edu.ua. (In Ukrainian).

Received: 31.01.2021
Accepted: 03.03.2021

Reviewers Acknowledgment

Peer reviewers are key to advancing scholarship and contributing to the quality of scholarly journals. We would like to thank the following reviewers who have taken part in the peer-review process for vol. 13, iss. 1, 2021 of Ecologia Balkanica.

Albena Vlasseva - Bulgarian Academy of Sciences, Institute of Biodiversity and Ecosystem Research (BULGARIA)
Alexander Pulev – Faculty of Nature and athematical Science, South-West University "Neofit Rilski" – Blagoevgrad (BULGARIA)
Ben Maskrey - Centre for Environment, Fisheries and Aquaculture Science (UK)
Bince Mani - St.Thomas College, Palai, Department of Botany (INDIA)
Carla Albuquerque de Souza - Núcleo de Estudos e Pesquisas Ambientais e Limnológicas, Faculdade UnB de Planaltina (BRAZIL)
Dilian Georgiev - Plovdiv University, Faculty of Biology, Department of Ecology and EC (BULGARIA)
Dimitar Plachiyski - Bulgarian Society for the Protection of Birds (BULGARIA)
Dobromir Dobrev - Bulgarian Society for the Protection of Birds (BULGARIA)
Duško Ćirović - Faculty of Biology, University of Belgrade (SERBIA)
Gopa Mitra - Central Institute of Freshwater Aquaculture (INDIA)
Hyacinth Highland - Department of Zoology, Biomedical Technology and Human Genetics, Gujarat University, Ahmedabad, Gujarat (INDIA)
Igor Resnick - Hebrew University of Jerusalem, Jerusalem (ISRAEL)
Israel Marquez - Department of Marine Sciences, University of South Alabama (USA)
Iuliia Vasheniak - Vasyl' Stus Donetsk National University (UKRAINE)
Ivan Iliev - Plovdiv University, Faculty of Biology, Department of Biochemistry and Microbiology (BULGARIA)
Ivanka Dimitrova - Department of Botany, Faculty of Biology, Plovdiv University (BULGARIA)
Ivelin Mollov - Plovdiv University, Faculty of Biology, Department of Ecology and EC (BULGARIA)
Joanna Czarnecka - UMCS, Faculty of Biology and Biotechnology, Ecology Department (POLAND)
Joseph Hun-wei Lee - The Hong Kong University of Science and Technology, School of Engineering (CHINA)
Kerim Cicek - Biology Department, Ege University (TURKEY)
Kiril Stoyanov - Agricultural University - Plovdiv (BULGARIA)
Kishor Rajput - Department of Botany, Faculty of Science, The Maharaja Sayajirao University of Baroda (INDIA)
Marius Skolka - Ovidius University of Constanta, Faculty of Natural and Agricultural Sciences (ROMANIA)
Myroslva Malovanyy - Ecology and Sustainable Environment Department, Lviv National Polytechnic University (UKRAINE)
Qaisar Mahmood - Department of Environmental Sciences COMSATS University Islamabad (PAKISTAN)
Rajib Gogoi - Botanical Survey of India (INDIA)
Rosani do Carmo de Oliveira Arruda - Centro de Ciências Biológicas e da Saúde, Universidade Federal de Mato Grosso do Sul (BRAZIL)
Tatiana Ivanova - Agrocultural Institute – Plovdiv (BULGARIA)
Tim Arciszewski - Alberta Environment and Parks (USA)
Torbjörn Tyler - Lund University, Department of Biology (SWEDEN)
Valentina Pidlisnyuk - Department of Technical Sciences, University of Jan Evangelista Purkyně (CZECH REPUBLIC)
Viliana Vasileva - Agricultural Academy, Institute of Forage Crops (BULGARIA)
Vinay Kumar - ICAR- National Institute of Biotic Stress Management, Ministry of Agriculture & Farmers Welfare (INDIA)
Wojciech Krztoń - Institute of Nature Conservation, Polish Academy of Sciences, Kraków (POLAND)

ECOLOGIA BALKANICA - INSTRUCTIONS FOR AUTHORS (2020)

General information

Submissions to "*Ecologia Balkanica*" can be original studies dealing with all fields of ecology, including ecology and conservation of microorganisms, plants, animals, physiological ecology, behavioral ecology, population ecology, population genetics, community ecology, ecosystem ecology, parasitology, animal evolution, ecotoxicology, ecological monitoring and bioindication, landscape and urban ecology, conservation ecology, as well as new methodical contributions in ecology. **The journal is dedicated to publish studies conducted on the Balkans and Europe.** Studies conducted anywhere else in the world maybe accepted only as an exception after decision of the Editorial Board and the Editor-In-Chief. ***The Editorial Board of "Ecologia Balkanica" reserves its right to reject publication of any manuscript which does not fit the aim and scope or does not comply with these instructions.***

Manuscript submission

The following types of manuscripts are accepted: *short research notes* (up to 4 pages), *research articles* (4 to 10 pages) and *review papers* (10 to 20 pages). *Short research notes* are shorter submissions of a preliminary nature or those including new records or observed phenomenon, etc. *Research articles* should present significant original research in the various fields of ecology, mentioned above. *Review papers* should deal with topics of general interest or of contemporary importance, being synthetic rather than comprehensive in emphasis. Authors of review papers should consult with the Editor before submission. The Editor may also invite review articles concerning recent developments in particular areas of interest. The Editor reserves the right to decide if a manuscript should be treated as a short note or research article. In general, studies that are purely descriptive, mathematical, documentary, and/or natural history will not be considered for publication.

Manuscripts must conform strictly with the instructions for authors and sent to the Editor. **All manuscripts must be accompanied with a cover letter, signed by ALL authors,** which can be downloaded from here. All fields from the cover letter form must be filled out and the cover letter must be sent along with the full text of the manuscript to the journal's e-mail. Incoming manuscripts are initially judged by the Editor. *Manuscripts may be rejected without peer review if they do not comply with the instructions to authors or are beyond the scope of the journal.* If the manuscript is acceptable, it will be forwarded to referees for evaluation. All manuscripts are peer-reviewed by 2 or 3 independent reviewers. After final edition and approval by the Editorial Board, the manuscript will be accepted for publication. The Editor reserves the right to make editorial changes. The authors agree, after the manuscript's acceptance, with the transfer of copyright to the publisher.

Legal requirements

Ecologia Balkanica follows the standards for Ethics and Publication Malpractice set by the Committee on Publication Ethics (COPE). Conformance to standards of ethical behavior is therefore expected of all parties involved: authors, reviewers, editors, and the publisher. Submission of a manuscript implies: that the work described has not been published previously (except in the form of an abstract, or as part of a published lecture, or thesis); that it is not under consideration for publication anywhere else; that its publication has been approved by all co-authors, if any, as well as by the responsible authorities - tacitly or explicitly - at the institute where the work has been carried out. The publisher will not be held legally responsible should there be any claims for compensation.

Manuscript preparation

Language
The manuscripts must be written in English. *Contributors who are not native English speakers are strongly advised to ensure that a colleague fluent in the English language*, if none of the authors is so, *has reviewed their manuscript.* Spelling should be British or American English and should be consistent throughout the text. All abbreviations and acronyms should be defined at first mention. To facilitate reader comprehension, abbreviations should be used sparingly.

Technical information
Submissions must be in **electronic version only**, as well as the original figures and tables, implemented in the text. Figures must be sent as separate files as well (see more information below). The manuscript text should be **prepared in rich text format (.rtf)**, justified, font size 11, font "Book Antiqua", without footnotes, column or page breaks, single spaced (about 60 lines per page), on A4 (210 x 297 mm) paper, with margins of exactly 2.5 cm on each side. Pages and lines should not be numbered.

The manuscripts should conform to the following format:
Title: Provide a title that is concise, but also an informative synthesis of the study. Where appropriate, include family or higher taxon.
Author(s): Full first name(s), middle initials and surname(s) in ***bold italic.*** The corresponding author should be marked with the *-symbol.
Affiliation(s) with postal address: As complete as possible. Affiliation should be given in the following order – University (Institute), Faculty, Department, postal address, city, COUNTRY (in capital letters). E-mail address is given only for the corresponding author!
Abstract: Maximum length 250 words. The abstract should state briefly the objective of the research, the primary results and major conclusions, with no description of methods, discussions, references and abbreviations.
Key words: Usually 3–10 words suitable for information-retrieval system.

The standard order of sections should be: Abstract, Key words, Introduction, Material and Methods, Results, Discussion (or Results and Discussion), Conclusions (optional), Acknowledgements (optional) and References.

The *Introduction* has to explain the actuality of the researched problem and give the aim of the study.
Materials and Methods have to provide sufficient information to permit repetition of the experiment and/or fieldwork. The technical description of study methods should be given only if such methods are new; otherwise a short presentation is enough.
The *Results* section must be a concise presentation of the finding of the study. **Avoid presentation of the same information as text and/or figure and/or table!**
The *Discussion* section should be separated from the results section at full-length papers and should deal with the significance of the results and their relationship to the aims of the paper. Also include how the findings of the paper will change or influence the state of our knowledge about the topic at hand. In separate cases a joint section "Results and Discussion" is allowed, but not preferable.
The *Conclusions* should shortly describe the main contributions and recommendations of the study without including citations and statistics.
In the *Acknowledgements* section all persons and organizations that helped during the study in various ways, as well as the organization that financed the study must be listed.

Short Notes (generally less than four-five manuscript pages) should be produced as continuous text, preceded by an abstract of no more than 150 words.

Tables: The tables must not repeat information already presented in the figures or in the text. Each table must be self-explanatory and as simple as possible. Avoid large landscape oriented tables! Tables must be numbered consecutively. **They should be placed within the text at the desired position by the author(s).** An explanatory caption, located on the top of the table, should be provided.

Example:

Table 1. Shannon-Wiener indexes in the burned ($\mathbf{H}_{burned}$) and control ($\mathbf{H}_{control}$) territory for the total duration of the study (2004–2006).

Figures: They must not repeat information already presented in the tables or in the text. Lines and letters in figures must be able to be enlarged or reduced without reduction in quality. They should conform to the size of the type area (up to 16 × 24 cm) which is the limit for all illustrations. Magnification should be shown by scale bars. All illustrations must be sharp, of high quality with at least 300 dpi. The following formats are acceptable: JPEG, PNG, TIFF, EPS. The figures must be numbered consecutively and should be provided with an explanatory legend below them. *When the figures present maps of the studied area, we recommend using some kind of GIS software for the preparation of the maps, or use of other indicative or topographical maps.* ***Satellite or aerial photos (especially from Google Earth) of the studied area will no***

longer be acceptable! **All figures must be placed within the text at the desired position by the author(s).**

Example:

Fig. 1. Indicative map of the study area.

All tables and figures must be referred to in the text!

Citations and references

From January 2020, Ecologia Balkanica adopts the APA (American Psychological Association) bibliographic style (7th edition – 2020).

APA Referencing Basics: In-Text Citation

In-text references must be included following the use of a quote or paraphrase taken from another piece of work. **Direct copy-paste from another source is not acceptable!** Submitted manuscripts will be pre-checked for plagiarism and auto-plagiarism. In-text citations are citations within the main body of the text and refer to a direct quote or paraphrase. They correspond to a reference in the main reference list. These citations include the surname of the author and date of publication only. For example: Smith (2017) states… Or …(Smith, 2017). In case of two authors: the surname of both authors is stated with an ampersand between. For example: Smith & Smith (2017) state… Or …(Smith & Smith, 2017). In case of three or more authors add „et al." after the first author's surname (*et alii*, from Latin means „and others"): Smith et al. (2017) state… Or …(Smith et al., 2017).

If the author of the cited source is unknown, the first few words of the reference should be used. This is usually the title of the source. If this is the title of a book, periodical, brochure or report, is should be italicised. For example: (*A guide to citation*, 2017). If this is the title of an article, chapter or web page, it should be in quotation marks. For example: ("APA Citation", 2017).

Citing authors with multiple works from one year:
Works should be cited with a, b, c etc. following the date. These letters are assigned within the reference list, which is sorted alphabetically by the surname of the first author. For example: (Smith, 2017a) Or (Smith, 2017b).
Citing multiple works in one parentheses:
If these works are by the same author, the surname is stated once followed by the dates in order chronologically. For instance: Smith (2007, 2013, 2017) Or (Smith, 2007, 2013, 2017)
If these works are by multiple authors then the references are ordered alphabetically by the first author separated by a semicolon as follows: (Brooks, 2000; Smith & Smith 2017; Swaen, 2015, 2017a, 2017b; Thomson et al., 2015).
Citing a group or organisation: (World Health Organization, 2015).

Examples:

A journal article

Citing a journal article in print:

Author, A. (Publication Year). Article title. *Periodical Title, Volume*(Issue), pp-pp.

Author, A., & Author, B. (Publication Year). Article title. *Periodical Title, Volume*(Issue), pp-pp.

Author, A., Author, B., & Author, C. (Publication Year). Article title. *Periodical Title, Volume*(Issue), pp-pp.

Citing an online journal article:

Author, A. (Publication Year). Article title. *Periodical Title, Volume*(Issue), pp-pp. doi:XX.XXXXX or Retrieved from URL

Author, A., & Author, B. (Publication Year). Article title. *Periodical Title, Volume*(Issue), pp-pp. doi:XX.XXXXX or Retrieved from URL

Author, A., Author, B., & Author, C. (Publication Year). Article title. *Periodical Title, Volume*(Issue), pp-pp. doi:XX.XXXXX or Retrieved from URL

Notes: When creating your online journal article citation, keep in mind: APA does NOT require you to include the date of access/retrieval date or database information for electronic sources. You can use the URL of the journal homepage if there is no doi number assigned and the reference was retrieved online. A doi (digital object identifier) is an assigned number that helps link content to its location on the Internet. It is therefore important, if one is provided, to use it when creating a citation. All doi numbers begin with a 10 and are separated by a slash.

A book

Citing a book in print:

Author, A. (Year of Publication). *Title of work.* Publisher City, Country: Publisher.

Author, A., & Author, B. (Year of Publication). *Title of work.* Publisher City, Country: Publisher.

Author, A., Author, B., & Author, C. (Year of Publication). *Title of work.* Publisher City, Country: Publisher.

Notes: When citing a book in APA, keep in mind: capitalize the first letter of the first word of the title and any subtitles, as well as the first letter of any proper nouns. The full title of the book, including any subtitles, should be stated and *italicized*.

Citing an e-book:

E-book is short for "electronic book." It is a digital version of a book that can be read on a computer, e-reader (Kindle, Nook, etc.), or other electronic device.

APA format structure:

Author, A. (Year of Publication). *Title of work*. Retrieved from http://xxxx or DOI:xxxx

Author, A., & Author, B. (Year of Publication). *Title of work*. Retrieved from http://xxxx or DOI:xxxx

Author, A., Author, B., & Author, C. (Year of Publication). *Title of work*. Retrieved from http://xxxx or DOI:xxxx

Citing edited book:
Author, A. (Ed.). (Year of Publication). *Title of work.* Publisher City, Country: Publisher.
Author, A., & Author, B. (Eds.). (Year of Publication). *Title of work.* Publisher City, Country: Publisher.
Author, A., Author, B., & Author, C. (Eds.). (Year of Publication). *Title of work.* Publisher City, Country: Publisher.

Book without known author:
Example: Management plan for the protected area for birds BG 0002086, "Rice Fields Tsalapitsa". (2013). Retrieved from https://plovdiv.riosv.com (In Bulgarian)

Proceedings or book chapter:
Author, A. (Year of Publication). Title of work. In A. Author (Ed.). *Title of the book or proceedings.* (Edition, pp. XX-XX). Publisher City, Country: Publisher.
Author, A., & Author, B. (Year of Publication). Title of work. In A. Author, & B. Author (Eds.). *Title of the book or proceedings.* (Edition, pp. XX-XX). Publisher City, Country: Publisher.
Author, A., Author, B., & Author, C. (Year of Publication). Title of work. In A. Author, B. Author, & C. Author (Eds.). *Title of the book or proceedings.* (Edition, pp. XX-XX). Publisher City, Country: Publisher.

Software:
Author, A. (Year of Publication). *Name of software*. Vers. XX. Retrieved from http://xxxx

Example:
StatSoft Inc. (2004). *STATISTICA (Data analysis software system)*, Vers. 7. Retrieved from http://www.statsoft.com

Website:
Author, A. (Year of Publication). *Title of page*. Retrieved from http://xxxx
In case of citing website with unknown author:
"Title of page". (Year of Publication). Retrieved from http://xxxx

European Directive:
Official European directives, issued from the European parliament and of the Council (EC) should be cited as follows (example):
EC. (2010). Directive 2010/63/EU of the European Parliament and of the Council on the protection of animals used for scientific purposes. *Official Journal of the European Union, L276,* 33-79. Retrieved from https://eur-lex.europa.eu/LexUriServ/LexUriServ.do?uri=OJ:L:2010:276:0033:0079:en:PDF

Legislation:
Official laws, orders etc. should be cited as follows (see examples).
Biological Diversity Act. (2002). *State Gazzette, 77*, 09.08.2002. (In Bulgarian).

Medicinal Plants Act. (2000). *State Gazette, 29,* 07.04.2000. (In Bulgarian).
Protected Areas Act. (1998). *State Gazette, 133,* 11.11.1998 (In Bulgarian).

In case of papers written in other than Latin letters, if there is an English (or German, or French) title in the summary, it is recommended to be used. If there is not such a summary, the author's names must be transcribed and the title of the paper must be translated into English. If the name of the journal is also not in Latin letters it also should be transcribed (not translated). This should be noted in round brackets at the end of the paragraph, for instance: (In Bulgarian, English summary).

Examples:

Angelov, P. (1960). Communications entomologiques. I. Recherches sur la nourriture de certaines espèces de grenouilles. *Godishnik na muzeite v grad Plovdiv, 3,* 333-337. (In Bulgarian, Russian and French summary).
Korovin, V. (2004). Golden Eagle (*Aquila heliaca*). Birds in agricultural landscapes of the Ural. Ekaterinburg, Russia: Published by Ural University. (In Russian).

Names of persons who provided unpublished information should be cited as follows: "(Andersson, 2005, Stockholm, pers. comm.)".

Unpublished theses (BSc, MSc, PhD, DSc) are not considered officially published scientific literary sources, therefore from January 2015, "*Ecologia Balkanica*" no longer allows citations of such references.

Citing references that are still "in press" is also considered frown upon, but not forbidden. If possible, please avoid using such references.

Additional requirements
For special symbols (Greek letters, symbols for male and female etc.) use the Symbol list on the Insert menu in Microsoft Word with the following preferable fonts: Symbol, Webdings, Wingdings, Wingdings 2 and Wingdings 3. Degree symbols (°) must be used (from the Symbol list) and not superscript letter "o" or number "0". Multiplication symbols must be used (×) and not small "x" letters. Spaces must be inserted between numbers and units (e.g., 3 kg) and between numbers and mathematical symbols (+, –, ×, =, <, >), but not between numbers and percent symbols (e.g., 45%).

Nomenclature and units. Follow internationally accepted rules and conventions: use the International system of units (SI). If other quantities are mentioned, give their equivalent in SI. Please use a standard format for the units and be uniform in the text, tables and figures. Please choose one of two possible styles: "m/s" or "m s-1". When using "m s-1" leave a space between the symbols.

Italic letters. The Latin genus and species names must be cited completely once in the text and should be typed in *italic*.

Statistics
Mean values should always be accompanied by some measure of variation. If the goal is to describe variation among individuals that contribute to the mean standard deviation (SD) must be used. When the aim is to illustrate the precision of the mean standard errors (SE) should be given. The last paragraph of Materials and Methods section should briefly present the significance test used. Quote when possible the used software. Real p values must be quoted both at significance or non-significance. The use of the sign is acceptable only at low values of p (e.g. $p<0.0001$).

Ethics
The authors of articles that are based on experiments that caused injuries or death of animals should explain and justify the grounds of the study and state that the scientific results of the study is at least in trade-off with the sufferings caused. In the Materials and Methods section of the manuscript, the authors should explain in detail and as precisely as possible the conditions of maintenance, transport, anaesthesia, and marking of animals. When available, references should be added to justify that the techniques used were not invasive. When alternative non-harming techniques exist, but were not used, the manuscripts may not be considered for publication.

Proofs and Reprints
Proof will be sent to the **first (or corresponding) author** for checking (a PDF file) only once and it should be returned without delay. Corrections should be limited to typographical errors. No additional changes of the manuscript are allowed. Following publication, the first (or corresponding) author will be provided with electronic copy (PDF) of the article. Hardcopy reprints are no longer sent to the authors, since 2011.

E-mail: ecologia_balkanica@abv.bg