



**20<sup>th</sup> INTERNATIONAL MULTIDISCIPLINARY  
SCIENTIFIC GEOCONFERENCE - SGEM 2020**

**8 – 11 December, 2020 - Vienna, Austria**

---

**CONFERENCE PROCEEDINGS OF SELECTED ARTICLES  
SCIENCE AND TECHNOLOGIES IN GEOLOGY, OIL AND GAS  
EXPLORATION, WATER RESOURCES, FOREST ECOSYSTEMS  
ISSUE 1.3**

- ❖ OIL AND GAS EXPLORATION
- ❖ HYDROLOGY AND WATER RESOURCES
- ❖ FOREST ECOSYSTEMS

## **DISCLAIMER**

All SGEM Conference proceedings papers have been subjected to a double-blind peer review process, performed by three international reviewers/scientists before acceptance – organized by cloud based Abstract and Manuscript Management System (AMMS) that secures details of anonymous uploading and review process. Its main purpose is to evaluate the validity, quality and originality of the articles sent for publication, as well as to support the integrity of science by filtering out invalid writings or writings of poor quality or plagiarism.

Authors are responsible for the content and accuracy of the written papers. Opinions expressed not meant to represent or reflect the position of the SGEM International Scientific Committee members.

No part of this book may be reproduced or transmitted in any form or by any means, electronic or mechanical, for any purpose, without the express written permission of the SGEM International Scientific Committee on Earth and Planetary Sciences.

Copyright © SGEM WORLD SCIENCE (SWS) Society 2020  
10/11 Gerlgasse, Vienna 1030, Austria  
Published by STEF92 Technology  
Total print: 5000

E-mail: [science@sgemviennagreen.org](mailto:science@sgemviennagreen.org) | URL: [www.sgemviennagreen.org](http://www.sgemviennagreen.org)

**ISBN 978-619-7603-17-0**

**ISSN 1314-2704**

**DOI: 10.5593/sgem2020V/1.3**

**International Multidisciplinary Scientific GeoConferences “Surveying, Geology and Mining, Ecology, Management” SGEM are organized by the SWS Scholarly Society** – international scholarly community of world scientists, researchers and educators from universities and academies of sciences, that have the ideal goal of creating a unique international multidisciplinary platform for scientific exchange, share experiences and research results on all aspects of Earth and Planetary Sciences.

---

**With the Scientific Support of SWS Scholarly Society Partners**

---

- **Latvian Academy of Sciences, Latvia**
- **Russian Academy of Sciences, Russia**
- **Czech Academy of Sciences, Czech Republic**
- **Czech Council of Scientific Societies, Czech Republic**
- **Croatian Academy of Sciences and Arts, Croatia**
- **Turkish Academy of Sciences, Turkey**
- **Academy of Agricultural and Forestry Sciences, Latvia**
- **National Academy of Sciences of Armenia, Armenia**
- **Georgian National Academy of Sciences, Georgia**
- **Montenegrin Academy of Sciences and Arts, Montenegro**
- **Science Council of Japan, Japan**

---

**SWS Scholarly Society ADVISORY BOARD**

---

**PROF. DR. HABIL. ART OJARIS SPARITIS**

President of the Latvian Academy of Sciences

**ACAD. PROF. DSC. VALERIY BONDUR**

Vice-president of the Russian Academy of Sciences

**PROF. MIRKO ORLIC, FCA**

Croatian Academy of Sciences and Arts

**ACAD. PROF. DSC. BAIBA RIVŽA**

President of the Academy of Agricultural and Forestry Sciences of Latvia

**ACAD. RADIK M. MARTIROSYAN**

President of the National Academy of Sciences of Armenia

**ACAD. GIORGI KVESITADZE**

President of the Georgian National Academy of Sciences

**ACAD. DRAGAN K. VUKČEVIĆ**

President of the Montenegrin Academy of Sciences and Arts

**PROF. DR. MUZAFFER ŞEKER**

President of the Turkish Academy of Sciences (TÜBA)

**SGEM International Scientific Committee on Earth and Planetary Sciences**

*\* alphabetically sorted by family name*

**Acad. Prof. DSc. Valeriy Bondur**

Vice President of the Russian Academy of Sciences, Russia

**Prof. Geol. Dr. Gerardo Brancucci**

Università di Genova, Italy

**Prof. DSc. Andrejs Cekulis**

University of Latvia, Latvia

**Distinguished Professor DSc. Tien-Hui Chiang**

UNESCO, Zhengzhou University, China

**Prof. Dr. Nikoloz Chikhradze**

G. Tsulukidze Mining Institute (TMI), Georgian Academy of Sciences

**Prof. DSc. Kirill Chistyakov**

Vice-President of Russian Geographical Society, Russia

**Prof. Dr. Greet Deruyter**

Ghent University, Belgium

**Prof. DSc. Stefan Dimov**

University of Birmingham, UK

**Prof. DSc. Raimonds Ernsteins**

UNESCO, University of Latvia, Latvia

**Prof. Dr. Peter Frigaard**

Aalborg University, Denmark

**Prof. DSc Sergey Gandzha**

South Ural State University, Russia

**Prof. Dr. Dr.h.c. Slaveyko Gospodinov**

University of Architecture, Civil Engineering and Geodesy, Bulgaria

**Prof. Dr. Dr. Habil Dusan Huska**

Slovak University of Technology, Slovakia

**Assoc. Prof. Dr. Alexander Ivanov**

Nizhniy Novgorod state University of Architecture and Civil Engineering

**Prof. Dr. Dr.h.c. Krystyna Januszkiewicz**

Poznan University of Technology, Poland

**Prof. Dr. Jan Kaźmierczak**

Silesian University of Technology, Polish Academy of Sciences, Poland

**Prof. DSc Yevgeniy A.Kontar**

University of Illinois, Federal GEOS Funding (USA)

**Prof. Dr. İsmail Koyuncu**

Turkey Academy of Sciences (TÜBA) - Earth & Planetary Sciences, Turkey

**Prof. Dr. Michail Lavrentiev**

Novosibirsk State University, Russian Academy of Sciences/Siberian Branch, Russia

**Prof. Dr. Steffen Lehmann**

University of Nevada, Las Vegas, USA

**Prof. DSc. Nikolay Leonyuk**

Moscow State University, Russia

**Prof. DSc. Mirela Mazilu**

University of Craiova, Romania

**Prof. Dr. Rui Moura**

University of Porto, Portugal

**Prof. Dr. Androula Nassiopoulou**

UNESCO, Institute of Nanoscience & Nanotechnology, Greece

**Prof. Dr. Ing.Karel Pavelka**

Czech Technical University in Prague, Czech Republic

**Prof. Dr. Elena Peneva**

University of Architecture, Civil Engineering and Geodesy, Bulgaria

**Prof. DSc. Baiba Rivza**

University of Life Sciences and Technologies and Latvian Academy of Science

**Prof. Dr. Tiberiu Rus**

Technical University of Civil Engineering, Romania

**Prof. DSc. Viktor Savinuh**

President of the Association of Russian Universities, Russia

**Prof. Dr. Dr.h.c. Harald Schuh**

GFZ German Research Centre for Geosciences, Germany

**Prof. Dr. Dr.h.c. Michael Sideris**

University of Calgary, Canada

**Prof. Dr. Rodney Stevens**

University of Gothenburg, Sweden

**Prof. DSc. Olga Trapeznikova**

Russian Academy of Science, Russia

**Prof. Oleksandr M. Trofymchuk**

National Academy of Sciences of Ukraine

**Prof. DSc. Victor Tsvetkov**

Academy of Space Named after E. K. Tsiolkovsky and Academy of Natural Sciences

**Prof. Dr. Vadim Zhmud**

Novosibirsk State Technical University, Russia

---

**SGEM International Review Committee on Earth and Planetary Sciences**

---

*\* alphabetically sorted by first name*

**Prof. DSc. Adam Smolinski**

Central Mining Institute, Poland

**PhD Alexandra Trif**

University of Agricultural Science and Veterinary Medicine, Romania

**PhD Alexandrina Manea**

National Research and Development Institute for Soil Science, Agrochemistry and Environment, Romania

**PhD Alexey Noskov**

Philipps-Universität Marburg, Germany

**PhD Alina Butu**

National Institute of Research & Development for Biological Sciences, Romania

**Assoc. Prof. PhD Alina Girip**

Technical University of Civil Engineering, Romania

**Prof. Dr. Habil Ana Cornelia Badea**

Technical University of Civil Engineering, Romania

**Prof. DSc. Andrejs Cekuls**

University of Latvia, Latvia

**Prof. Dr. Anna Bazan-Krzywoszanska**

University od Zielona Gora, Poland

**Assoc. Prof. PhD Bogdan Diaconu**

University “Constantin Brâncuși” Târgu-Jiu, Romania

**Assoc. Prof. Dr. Bogdan-Mihai Niculescu**

University of Bucharest, Romania

**Prof. PhD Claudia-Maria Simonescu**

Polytechnic University of Bucharest, Romania

**PhD Cristina Balaceanu**

Christian University, Romania

**Assoc. Prof. PhD Dalibor Bartoněk**

Brno University of Technology, Czech Republic

**PhD Damian Kasza**

Wroclaw University of Science and Technologies, Poland

**PhD Dana-Alexandra Ciupageanu**

Polytechnic University of Bucharest, Romania

**PhD Daniela Docan**

European Environment Agency, Denmark

**PhD Dmitry Zaitsev**

Moscow Institute of Physics and Technology, Russia

**Prof. DSc Elena Andreeva**

Don State Technical University, Russia

**Assoc. Prof. Elena Mikhailova**

Saint Petersburg State University, Russia

**Dr. Florina Tuluca**

Romanian Society of Applied Geophysics (RSAG), Romania

**Prof. Dr. George Abuselidze**

Batumi Shota Rustaveli State University, Georgia

**PhD Gheorghe-Adrian Branoiu**

Petroleum Gas University of Ploiesti, Romania

**PhD Hynek Roubík**

Czech University of Life Sciences, Czech Republic

**Prof. DSc Ihor Petrushka**

Lviv Polytechnic National University, Ukraine

**PhD Ileana Spiroiu**

National Agency for Cadastre and Land Registration, Romania

**PhD Ionut Ovidiu Toma**

Technical University of Iasi, Romania

**Assoc. Prof. PhD Jakub Szulwic**

Gdansk University of Technology, Poland

**PhD Jan Stefanak**

Brno University of Technology, Czech Republic

**PhD Janine Figuerido**

University of Porto, Portugal

**Assoc. Prof. DSc. Janusz Bohatkiewicz**

Lublin University of Technology, Poland

**Assoc. Prof. PhD Jesper Knutsson**

Chalmers University of Technology, Sweden

**PhD John Bosco Namwamba**

Southern University and A&M College, United States

**PhD Liliana Rusu**

Dunarea de Jos University of Galati, Romania

**Prof. PhD Livia Vidu**

University of Agricultural Science and Veterinary Medicine, Romania

**Dr. Marian Butu**

National Institute of Research & Development for Biological Sciences, Romania

**PhD Marian Pompiliu Cristescu**

University of Sibiu, Romania



**Prof. PhD Mariana Nagy**  
University of Arad, Romania

**Dr. Marian-Catalin Nistor**  
University of Petrosani, Romania

**PhD Marius Miricioiu**  
National Institute of Research and Development for Cryogenic and Isotopes  
Technologies, Romania

**PhD Marta Kadlubek**  
Czestochowa University of Technology, Poland

**PhD Michal Kraus**  
Institute of Technology and Business, Czech Republic

**PhD Mikolaj Miskiewicz**  
Gdansk University of Technology, Poland

**PhD Miroslav Langer**  
Silesian University in Opava, Czech Republic

**Assoc. Prof. Dr. Sc. Mladen Zrinjski**  
University of Zagreb, Croatia

**Assoc. Prof. PhD Monica Marin**  
University of Agricultural Science and Veterinary Medicine, Romania

**PhD Nicolae Ciont**  
Technical University of Cluj-Napoca, Romania

**PhD Niyaz Gabdrakhmanov**  
National Research University Higher School of Economics, Russia

**Prof. DSc. Olga Hachay**  
Institute of Geophysics, Russian Academy of Sciences, Russia

**Prof. DSc. Olga Kudryavtseva**  
Moscow Lomonosov State University, Russia

**Assoc. Prof. PhD Pavlos Avramidis**  
University of Patras, Greece

**PhD Peter Radermacher**  
University of Petrosani, Romania

**Prof. PhD Radu Sumalan**  
University of Banat, Romania

**Assoc. Prof. DSc. Rafal Blazy**  
Cracow University of Technology, Poland

**PhD Raluca Felseghi**  
Stefan cel Mare University of Suceava, Romania

**PhD Roman Timofeev**  
Kazan Power Engineering University, Russia

**PhD Sanda Budea**  
Polytechnic University of Bucharest, Romania

**Assoc. Prof. PhD Sebastian George Maxineasa**  
Technical University of Iasi, Romania

**Prof. Dr. Slavisa Trajkovic**  
University of Nis, Serbia

**PhD Steliana Rodino**  
Institute of Research and Development for Biological Sciences, Romania

**PhD Szymon Kuczynski**  
University of Science and Technology in Cracow, Poland

**PhD Tatiana Chekushina**  
Institute of Comprehensive Exploitation of Mineral Resources Russian Academy of Sciences, Russia

**Assoc. Prof. PhD Tatyana Krupnova**  
South Ural State University, Russia

**PhD Thota Sivasankar**  
NIIT University, India

**Assoc. Prof. PhD Tudor Salagean**  
University of Agricultural Science and Veterinary Medicine, Romania

**Assoc. Prof. PhD Valeria-Ersilia Oniga**  
Technical University of Iasi, Romania

**Prof. PhD Victorita Radulescu**  
Polytechnic University of Bucharest, Romania

**PhD Violeta Niculescu**  
National Institute for Cryogenics and Isotopic Technologies, Romania

**DSc. Vlad Mihai Pasculescu**  
INSEMEX, Romania

---

## CONFERENCE PROCEEDINGS CONTENTS

### SECTION OIL AND GAS EXPLORATION

---

- 1. ANALYZING THE SEISMIC STRATIGRAPHY OF BADENIAN DEPOSITS IN THE EAST EUROPEAN PLATFORM**, Assist. Prof. Dragos Cristea, Prof. Dr. Iulian Nistor.....3
- 2. CRISIS OF THE WORLD’S OIL EXPORTING COMPANIES BECAUSE OF THE CORONAVIRUS COVID-19**, Prof. DSc. Tatyana Makarenaya, Polina Nikashina, PhD Ahmed Ibrahim Obaidi.....11
- 3. GEOPHYSICAL SYSTEM OF PERMANENT INSTALLATION FOR UNDERWATER MONITORING OF SEISMIC EVENTS**, Assist. Prof. Alexander Neeshpapa, Alexander Antonov, Dr. Dmitry Zaitsev, Dr. Egor Egorov, Dr. Vadim Agafonov.....17
- 4. INFRARED SCANNING METHOD FOR LONG DISTANCE IDENTIFICATION AND VISUALIZATION OF GASES**, PhD Adrian-Bogdan Simon-Marinica, Gheorghe Daniel Florea, Zoltan Vass, Laurentiu Munteanu, Andrada Denisa Babut.....25
- 5. THE EFFECT OF USING A DIFFERENT POROUS MEDIUM FOR GAS HYDRATE PRODUCTION: A COMPARISON BETWEEN PURE QUARTZ SAND AND A NATURAL PRODUCT COMING FROM THE MEDITERRANEAN SEABED**, PhD Albert Gambelli, Prof. Federico Rossi.....33
- 6. THE MODELLING NONLINEAR SOIL RESPONSE TO VERTICAL GROUND MOTIONS**, Dr. Artem Krylov.....45
- 7. USE OF UAVS WHEN MAPPING THE AREA OF SEISMIC EXPLORATION**, Alexander Starovoytov, Artur Fattakhov, Victor Kosarev.....51

### SECTION HYDROLOGY AND WATER RESOURCES

---

- 8. ACCIDENTAL POLLUTION AND TRANSPORT OF PETROLEUM SUBSTANCES IN GROUNDWATER**, PhD Alexandru-Florin Simion, PhD Emilian Ghicioi, PhD Angelica-Nicoleta Călămar, PhD Andrei-Lucian Gireadă, PhD Cosmin Ilie.....61
- 9. ANALYSIS OF THE FLASH FLOOD CAUSES IN SLOVAK REPUBLIC**, Prof. Jana Mullerova.....71

<b>10. ASSESSMENT OF SEWERAGE NETWORK COLLECTORS AT HEAVY RAINFALL OCCURRENCE IN URBAN CATCHMENT</b> , Reka Wittmanova, Prof. Stefan Stanko, Ivana Marko, Marek Sutus.....	79
<b>11. THE BANKFULL DISCHARGE OF A MOUNTAINOUS ANTHROPISED RIVER: HOW RELEVANT IS FOR THE CHANNEL GEOMORPHOLOGY?</b> , PhD Valeriu Stoilov-Linu, Assoc. Prof. Dr. Mihai Niculita, Prof. Dr. Dan Dumitriu....	87
<b>12. CURRENT HYDROECOLOGICAL CONDITION OF THE NORTH-WESTERN PRYAZOVIE RIVERS</b> , Assist. Prof. Oleksandr Nepsha, Assoc. Prof. PhD Svitlana Hryshko.....	95
<b>13. DESIGNING THE OPERATING RULES OF A RESERVOIR TO MAXIMIZE THE FINANCEAL REVENUE FROM A HYDROPOWER PLANT: CASE STUDY OF MOSTIŠŤĚ, CZECH REPUBLIC</b> , Martin Bednar, PhD Pavel Mensik, PhD Daniel Marton.....	103
<b>14. EFFECTIVE COAGULANT FOR WASTE WATER PURIFICATION FROM HYDROGEN SULFUR</b> , Assoc. Prof. Yerzhan Kuldeyev, PhD Bekzat Abdikerim, Aisha Tastanova, PhD Igor Bondarenko, Assoc. Prof. PhD Bibigul Botantayeva.....	113
<b>15. EXPERIMENTAL STUDY OF FLEXIBLE STREAM-GUIDING GRIDS PROTECTING HYDROSYSTEM TAILRACES</b> , Assist. Prof. PhD Yulia Kuznetsova, Prof. Dr. Anatoly Pozdeev, Valeria Vasilieva.....	121
<b>16. FLOOD RISK ASSESSMENT IN THE CRISIS MANAGEMENT SYSTEM OF THE SLOVAK REPUBLIC</b> , Prof. Jana Mullerova.....	129
<b>17. IMPACT OF LID FACILITIES ON SEWERAGE NETWORK OVERLOAD IN HIGHLY URBANIZED AREAS</b> , PhD Jaroslav Hrudka, Prof. Stefan Stanko, Reka Wittmanova, Gergely Rozsa.....	137
<b>18. IMPACT OF THE WATER SUPPLY NETWORK ESTABLISHMENT IN BICAZ CHEI VILLAGE, NEAMT COUNTY</b> , Dr. Alina Agafitei, Assoc. Prof. Dr. Vasile Lucian Pavel, PhD Cristina Virlan Toma, Dr. Daniel Toma.....	143
<b>19. INFLUENCE OF CLIMATIC CONDITIONS ON THE DIMENSION OF HYDROLOGICAL MODELS</b> , Assoc. PhD Ekaterina Gaidukova, Assoc. PhD Natalia Victorova, Assoc. Igor Vinokurov, Assoc. PhD Victor Alexandrov.....	149
<b>20. INFORMATION TECHNOLOGY FOR ENVIRONMENTAL ASSESSMENT OF LIMNOLOGICAL SYSTEMS</b> , PhD Natalia Sheviakina, PhD Viktoriia Klymenko, PhD Snizana Zagorodnya, PhD Ihor Radchuk, PhD Viacheslav Vyshniakov.....	155

<b>21. MEDIUM RESOLUTION SATELLITE IMAGE PROCESSING TECHNOLOGY TO CREATE A SMOOTH COASTLINE ON MAPS</b> , PhD Lyudmila Shagarova, Prof. DSc. Malis Absametov, Mira Muratova.....	163
<b>22. MODELING OF CHANGES IN WATER DIVISIONS ON THE BORDER OF BASINS OF THE BALTIC, WHITE AND CASPIAN SEAS</b> , Nikolai Anisimov, Nadezda Maksutova, Maria Minina.....	171
<b>23. LAKE GOVERNANCE SYSTEM DEVELOPMENT IN LATVIA: TOWARDS CROSS-LEVEL AND CROSS-SECTORIAL INTEGRATION FRAMEWORK</b> , Karlis Konkovs, Prof. Raimonds Ernsteins.....	179
<b>24. MONITORING OVER WATER SOURCES USED FOR CENTRALIZED DRINKING WATER SUPPLY TO POPULATION IN THE IN THE RUSSIAN FEDERATION</b> , Acad. Nina Zaitseva, Dr. Irina May, Assoc. Dr.. Svetlana Kleyn, Svetlana Vekovshinina.....	193
<b>25. POPULATION HEALTH RISK ASSESSMENT ASSOCIATED WITH THE CONSUMPTION OF DRINKING WATER WITH A HIGH CONTENT OF ARSENIC IN GEOCHEMICAL PROVINCE</b> , Nina Zaiceva, Olga Ustinova, Pavel Shur, Irina Leshkova, Elena Vlasova.....	200
<b>26. POTASSIUM HUMATE OBTAINED FROM ORGANIC AND PEAT-HUMIC FERTILIZERS AND ITS EFFECT ON THE ECOLOGICAL AND TOXIC ASSESSMENT OF SOD-PODZOLIC SOIL</b> , Prof. DSc. Victor Kasatikov, PhD Vyacheslav Raskatov, Prof. Lydia Stepanova, PhD Aza Pisareva.....	207
<b>27. IMPOSING LIMITS ON POLYPHOSPHATES IN SYNTHETIC DETERGENTS AS A WAY TO PREVENT CONTAMINATION OF WATER BASINS AND COURSES USED FOR COMMUNAL NEEDS AND DRINKING WATER SUPPLY</b> , Prof. Dr. Irina May, Assoc. Prof. Svetlana Kleyn, Acad. Nina Zaitseva, Svetlana Vekovshinina.....	217
<b>28. SEDIMENT TRANSPORT MODELLING ON THE DANUBE SECTOR BETWEEN BECHET AND CORABIA (RKM 678 - RKM 625)</b> , PhD Elena-Andreea Savu.....	225
<b>29. SIMULATION OF URBAN SURFACE RUNOFF USING SWMM MODEL</b> , Ivana Marko, Reka Wittmanova, Prof. PhD Ivona Skultetyova, Marek Sutus.....	233
<b>30. SPI AND RECESSION CURVES ANALYSIS FOR KARST SPRING MANAGEMENT: A CASE STUDY IN CENTRAL ITALY</b> , Giuseppe Sappa, Francesco Maria De Filippi, Gerardo Grelle, Silvia Iacurto.....	241
<b>31. STATISTICAL ANALYSIS OF THE TYPES OF SHIPS THAT HAVE CROSSED THE EUROPEAN PORTS IN THE LAST DECADE</b> , PhD Ana-Maria Chiroasca, Prof. Dr. Liliana Rusu.....	249

**32. STUDYING THE EFFECT OF URBAN RUNOFF FROM THE ROADWAY AND ANALYSIS OF THE CHEMICAL COMPOSITION OF STORMWATER,** Ivana Marko, Prof. PhD Ivona Skultetyova, PhD Jaroslav Hrudka, Gergely Rozsa .....257

**33. THE ECO-TOXICOLOGICAL PARAMETERS OF ADJARA COASTLINE WATERS OF THE BLACK SEA BASIN AND SOME HIDROBIONTS OF IT,** Assoc. Prof. Dr. Nino Kiknadze, Assoc. Prof. Dr. Nani Gvarishvili, Assist. Prof. Dr. Gultamze Tavdgiridze, Assist. Prof. Dr. Nunu Nakashidze, Nargiz Megrelidze.....265

**34. THE IMPACT OF SOIL WATER STORAGE ON THE RADIAL CHANGES OF THE ROYAL WALNUT (JUGLANS REGIA L.),** Martina Kovacova, Prof. Viliam Barek.....273

**35. WATER QUALITY ASSESSMENT OF DIFFERENT TYPES OF WATER BODIES IN THE OB AND YERKUTA RIVER BASINS,** Gulnara Nigamatzyanova, Natalia Alekseeva, Assoc. Prof. Dr. Irina Fedorova, Elena Shestakova, Assoc. Prof. Dr. Larisa Frolova.....281

**36. WATER RISKS IN GEOPARKS OF THE NIZHNY NOVGOROD REGION,** Prof. Dr. Andrey Lapshin, Prof. Dr. DSc. Alexei Kolomiets, Assoc. Prof. Dr. Aleksander Ivanov, Ivan Krayev, Denis Malyshev.....289

## **SECTION FOREST ECOSYSTEMS**

---

**37. ANALYSIS OF VITALITY AND DENDROMETRICAL INDICES OF INTRODUCED WOODY PLANT SPECIES IN ARBORETUM LACUPITE IN LATVIA,** Bc. Silv. Evelina Erzama, Assist. Prof. Dr. Aigars Indriksons.....299

**38. ECONOMICAL EVALUATION OF SELECTED LANDSCAPE CUTTING IN SCOTS PINE PINUS SYLVESTRIS L. IN MEZAPARKS, RIGA,** Prof. Dr. Inga Straupe, Bsc. Silv. Davis Rudzitis, Assoc. Prof. Dr. Liga Liepa.....307

**39. INCREASING THE HOLDIND POWER OF A PILE PIER RESEARCH,** Assoc. Prof. Dr. Pavel Perfiliev, Assoc. Prof. Dr. Natalia Zadrauskaite, Aleksander Anufriev.....315

**40. MONITORING AND ASSESSMENT OF THE STATE OF FOREST ECOSYSTEMS TAKING INTO ACCOUNT THE NATURAL AND CLIMATIC FACTORS BASED ON GIS-TECHNOLOGIES,** Assoc. Prof. Olena Liashenko, Assoc. Prof. Dmytro Kyryichuk, PhD Serhii Yatsiuk, PhD Viktor Prachyk, PhD Viktoriia Palona.....321

**41. COMBINED USE OF TERRESTRIAL LASER SCANNER AND UNMANNED AERIAL VEHICLE AS AN EFFECTIVE TOOL FOR FOREST PARAMETERS EXTRACTION,** PhD Lampros Papalampros, Prof. Vassilios Tsioukas.....329

**42. SIMULATING LARGE-SCALE WILDFIRES AND COMMUNITY EXPOSURE: A FRAMEWORK AND APPLICATION IN MACEDONIA, GREECE, Dr. Palaiologos Palaiologou, Prof. Kostas Kalabokidis, PhD Lampros Papalampros, Prof. Spyros Galatsidas.....339**





## CURRENT HYDROECOLOGICAL CONDITION OF THE NORTH-WESTERN PRYAZOVIE RIVERS

**Assistant Professor, Oleksandr Nepsha**

**Associate Professor, PhD (Geography) Svitlana Hryshko**

Bogdan Khmelnytsky Melitopol State Pedagogical University, Melitopol, **Ukraine**

### ABSTRACT

The territory of the North-Western Pryazovie is adjacent to the northern coast of the Sea of Azov. There are 14 rivers flowing through the territory of the North-Western Pryazovie with a total length of 944.1 km and a water intake area of 10.613 km<sup>2</sup>. Territorially, the river network of the Sea of Azov can be divided into two parts: western and eastern, which differ from each other in the structure of the surface, climatic conditions and the nature of the hydrological regime. The rivers of the North-Western Pryazovie can be grouped according to the following characteristics: length, size of the basin, catchment area, nature of the flow, nature of the sources, tendency to dry out.

If in the early stages of economic development the rivers of the North-Western Pryazovie could meet all the needs of people and cope with anthropogenic pressure, now most rivers can no longer withstand these loads and have lost the possibility of environmental self-regulation. The concept of «economic burden» on the natural environment now does not fully correspond to the actual state of the smallest river and its catchment area. A more precise concept of «anthropogenic press», which should be understood not only as the direct economic use of the riverbed, its valley, shores and surrounding areas, but also the side (not infrequently contradictory or negative) consequences of such use.

When assessing the current or expected state of the steppe rivers of the North-Western Pryazovie, it is necessary to take into account the following features: these rivers are the main source of food for large rivers, so their preservation is essential to protect water resources from depletion; the watersheds of these rivers house a significant number of people, industrial facilities, agricultural lands, which determines the great economic importance of this category of rivers; due to their small size, these rivers are very sensitive to certain types of economic activity, which is particularly acute in the water regime of the territory.

**Keywords:** river, hydroecological condition, hydrological indicators, anthropogenic load, North-Western Pryazovie

## INTRODUCTION

Rivers are closely connected with the economy of the surrounding areas and play a significant role in the development of the social environment. At the same time, the comprehensive use of river resources, their regulation, selection of water for irrigation and household needs, as well as the transformation of rivers into sewage collectors violated their natural state. Rivers have become polluted, upright, shallow, with poor water quality, depleted of plant and animal organisms. Excessive use of both rivers and watersheds in the national economy disrupts their natural hydrochemical and hydrobiological regimes, reduces water content and depth, rivers are silted up and overgrown, their eutrophication increases.

## MATERIALS AND METHODS

The material for studying the problem was specialized arrays of long-term data on the hydrological regime of the rivers of the North-Western Priazovie, air temperature and precipitation by hydrometeorological stations (HMS) located in the northwestern part of the Sea of Azov, Central Geophysical Observatory and National Oceanic and Atmospheric Administration (open access).

During the study period (1960-2019), the most reliable and continuous data series were selected. From the point of view of hydrological research, the area of the North-Western Priazovie is one of the least studied. The distribution of stations on the territory is extremely uneven with frequent and long breaks in observations, which significantly complicates the study of the water regime of rivers. Thus, within the study area, systematic observations of the hydrological regime of rivers were conducted only at 4 stations with the longest observation periods – 49 years (Table 1).

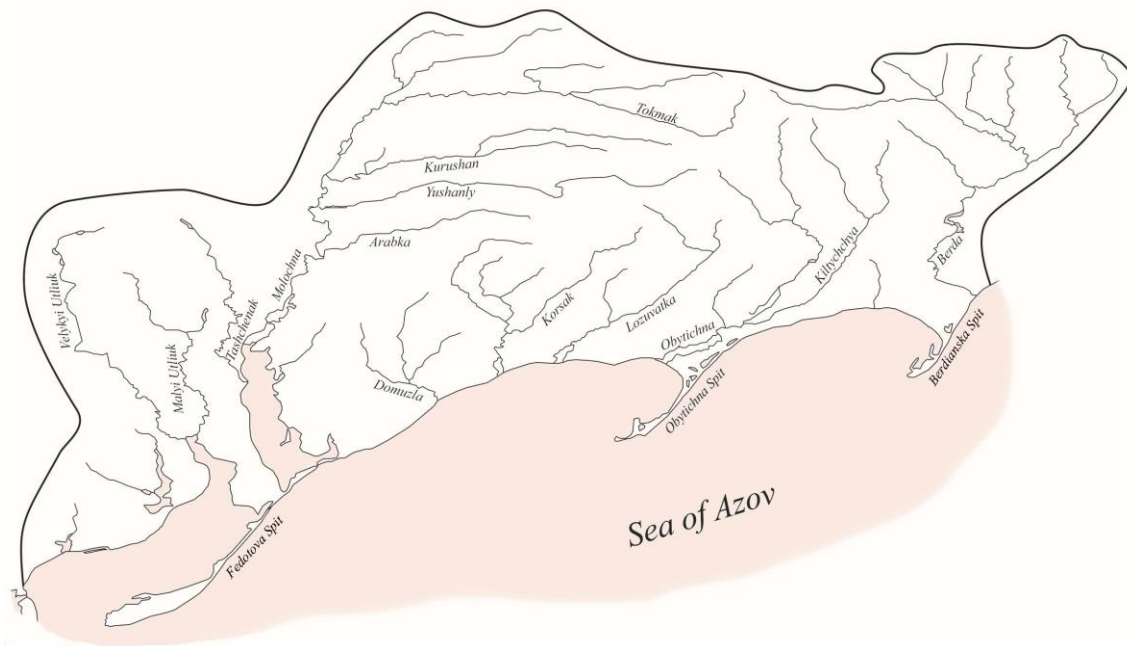
**Table 1**

List of operating hydrological station on the rivers of the North-Western Priazovie

№	River-station	Validity		Years, <i>n</i>
		Opened	Closed	
1	Molochna River – Terpinia village	01.01.1952	operates	60
2	Lozuvatka River – Novooleksiivka village	30.10.1974	operates	38
3	Obytichna River – Prymorsk town	28.09.1936	operates	76
4	Berda River – Osypenko village	17.05.1962	operates	51

## DISCUSSION

The North-Western Pryazovia occupies the northern coast of the Sea of Azov and, as the geographical territory, it is limited: it is the line of the watershed of the Berda, Kalmius and Kalchyk rivers from the east; it is the line of the watershed of the Dnipro and the Molochna from the west and north-west (taking into account the basin of the Velykyi Utliuk): it is the line of the watershed of the Pryazovia crystalline massif between the Berda in the north (with the Karatysh and the Karatuk rivers) and the system of the confluents of the Mokra Konka and the Sukha Konka rivers, the Haichur and Kamyanka rivers. From the south, the territory is limited with the coastline of the Sea of Azov with its gulfs and the limans (Fig. 1) [11].



**Fig. 1.** The boundaries of the North-Western Pryazovia region [11]

There are 14 rivers with a total length of 944.1 km and a water intake area of 10.613 km<sup>2</sup> on the territory of the North-Western Priazovie [3]. The territory of the North-Western Priazovie is characterized by a developed, as for the steppe zone, river network with an increase in its density in the direction from west to east from 0.19 km/km<sup>2</sup> to 0.36 km/km<sup>2</sup> [2]. This change in the density of the river network is explained by the nature of the relief of river basins. A significant part of the area of river basins in the west and south of the studied region is located within the Black Sea lowlands, in the east – within the Azov Upland. Therefore, the territorial river network of the North-Western Priazovie can be divided into two parts: western and eastern. They differ from each other in surface structure, climatic conditions and the nature of the hydrological regime. Rivers in the western region have a flat flow, their channels are often formed by meanders, valleys have a wide floodplain. The rivers of the eastern region originate on the Azov Upland, in the upper reaches they have a semi-mountainous character, their channels are strongly incised, narrow, limited by the steep slopes of the valley, the banks are covered with ravines and gullies. Downstream, the valleys of these rivers become wider, the coastal slopes are gentle, the flow slows down, meanders are formed and floodplains in some places even become swampy. In the upper reaches, these rivers flow rapidly and develop intense erosion. Due to this, the density of the river network of the western part differs sharply from the eastern one. In the west it does not exceed 0.19 km/km<sup>2</sup>, and in the east it reaches 0.36 km/km<sup>2</sup> [2]. The length of the river of the western basin is longer than the rivers of the eastern basin. The largest river flowing in the western part of the region is the Molochna River (198 km), and in the eastern part of the Obyrichna River (100 km) and the Berda River (125 km) [7].

Analyzing the hydrological features of the rivers of the North-Western Priazovie, it should be noted that the relief in which the river network, climatic conditions and power source formed have the greatest influence on the water content of rivers. The main source of food for the rivers of the North-Western Priazovie is precipitation, which averages 250-300 mm in the west and 400-450 mm in the east in the study area

(Table 2). That is, precipitation changes from west to east as well as the nature of the current. They are distributed not evenly not only in space but also in time: the largest number falls in summer, mainly in the form of showers, the smallest – winter. The smallest amount falls in the basins of the Velykyi Utiuk and Malyi Utiuk – on average 350 mm, further to the east the amount of precipitation increases and on the Priazovska Upland they can reach 550 mm in some years. In summer, very high evaporation from the territory up to 890 mm, so a significant role in feeding the rivers play along with the rains of melt spring water and groundwater. The nature of the water regime of rivers is determined by the characteristics of floods, its duration. Thus, in the annual course of water levels in the rivers of the Azov Sea basin, there are usually two highs (during spring floods and during summer floods) and two lows (late summer and early autumn and winter). In the spring (February – April) is 45-60% of annual runoff [4, 9].

**Table 2**

Statistical analysis of average annual precipitation amounts at hydrometeorological stations during 1960-2019

Station	n	M±	Min	Max
Melitopol	64	465.6±98	287	741.7
Berdyansk	64	475.1±118.9	223	894
Botieve	64	430.6±107.5	247	961.1

Intensive rise in spring floods begins in the second decade of February. The recession on the rivers of the North-Western Priazovie ends in the second half of March – early April. The limited runoff (January, May) is 40-45% per annum. The summer-autumn period is covered by rain floods, which are characteristic of all rivers of the North-Western Priazovie [8].

Annual values of the river runoff layer vary from west to 0.4-6.7 mm (for the Molochna River) to the east to 11-15 mm (Lozuvatka and Berda rivers) [6]. This change in river runoff is explained by the change in precipitation in the study area.

Based on the above, the rivers of the North-Western Priazovie can be grouped according to the following characteristics: the area of the river basin, length, nature of the flow, the nature of the sources, the tendency to dry out.

Types of rivers by river basin area:

- a) rivers with a catchment area of 100-1000 km<sup>2</sup> (the Apanly, Velykyi Utiuk, Malyi Utiuk, Domuzla, Korsak, Lozuvatka, Kiltychia rivers);
- б) rivers with a catchment area of 1000-2000 km<sup>2</sup> (the Obytichna, Berda);
- в) rivers with a catchment area of more than 2000 km<sup>2</sup> (Molochna).

Types of rivers by length according to the Water Code of Ukraine [10]:

- a) small rivers – rivers with a catchment area of less than 2000 km<sup>2</sup> (all rivers of the North-Western Azov Sea, except the Molochna River).
- б) medium rivers – rivers with a catchment area from 2000 km<sup>2</sup> to 50,000 km<sup>2</sup> (Molochna River).

There are no large rivers in the North-Western Priazovie.

Types of rivers by the nature of the flow:

- a) plain rivers with slow flow – typical steppe (the Domuzla, Velykyi Utliuk, Malyi Utliuk, Tashchenak, Molochna, Lozuvatka, Korsak);
- b) rivers, which in the upper reaches have the form of a semi-mountain river (the Berda, Obytichna).

Types of rivers by the nature of sources:

- a) rivers that originate on the slopes of the Azov crystalline massif, their sources exceed a height of 200 m above sea level, and are fed by springs originating from crystalline rocks (the Berda, Obytichna, Lozuvatka, Molochna, Korsak and their tributaries);
- b) rivers, which originate at 50-55 m above sea level, and are fed mainly by precipitation (the Domuzla, Jakelnya, Tashchenak, Velykyi Utliuk, Malyi Utliuk and their tributaries).

Types of rivers by tendency to dry out:

- a) rivers that partially dry up in the upper reaches (the Kurushan, Apanly, Metrozly, Kurkulak, Akchokrak, Arabka);
- b) rivers that dry up in the lower reaches (the Chingul, Jakelnya, Tashchenak, Kiltychia, Velykyi Utliuk, Lozuvatka);
- b) rivers that do not dry up (the Molochna, Berda, Obytichna).

The most important factors influencing the hydrological regime of rivers are irreversible intake, removal of runoff when filling ponds and reservoirs. In addition to irreversible water intake, river flow is affected by over-regulation of riverbeds. However, about 87 ponds and reservoirs with a total water surface area of more than 1000 ha have been created on the Molochna River [5] (Table 3).

**Table 3**

Availability of ponds and reservoirs in the river basins of the North-Western Priazovie

River basin	Ponds			Reservoirs	
	number	area, ha		number	area, ha
Velykyi Utliuk and Malyi Utliuk	23	561.7		–	–
Molochna	81	536.2		6	497
Obytichna	56	472.1		4	215.2
Lozuvatka	12	180.0		1	40.0
Berda	56	375.6		5	491.8
Other rivers	42	579.2		–	38.5
Total	270	2704.8		16	1282.5

The assessment of the state of ecosystems of the vast majority of rivers of the North-Western Priazovie shows that it is currently critical, and water quality is much lower than natural [1]. The main reasons that led to this state of the rivers of the North-Western Priazovie are:

- pollution of rivers by industrial, agricultural and municipal effluents;
- increase of polluted surface runoff due to plowing of floodplains, ravine slopes, beams, river sources, intensive use of floodplains for construction;
- siltation of riverbeds due to pollution and changes in the state of the catchment surface due to deforestation and increasing the area of arable land;
- reduction of drainage capacity of riverbeds due to their siltation;
- use of runoff for economic needs, which reached 25% of the annual volume;
- high degree of runoff regulation, which causes an increase in water mineralization in reservoirs and ponds due to water losses due to evaporation from the surface of the water mirror.

To preserve the ecosystems of the rivers of the North-Western Priazovie, improve their condition and restore water content, it is necessary to take a number of urgent measures, in particular:

- at the state level to identify agencies that will be responsible for the condition of rivers, especially small ones;
- get the results of the certification of rivers and complete it;
- in order to determine the feasibility of maintaining a number of reservoirs and ponds in riverbeds to conduct an examination and assessment of their condition;
- to take measures to restore the ecological functions of coastal protection strips in river floodplains, in particular their afforestation, silting, removal of ecologically dangerous objects;
- prohibit the use of riverbeds as sewage systems for direct discharge of polluted water, regardless of the length of the river and its water content;
- begin work to restore the natural state of river valleys;
- liquidate summer camps for farm animals within the coastal protection strips of rivers and move their buildings beyond the floodplain, set up treatment facilities in them;
- increase the area of forests in river basins, especially small ones;
- flood river floodplains with meadow grasslands;
- to prohibit the extraction of sand and gravel in the channels of small rivers, which will preserve the structure of bottom biocenoses, etc.

These measures are a priority and do not require significant funds. They will allow to some extent to preserve the water content of rivers, rational use of their water resources, stimulate natural processes of self-purification in the riverbeds, and so on.

## **CONCLUSION**

Analysis of literature sources and our own field research allowed us to combine the rivers of the North-Western Priazovie into separate groups according to the following features: river basin area, length, flow nature, source nature, tendency to dry out. Such comprehensive studies of the rivers of the North-Western Priazovie allow to assess their current ecological condition and to develop specific measures for their rational use and protection. The main factors that currently determine the state of river hydroecosystems

of the North-Western Priazovie are the following: pollution of rivers by industrial, agricultural and municipal effluents; increase of contaminated surface runoff; siltation of riverbeds due to pollution and changes in the state of the catchment surface; reduction of drainage capacity of riverbeds due to their siltation; use of runoff for economic needs; high degree of overflow regulation. In order to preserve the river ecosystems of the North-Western Priazovie and improve their ecological status, it is necessary to identify agencies at the state level that will be responsible for the state of rivers, complete the process of their certification and propose a set of remedial measures.

## REFERENCES

- [1] Cherchenko Kh.V. Ekolohichna otsinka poverkhnevyykh vod Pivnichno-Zakhidnoho Pryazovia za hidrokhimichnymi ta hidrofizychnymi kharakterystykamy, Visnyk Zaporizkoho natsionalnoho universytetu. Biolohichni nauky, Zaporizhzhia, № 1, ss. 170-179, 2017.
- [2] Cherchenko Kh.V. Vplyv pryrodnoi ta antropohennoi transformatsii na richkovi ekosystemy Pivnichno-Zakhidnoho Pryazovia, Naukovi zapysky natsionalnoho pedahohichnoho universytetu imeni Volodymyra Hnatiuka. Seria: Biolohiia, Ternopil, № 2, ss. 62-69, 2016.
- [3] Chernenko Kh.V., Demchenko N.A. Suchasni osoblyvosti hidrolohichnoho rezhymu ta pokaznykiv yakosti vody richok Pivnichno-Zakhidnoho Pryazovia, Zapovidna sprava u Stepovii zoni Ukrainy (do 90-richchia vid stvorennia Nadmorskykh zapovidnykiv), Urzuf, 2017, ss. 329-334.
- [4] Fizychna heohrafiia Zaporizkoi oblasti / vidp. red. L.M. Datsenko, Melitopol, 200 s., 2014.
- [5] Ivanova V., Nepsha O., Sapun T. Osnovni pokaznyky morfometrii ta hidrolohichnoho rezhymu richok Pivnichno-Zakhidnoho Pryazovia, Paradyhmatychni aspekty y dylemy rozvytku nauky ta osvity, Konin – Uzhhorod – Melitopol – Kherson – Kryvyi Rih, ss. 272-283, 2019.
- [6] Kulyk P.R. Vnutrishni vody Zakhidnoho Pryazovia, Problemyi ekologii i prirodopolzovaniya, Melitopol, ss. 118-134, 1994.
- [7] Mali richky Ukrainy: Dovidnyk / za red. Yatsyka A.V., Kyiv, 296 s., 1991.
- [8] Miller M.E. Rechnaya set Severo-Zapadnogo Priazovya, Prirodnoe hozyaystvo i priroda Severo-Zapadnogo Priazovya, Leningrad, Vyp. 2, ss. 29-34, 1972.
- [9] Pivnichno-Zakhidne Pryazovia: heolohiia, heomorfolohiia, heolohoheomorfolohichni protsesy, heoekolohichni stan / vidp. red. L.M. Datsenko, Melitopol, 308 s., 2014.
- [10] Vodnyi kodeks / Vidomosti Verkhovnoi Rady. 1995. № 24. St. 79.
- [11] Vorovka V., Hryshko S. Determining the boundaries of the North-Western Pryazovia region as a coastal zone for further studying and managing it, Czasopismo Geograficzne, Warszawa, vol. LXXXVIII, part. 1-2, pp. 21-30, 2017.

