

*POLISH*

*JOURNAL OF ENVIRONMENTAL  
STUDIES*



*HARD OLSZTYN*

**Vol. 34, No. 1, 2025**  
**PART I**

# POLISH JOURNAL OF ENVIRONMENTAL STUDIES

Professor  
**JERZY RADECKI**

EDITOR in - CHIEF  
Professor **HANNA RADECKA**

EXECUTIVE EDITOR  
Dr. **DOROTA KULKA-RADECKA**

TECHNICAL EDITOR  
Eng. **MARIUSZ KULKA**

## EDITORIAL BOARD:

**IMRAN ALI**  
Southwest University of Science and  
Technology, Mianyang, China

**IRENA BARANOWSKA**  
Polytechnic of Silesia, Gliwice, Poland

**LIGITA BALEŽENTIENĖ**  
Vytautas Magnus University, Kaunas  
district, Lithuania

**JAN BOGACKI**  
Warsaw University of Technology, Poland

**BOGUSŁAW BUSZEWSKI**  
Nicolaus Copernicus University, Toruń,  
Poland

**MEHMET CETIN**  
Kastamonu University, Kastamonu,  
TURKEY

**LUKASZ CHRZANOWSKI**  
Poznań University of Technology, Poland

**JAN DERCO**  
Slovak University of Technology,  
Bratislava, Slovakia

**JAN DOBROWOLSKI**  
AGH University of Science and  
Technology, Kraków, Poland

**HÉCTOR FERNÁNDEZ**  
Universidad Nacional De Rio Cuarto,  
Departamento de Química, Rio Cuarto,  
Argentina

**S. J. S. FLORA**  
National Institute of Pharmaceutical  
Education and Research (NIPER),  
INDIA

**EWA FLOREK**  
University of Medical Sciences, Poznań,  
Poland

**MAGDALENA GANTNER**  
Warsaw University of Life Sciences, Poland

**JANIŃA GOSPODAREK**  
University of Agriculture, Cracow, Poland

**MARIA HEPEL**  
Potsdam College, The State University  
of New York, USA

**PIOTR HERBUT**  
University of Agriculture, Cracow, Poland

**YUH-SHAN HO**  
College of Environmental Sciences, Peking  
University, Beijing, People's Republic  
of China

**MIROSLAV HUTNAN**  
Slovak University of Technology, Slovakia

**DANA - ADRIANA ILUTIU - VARVARA**  
Technical University of Cluj – Napoca,  
Romania

**MUNAWAR IQBAL**  
University of Lahore, Lahore, Pakistan

**HARRY D. KAMBEZIDIS**  
National Observatory of Athens, Greece

**HANNA KLIKOCA**  
University of Life Sciences in Lublin,  
Poland

**MONIKA KOWALSKA-GÓRALSKA**  
Institute of Biology, Wrocław, Poland

**ANNA KOZAK**  
Adam Mickiewicz University in Poznań,  
Poland

**MALGORZATA KRZYWONOS**  
Wrocław University of Economics, Poland

**JAN KUCHARSKI**  
University of Warmia and Mazury  
in Olsztyn, Poland

**E. KUDJO DZANTOR**  
Tennessee State University, USA

**ROBERTO LAI**  
University of Sassari, Italy

**ULRICH LÜTTGE**  
Institute of Botany, TH Darmstadt,  
Germany

**GRZEGORZ MAJ**  
University of Life Sciences in Lublin,  
Poland

**SHELLEY MINTER**  
University of Utah, Department of  
Chemistry, Salt Lake City, USA

**JACEK NAMIESNIK**  
Chemical Faculty, Gdansk University  
of Technology, Poland

**CEMILE OZCAN**  
Kirkklareli University, TURKEY

**DAINIUS PALIULIS**  
Vilnius Gediminas Technical University,  
Lithuania

**MARIUSZ PELECHATY**  
University of Adam Mickiewicz, Poznań,  
Poland

**FÁBIO PORTELLA**  
Federal University of Pernambuco, Recife,  
Brazil

**FERNANDO PORTO**  
Federal Rural University of Pernambuco,  
Recife, Brazil

**BALTRENAS PRANAS**  
Vilnius Gediminas Technical University  
(VGTU), Lithuania

**STANISŁAW PRZESTALSKI**  
University of Agriculture, Wrocław, Poland

**MAHMOOD QAISAR**  
COMSATS University Abbottabad,  
Pakistan

**JOANNA ROSAK-SZYROCKA**  
Czestochowa University of Technology, Poland

**GUNNO RENMAN**  
Royal Institute of Technology, Stockholm,  
Sweden

**ROBERTO RICO-MARTÍNEZ**  
Autonomous University of Aguascalientes,  
Aguascalientes, Mexico

**JERZY SIEPAK**  
University of Adam Mickiewicz, Poznań,  
Poland

**PEDRO SIMÕES**  
CERIS-IST, University of Lisbon, Portugal

**MITSUYUKI SOMA**  
University of Shizuoka, Shizuoka 422,  
Japan

**AGATA SZYMAŃSKA-PULIKOWSKA**  
University of Life Sciences in Wrocław,  
Poland

**YUKINORI TANI**  
University of Shizuoka, Japan

**CEM TOKATLI**  
Trakya University, Ipsala Vocational  
School, Edirne – Turkey

**ASHOK VASEASHTA**  
U.S. Department of State, Washington,  
USA

**CARLOS EDUARDO FRONTANA  
VÁZQUEZ**  
Centra de Investigación y Desarrollo  
Tecnológico en Electroquímica, Cideteq,  
SC, Queretaro, Mexico

**HEINZ-RUDOLF VOIGT**  
University of Helsinki, Finland

**JAN VYMAZAL**  
Czech University of Life Sciences Prague,  
Czech Republic

**AMIR WASEEM**  
Quaid-i-Azam University, Islamabad-  
45320, Pakistan

**AGNIESZKA WOLIŃSKA**  
The John Paul II (The Second) Catholic  
University of Lublin, Poland

# POLISH JOURNAL OF ENVIRONMENTAL STUDIES

Vol. 34, No. 1 (2025)

## PART I

### REVIEW

1. Leveraging the Potential of Environmental Microorganisms: An Extensive Examination of Their Capacity in Tackling Global and Local Environmental and Ecological Challenges  
KHULOOD FAHAD ALABBOSH ..... 1

### ORIGINAL RESEARCH

1. Lead Pollution in the Angke Kapuk Mangrove Forest of the Jakarta Bay Area  
YULI ANDRIANI, ASRINA DESY PERMATA FITRI,  
ZMOCHAMAD CANDRA WIRAWAN ARIEF, ZAHIDAH ..... 13
2. Q-SSC Behavior During Floods in the Isser Watershed, (North-West of Algeria)  
DJOUHRA BALOUL, ABDERRAHMANE NEKKACHE GHENIM,  
ABDESSELAM MEGNOUNIF ..... 21
3. Searching for the Most Suited Distribution and Estimation Method for At-Site Flood Frequency Analysis: A Case of the Chenab River  
SAJJAD HAIDER BHATTI, MUHAMMAD UMAR,  
SANDILE CHARLES SHONGWE, MUHAMMAD IRFAN,  
MAHMOOD UL HASSAN ..... 29
4. Threshold Effects of Digital Economy on Tourism Carbon Emissions: Empirical Evidence from the Yangtze River Economic Belt in China  
CHAO CHEN, WEIPING WU ..... 43
5. The Impact of Carbon Emission Intensity on High-Quality Economic Development: An Empirical Study from 284 Prefecture-Level Cities in China  
YUJIE CHEN, JIANGWEI TANG ..... 57
6. Nonlinearity, Heterogeneity and Indirect Effects in the CO<sub>2</sub> Emissions-Financial Development Relation From Partial Linear Additive Panel Model  
XIAOPING CONG, XINGYU WANG, QICHANG XIE ..... 67
7. Research on Comprehensive Evaluation of Graduate Education Effect Under Green and Sustainable Background  
HAIXIA GUO, GANG ZENG ..... 83
8. On Prediction of Air Pollution Using Piecewise Affine Models  
JIANFENG GUO, ZHENXING REN ..... 93
9. Analysis of CCUS Challenges in the Yangtze River Delta Region, China  
DAWEI HU, TANGFA ZHOU, SHENGFAN XU ..... 101
10. Research on the Development of Green Supply Chain Finance Empowered by Blockchain: A Three-party Evolutionary Game Analysis Based on the Cost Perspective  
YI HU, BAO FENG, SHU FANG ..... 115

11. Optimizing Seed Rate and Herbicide Doses With or Without Adjuvant for Weed Control and Its Influence on Yield of Winter Wheat MUJAHID HUSSAIN, NADIA RAFIQUE, REHANA KAOUSAR, SYED IJAZ UL HAQ, CHANGFENG SHAN, GUOBIN WANG, WANG SHIZHOU, YUBIN LAN .....	127
12. Could Tax Collection and Management Improve the Green TFP of Enterprises: Evidence Based on China’s “Third Phase of the Golden Tax Project” HAOYU KUANG, FAN QI .....	139
13. Use of the Organic Fraction of Urban Solid Waste to Recover Degraded Areas in Chilca, Peru HÉCTOR VLADIMIR LA-CRUZ-FLORES, ROSA HAYDEÉ ZÁRATE-QUIÑONES, HIPÓLITO CARBAJAL-MORÁN, EMILIO OSORIO-BERROCAL, MARÍA JULIA MAZZARINO .....	151
14. Study on Uplift Bearing Characteristics of Micropile Group in Gravel-Containing Silty Clay Regions HAITAO LI, GUANGMING REN, WENJUAN GAN, JIAYUAN FAN, RONGQUAN FAN, WENHUI ZENG, YI LUO, BIN ZOU .....	165
15. Enterprise Digital Transformation and Green Technology Innovation: Evidence from Innovation Sub-Dimension and Time Lag Effect MENGYU LI, YINGYING ZHAO, JIALE YAN, YONGJIAN HUANG .....	177
16. China’s Wetland Management Laws and Practices, and Their Future YOUJIN LIAN, LI FENG .....	187
17. The Effect of Waste Plastic on Environmental Degradation: A Corporate Perspective SONG LIN, LINGFANG ZENG, HUAN WANG, MUHAMMAD USMAN, MARTINA HEDVICAKOVA .....	203
18. Adsorption of Reactive Blue 13 from Dyeing Wastewater onto Mesoporous Carbon Xerogels HUIYUN LU, JIANJIONG ZHU, DONGLEI LI, JIAHANG LIU, RUI YAO, MIN YAO .....	213
19. Short-Term Early Warning Method for Algal Bloom Risk Based on a Neural Network and a Two-Dimensional Hydrodynamic Model NA LUO, XIAOCHAO GU, KAI GAO, ZELI LI, PENGYU MEI, ZHEN ZHANG, ZILU WANG, DEYUE SU .....	227
20. Green Synthesis of NiO Nanoparticles Using the Shell Waste of <i>Prunus dulcis</i> : their Characterization and Electrochemical Studies WAQAR MIRZA, SHABBIR HUSSAIN, AFFIFA TAJAMMAL, AMINA ASGHAR, BUSHRA PARVEEN, TAUQEER AHMAD, FARZANA SHAHEEN, ZEESHAN MUSTAFA, MOHAMMAD Z. AHMED, AMJAD ISLAM .....	237
21. Tripartite Evolutionary Game Analysis of Fishery Carbon Sink Trading in China Based on Prospect Theory HAILIN MU, PEIYAO CHEN, HONGYE WANG, NAN LI, NA XU .....	245

22. Analysis of Heavy Metal Content Characteristics in Topsoil of Wasteland in the Industrial and Mining Areas of Shenmu, Shaanxi Province, China LU NAN, LUO YUHU, WANG NA, ZHANG BAOQIANG, LI GANG, SUN YINGYING, LI YAN .....	263
23. Health Evaluation of Innovation Ecosystems in Smart Cities Based on the DEMATEL-TOPSIS Method Using Wuhan as an Example WENJUN PENG, MENGJIAO ZENG, XIANYU YU .....	275
24. Biochar Based on Boehmeria nivea from Arsenic-Contaminated Soil and the Effect on Soil YAQUN QIU, LIN YUE WENLONG SHI, KAIHENG MA, SHIZHI WEN, LILI YANG .....	287
25. Impact Analysis of Chinese FDI and Green Innovations on Carbon Emissions in Pakistan: Utilizing the ARDL Bounds Testing Method ALI RAZA, XIAO LIU, HONGGUANG SUI, QINGLIN LIU, MUDASIR HUSSAIN .....	297
26. Empowering Green Choices: How Laws Influence Ecological Commitment, Environmental Knowledge, and Green Technology Adoption for a Cleaner Tomorrow YU WANG, BOWEN LIAO, JIANCONG WANG, MUHAMMAD USMAN .....	311
27. Sensitivity Analysis of AquaCrop Model Parameters for Winter Wheat under Different Meteorological Conditions Based on the EFAST Method HUIMIN XING, QI SUN, ZHIGUO LI, ZHEN WANG, HAIKUAN FENG .....	329
28. Nitrification and Urease Inhibitors Reduce the Stimulated Nitrous Oxide Emissions by the Freeze-Thaw Cycles YOULONG XU, FEI XIA, YUNYIN XUE, JUNQIANG WANG, YUANYUAN ZHAO, YANFANG ZHOU, LINLING RAN, HAOYANG WU, ZITENG XIE, JIANYAO LI .....	347
29. Response of Soil Carbon and Nitrogen Storage to Nitrogen Addition in Alpine Meadow of Qinghai-Tibet Plateau XIANG XUEMEI, DE KEJIA, LIN WEISHAN, FENG TINGXU, LI FEI, WEI XIJIE, WANG WEI .....	359
30. Estimation of Carbon Emissions and Empirical Analysis of Carbon Compensation in Rural Tourism Development LING YANG .....	369
31. Can Environmental Improvement Promote the Development of Forest Tourism? An Empirical Study Based on Chinese National Forest Parks FENG YU .....	383
32. Research on the Related Allocation of Green Financial Assets among Enterprises in The Insurance Shareholding Network WENCHENG YU, YIKANG ZHANG, KUN DU .....	397
33. Comprehensive Effectiveness Evaluation of Constructing a Multi-Objective Sponge Campus FAN ZHANG, GWON-SOO BAHN .....	415

34. Digital Economy, Environmental Regulation and Urban Green Development – A Study Based on 282 Prefecture-Level Cities in China HAO ZHANG, WENYAN HUA .....	431
35. The Impact of Environmental Regulation on Green Innovation of Environmental Enterprises in China: The Moderating Effect of R&D Investment and Government Green Subsidies YING ZHANG, WEIFENG LI, LI YANG .....	447
36. Has Green Credit Promoted High-Quality Economic Development? Evidence from China LULU ZHAO, JINGJING YE .....	463
37. Research on Joint Governance Network of Regional Haze Pollution from the Perspective of Spatial Spillover YANFEI ZHOU .....	475
38. Consumer’s WTPE for Grass-fed Meat and Its Implications in Sustaining Grassland for Degrading Karst Region of Guizhou, China CHANGHUI ZOU, ZHAOJUN LIU, YINGPING DONG .....	489

## NOTES TO AUTHORS

The following types of articles will be published:

- Full length research paper – describing original research;
- Short Communication – short research articles intended to present exciting findings that will have a major impact in environmental science;
- Reviews – should be a critical evaluation of the current stage of research on a particular environmental problem;
- Invited accelerated articles – stimulating the up-to-date research;

The submitted manuscripts, which must not have been published elsewhere, will be reviewed by The Editorial Board Members of the “Polish Journal of Environmental Studies,” assisted by Referees.

Authors of papers involving experiments with animals are requested to include the opinion and approval of Local Committee of Ethics.

### The recommended order of presentation

- **T i t l e.**
- Author's name and affiliations, e-mail address.
- **A b s t r a c t.** An abstract stating the results and the novel aspects of the work and findings.
- **K e y w o r d s.** Up to 5 keywords or key phrases, indicating the topic of importance in the work.
- **I n t r o d u c t i o n.** An introductory statement of the subject under investigation with any essential historical background.
- **E x p e r i m e n t a l P r o c e d u r e s.** Working details must be given concisely; well-known operations should not be described in detail.
- **R e s u l t s.** These could be presented in tabular or graph form, with appropriate statistical evaluation.
- **D i s c u s s i o n o f R e s u l t s.** The consolidation of the study and general implications should be presented and discussed with up-to-date scientific literature.
- **C o n c l u s i o n s.** Should include significance of the findings and recommendations for future work.
- **A c k n o w l e d g e m e n t s.**
- **U n i t s a n d N o m e n c l a t u r e.** The SI system of units and current internationally recognized (IUPAC) chemical nomenclature should be used. Common trivial names may be used, but should first be defined in terms of IUPAC nomenclature.
- **R e f e r e n c e s** should be indicated in the text by consecutive numbers and the full references should be listed in the same order at the end of the article in the following form:

***In the year 2023 Index Citation Report:  
Impact Factor: 1.400***

ISO Abbrev. Title: Pol. J. Environ. Stud.

*The “Polish Journal of Environmental Studies” is indexed and abstracted in: Chemical Abstracts; Ulrich's International Periodicals Directory; R.R., Bowker; USA; CAB International, Oxon, U.K.; Environmental Abstracts, Congressional Information Service, Maryland, USA; Zoological Record-BIOSIS, U.K.; International Soil Reference and Information Centre, the Netherlands; AGRIS EAO – Central Agricultural Library, Warsaw, Poland; Current Contents/Agriculture; Biology and Environmental Sciences; Sciences Citation Index Expanded; EBSCO Information Services; ELSEVIER Bibliographic Databases; AGRO Data Bases.*

**Visit us at: <http://www.pjoes.com>**

**Our e-mail: [officehard@pjoes.com](mailto:officehard@pjoes.com)**

HARD Publishing Company Olsztyn, POLAND  
Linguistic edition: Mark Macznik "COPYMARK"

Composition: Jolanta Czaplą

Technical edition and technical verification: dr. Elena Bisetto

Printing: "GUTGRAF" Olsztyn, Poland

## References

1. KŁOS-WITKOWSKA A. Enzyme-based fluorescent biosensors and their environmental, clinical and industrial applications. *Pol. J. Environ. Stud.* **24** (1), 19, **2015**.
2. CHEN T. Y., LAI P. Y. A comparative study of energy utilization efficiency between Taiwan and China. *Energ. Policy.* **38** (5), 2386, **2010**.
3. HEPEL M., ZHONG C. J. Functional nanoparticles for bioanalysis, nanomedicine and bioelectronics devices. ACS symposium series; 1112, USA, **2012**.

### The following parameters should be used for manuscript preparation:

- Spacing 1.5, font size 12, and a margin of 2.5 cm on all four sides of the paper
- Tables and figures should be included after references
- The most popular word processor file formats are recommended

## Proofs

Proofs should be carefully checked by corresponding Author and returned on time to Editors.

### On-line manuscript submission

Please create an account and log in at:

**[www.editorialsystem.com/pjoes](http://www.editorialsystem.com/pjoes)**

In the case of any problem, please do not hesitate to contact with us via e-mail:

[office@pjoes.com](mailto:office@pjoes.com)

After submission, each manuscript will be assigned an editorial number that authors should use in all correspondence with journal staff.

## Payment

The price of publishing in “Polish Journal of Environmental Studies” is **35 EURO + 0% VAT** and **140 PLN + 8% VAT** per one page of manuscript for foreign and Polish Authors, respectively. Each Figure and each Table is considered as one page of manuscript. The fee for each Figure in colour is 70 EURO. The price includes high quality PDF of article, which will be send to corresponding Author.

### SUBSCRIPTION INFORMATION

"Polish Journal of Environmental Studies"  
(ISSN 1230-1485)  
is published bimonthly since 1996.  
Subscription rates for Volume 34 (2025) are:  
Institutions: 288 EURO + 0% VAT  
(six issues per year)  
Individuals: 96 EURO + 0% VAT  
(six issues per year)

### INFORMACJE O PRENUMERACIE

„Polish Journal of Environmental Studies”  
(ISSN 1230-1485)  
jest dwumiesięcznikiem od 1996 roku.  
Roczna prenumerata tomu 34 (2025) wynosi dla:  
Instytucji: 360 PLN + 8% VAT (6 numerów w roku)  
Indywidualnych odbiorców: 144 PLN + 8% VAT  
(6 numerów w roku)

### ORDER FORM of "Polish Journal of Environmental Studies"

Volume:  
Year:  
Number of issues:  
Institution:  
- name  
- address  
- VAT number

Please send the order to:  
"Polish Journal of Environmental Studies"  
"HARD" Publishing Company  
WENGRIS 71  
10-718 OLSZTYN, POLAND  
e-mail: officehard@pjoes.com

Method of payment:  
Please send payments to the account of  
Polska Kasa Opieki S.A., Oddział Olsztyn, Poland  
number: **PL 19124015901111000014317981**  
SWIFT: PKOPPLPW

**ISSN 1230-1485**

### FORMA ZAMÓWIENIA PRENUMERATY „Polish Journal of Environmental Studies”

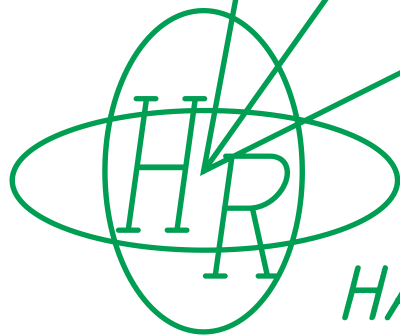
Numer tomu:  
Rok:  
Ilość egzemplarzy:  
Instytucja zamawiająca:  
- Nazwa  
- Adres  
- Nr NIP

Zamówienie należy przesłać na adres:  
„Polish Journal of Environmental Studies”  
Redakcja HARD Publishing Company  
ul. WENGRIS 71  
10-718 OLSZTYN  
e-mail: officehard@pjoes.com

Sposób opłacenia:  
Proszę przekazać opłatę na rachunek  
Polska Kasa Opieki S.A., Oddział Olsztyn  
numer: **19124015901111000014317981**

*POLISH*

*JOURNAL OF ENVIRONMENTAL  
STUDIES*



*HARD OLSZTYN*

**Vol. 34, No. 1, 2025**  
**PART II**

# POLISH JOURNAL OF ENVIRONMENTAL STUDIES

Professor  
**JERZY RADECKI**

EDITOR in - CHIEF  
Professor **HANNA RADECKA**

EXECUTIVE EDITOR  
Dr. **DOROTA KULKA-RADECKA**

TECHNICAL EDITOR  
Eng. **MARIUSZ KULKA**

## EDITORIAL BOARD:

**IMRAN ALI**  
Southwest University of Science and  
Technology, Mianyang, China

**IRENA BARANOWSKA**  
Polytechnic of Silesia, Gliwice, Poland

**LIGITA BALEŽENTIENĖ**  
Vytautas Magnus University, Kaunas  
district, Lithuania

**JAN BOGACKI**  
Warsaw University of Technology, Poland

**BOGUSŁAW BUSZEWSKI**  
Nicolaus Copernicus University, Toruń,  
Poland

**MEHMET CETIN**  
Kastamonu University, Kastamonu,  
TURKEY

**LUKASZ CHRZANOWSKI**  
Poznań University of Technology, Poland

**JAN DERCO**  
Slovak University of Technology,  
Bratislava, Slovakia

**JAN DOBROWOLSKI**  
AGH University of Science and  
Technology, Kraków, Poland

**HÉCTOR FERNÁNDEZ**  
Universidad Nacional De Rio Cuarto,  
Departamento de Quimica, Rio Cuarto,  
Argentina

**S. J. S. FLORA**  
National Institute of Pharmaceutical  
Education and Research (NIPER),  
INDIA

**EWA FLOREK**  
University of Medical Sciences, Poznań,  
Poland

**MAGDALENA GANTNER**  
Warsaw University of Life Sciences, Poland

**JANIŃA GOSPODAREK**  
University of Agriculture, Cracow, Poland

**MARIA HEPEL**  
Potsdam College, The State University  
of New York, USA

**PIOTR HERBUT**  
University of Agriculture, Cracow, Poland

**YUH-SHAN HO**  
College of Environmental Sciences, Peking  
University, Beijing, People's Republic  
of China

**MIROSLAV HUTNAN**  
Slovak University of Technology, Slovakia

**DANA - ADRIANA ILUTIU - VARVARA**  
Technical University of Cluj – Napoca,  
Romania

**MUNAWAR IQBAL**  
University of Lahore, Lahore, Pakistan

**HARRY D. KAMBEZIDIS**  
National Observatory of Athens, Greece

**HANNA KLIKOCA**  
University of Life Sciences in Lublin,  
Poland

**MONIKA KOWALSKA-GÓRALSKA**  
Institute of Biology, Wrocław, Poland

**ANNA KOZAK**  
Adam Mickiewicz University in Poznań,  
Poland

**MALGORZATA KRZYWONOS**  
Wrocław University of Economics, Poland

**JAN KUCHARSKI**  
University of Warmia and Mazury  
in Olsztyn, Poland

**E. KUDJO DZANTOR**  
Tennessee State University, USA

**ROBERTO LAI**  
University of Sassari, Italy

**ULRICH LÜTTGE**  
Institute of Botany, TH Darmstadt,  
Germany

**GRZEGORZ MAJ**  
University of Life Sciences in Lublin,  
Poland

**SHELLEY MINTER**  
University of Utah, Department of  
Chemistry, Salt Lake City, USA

**JACEK NAMIESNIK**  
Chemical Faculty, Gdansk University  
of Technology, Poland

**CEMILE OZCAN**  
Kirkklareli University, TURKEY

**DAINIUS PALIULIS**  
Vilnius Gediminas Technical University,  
Lithuania

**MARIUSZ PELECHATY**  
University of Adam Mickiewicz, Poznań,  
Poland

**FÁBIO PORTELLA**  
Federal University of Pernambuco, Recife,  
Brazil

**FERNANDO PORTO**  
Federal Rural University of Pernambuco,  
Recife, Brazil

**BALTRENAS PRANAS**  
Vilnius Gediminas Technical University  
(VGTU), Lithuania

**STANISŁAW PRZESTALSKI**  
University of Agriculture, Wrocław, Poland

**MAHMOOD QAISAR**  
COMSATS University Abbottabad,  
Pakistan

**JOANNA ROSAK-SZYROCKA**  
Czestochowa University of Technology, Poland

**GUNNO RENMAN**  
Royal Institute of Technology, Stockholm,  
Sweden

**ROBERTO RICO-MARTÍNEZ**  
Autonomous University of Aguascalientes,  
Aguascalientes, Mexico

**JERZY SIEPAK**  
University of Adam Mickiewicz, Poznań,  
Poland

**PEDRO SIMÕES**  
CERIS-IST, University of Lisbon, Portugal

**MITSUYUKI SOMA**  
University of Shizuoka, Shizuoka 422,  
Japan

**AGATA SZYMAŃSKA-PULIKOWSKA**  
University of Life Sciences in Wrocław,  
Poland

**YUKINORI TANI**  
University of Shizuoka, Japan

**CEM TOKATLI**  
Trakya University, Ipsala Vocational  
School, Edirne – Turkey

**ASHOK VASEASHTA**  
U.S. Department of State, Washington,  
USA

**CARLOS EDUARDO FRONTANA  
VÁZQUEZ**  
Centra de Investigación y Desarrollo  
Tecnológico en Electroquímica, Cideteq,  
SC, Queretaro, Mexico

**HEINZ-RUDOLF VOIGT**  
University of Helsinki, Finland

**JAN VYMAZAL**  
Czech University of Life Sciences Prague,  
Czech Republic

**AMIR WASEEM**  
Quaid-i-Azam University, Islamabad-  
45320, Pakistan

**AGNIESZKA WOLIŃSKA**  
The John Paul II (The Second) Catholic  
University of Lublin, Poland

# POLISH JOURNAL OF ENVIRONMENTAL STUDIES

Vol. 34, No. 1 (2025)

## PART II

### REVIEW

1. Progress of Forest Eco-Product Value Realization and Eco-Industry: Implications for Closing Mountain for Afforestation under Karst Desertification Control  
YOUZE NING, YU ZHANG, JUAN HU, KANGNING XIONG, ZEFU ZHANG ..... 507
2. Green Leadership in Policy Making towards Sustainable Future: Systematic Critical Review and Future Direction  
HERU NURASA, SAPEN SARTIKA UNYI PUTRI, ABDILLAH ABDILLAH,  
IDA WIDIANINGSIH ..... 519
3. Influence of Water Rock Interaction on Stability of Tunnel Engineering  
XULIN SU, CHENGPING ZHANG, ZHENXIANG ZOU, YONGLEI WANG,  
JINXING LAI, TONG LIU ..... 535
4. Research Progress on Identification of Basin Water Yield Baseline and Regulation Slope Water Yield Process  
WENYU WANG, JUN HOU, XIN ZHANG, TAO DU, SHIZHI WANG,  
TIANLING QIN ..... 549
5. Waste Transportation Environmental Impact Using Life Cycle Assessment: Bibliometric Analysis and Systematic Review  
HESSY RAHMA WATI, MOCHAMAD ARIEF BUDIARDJO,  
PERTIWI ANDARANI ..... 563

### ORIGINAL RESEARCH

1. Influence of Trace Elements (Co, Ni, Se) on Growth, Nodulation and Yield of Lentil  
MUHAMMAD ABBAS ANEES, SYED IJAZ UL HAQ, MUHAMMAD RASHEED,  
MUJAHID HUSSAIN, GHULAM QADIR, RIFAT HAYAT,  
MUHAMMAD ARSHAD ULLAH, ABEER HASHEM,  
ELSAYED FATHI ABD ALLAH, YUBIN LAN ..... 573
2. Spatial Distribution Characteristics and Influencing Factors of Key Rural Tourism Villages in China  
ZHI-YANG CHANG ..... 593
3. Mitigating Carbon Dioxide in Atmosphere by Utilizing Biochar as a Fertilizer; A Step Towards Sustainable Agriculture  
AMARA DAR, MAHREEN HAFEEZ, FIZA SARWAR, NOOR UL AIN,  
GHAZALA YASEEN, JAMIL ANWAR, MEHDI KHOSHNAMVAND,  
MUSHTAQ AHMAD ANSARI ..... 607
4. Green Environment via Theory of Consumption Values: Impact of Attitude Towards Environment and Green Product Quality on Green Purchase Intention  
ZHEN DONG, MINGHAO HUANG ..... 617

5. Responses of <i>Gossypium barbadense</i> L. Cotton Plants to Biofertilizers under Different Levels of Nitrogen Fertilization ESSAM ABDELAZIZ EL-WARAKY, HOSSAM S. EL-BELTAGI, MOHAMED FATHI EL-NADY, MOHAMMED I. AL-DAEJ, ELSAYED B. BELAL, WAEI F. SHEHATA, MAHA LOUTFI HADID, METWALY MAHFOUZ SALEM METWALY .....	631
6. Mechanisms for the Evolution of a Multiple Governance Model: Evidence from Water Pollution Control in the Erhai Lake Tourism Environment in China SHU FANG, BAO FENG .....	645
7. Can Market-Based Environmental Regulation Inhibit the Industrial Water Pollution? BINGNAN GUO, WEIZHE FENG, HAO ZHANG .....	657
8. Analysis of Influencing Factors of Rainfall Infiltration Slope Sensitivity Based on Grey Relational Analysis CHANGYU HAN, YIDAN HAO, KUN LIU, HAOTING ZHAO, WENCHAO CHEN, XUJIE LIU .....	671
9. Spatial Pattern of Ecosystem Carbon Stocks in the Lhasa River Basin and Its Response Mechanism to Land Use Change WENYUAN HAO, MENGROU GENG, JIANXIA HAN, YONGXIA LI, JIN XU, ZHEN XING .....	681
10. Modelling Air Pollution from Steel Plants and Determining the Safety Distance for the Surrounding Area in Phu My Town, Ba Ria - Vung Tau Province, Vietnam DUNG MINH HO, TUAN QUOC NGUYEN, HA MANH BUI .....	695
11. Optimization of Urban Cold Chain Logistics Path Considering Carbon Constraints JIAQI HOU, YANQIU LIU, YING ZHANG, JIHUI HU, AOBELI ZHANG .....	705
12. Analysis of Ecological Environment Changes Associate with Driving Factors in the Inland River Basin of Northwest China Based on GeoDetector HAOCHENG KE, MENGHAN TIAN, LIANG LIANG, CHUNHUI YUAN, MAOLIN WANG, YAYU GAO .....	719
13. Dynamic Evolution and Regional Differences in Ecological Welfare Performance: Insights from Guangdong Province, China FANGHUI LIU, CHUNYUAN KE, YAQING WEN .....	735
14. From Linear to Circular: Assessing the Influence of Circular Economy Practices on Business and Environmental Dynamics YING LIU, MUHAMMAD USMAN, AHSAN AKBAR, MARTINA HEDVICAKOVA .....	755
15. Molecular Mechanisms Underlying Triple and Single-Capsule Sesame ( <i>Sesamum Indicum</i> L.) Varieties and Their Antioxidant Enzyme Activities AYNUR B. ÖZÇINAR, HÜSEYİN ARSLAN, BEHÇET İNAL .....	767
16. Unraveling Vegetation Diversity and Environmental Influences in the Sultan Khail Valley, Dir Upper, Pakistan: An Advanced Multivariate Analysis Approach KHAISTA RAHMAN, NAVEED AKHTAR, SARAH ABDUL RAZAK, MUHAMMAD NAUMAN KHAN, ALEVCAN KAPLAN, MAJID IQBAL, SEZAI ERCISLI, MUHAMMAD JAVED ANSARI, HESHAM S. ALMOALLIM .....	777

17. Carboxymethyl Chitosan Improves Sugar Beet Tolerance to Drought by Controlling Enzyme Activity and Stomatal Conductance KHALED M. A. RAMADAN, HOSSAM S. EL-BELTAGI, BASEM SOBH Y IBRAHIM MAKHLOUF, SOHA RAMADAN ABOU ELELA KHALIL, MOHAMMED I. AL-DAEJ, TAREK A. SHALABY, ESLAM S.A. BENDARY, HANI SABER SAUDY .....	791
18. Identification and Driving Effects of Land Use Conflicts in Mega-City in Northeast China: A Case Study of Shenyang City RUIQING SU, GE SONG, QUANXI WANG .....	801
19. Spatiotemporal Variations and Main Drivers of Landscape Ecological Risks in the Qinling-Daba Mountains: A Case Study in Ankang City FEI SUN, PING SONG, ZUOBIN WU .....	815
20. The Variability of Indoor Air Pollutants in the Office and Their Impact on the Workers' Health ANDREEA TEPENEU, DORINA CHAMBRE, TEODORA SURDEA-BLAGA, ANDREEA LUPITU, CRISTIAN MOISA, DANA MARIA COPOLOVICI, LUCIAN COPOLOVICI .....	835
21. Harvesting Green Propensity: Creating Environmental Oriented Behavior among Rural Communities through Green Knowledge Sharing JIANCONG WANG, YING WU, QIMING YANG, ÇAĞATAY YILDIRIM .....	851
22. Introduction of Resin Barrier to Improve the Efficiency of Electrokinetic Remediation for Pb-Contaminated Soil SHUAIJIE WANG, SIRU CHEN, YUTONG FU, FEI YE, HAIYUN QI .....	867
23. The Impact of Free Trade Zones Establishment on Urban Environmental Pollution: Evidence from China LEI XU .....	879
24. Research on the Spatiotemporal Evolution and Influencing Factors of Sudden Environmental Incidents in China from 2008 to 2021 JUN YAN, XINYING WANG, TING WANG, XU ZHANG .....	891
25. Effects of Long-Term Organic Fertilizer Application on Tea Plantation Soil of Its Physical and Chemical Properties and Microbial Communities JIAN YANG, ZUYONG CHEN, JIE DAI, FANG LIU, JIAN ZHU .....	905
26. Health Risk Assessment of Soil Heavy Metals in the Urban-Rural Area of Lanzhou City, Gansu Province, China JINCHEN ZHANG, WEIHUA PENG, XINRUI HUANG, MANLI LIN .....	917
27. Effects of Nano-Potassium Molybdate Preventing the Heavy Metal Poisoning in the Przewalski's Gazelle WANYI ZENG, HONG REN, XIAOYUN SHEN .....	929
28. Effect of Social Class Cognition and Public Service Satisfaction on Pro-Environmental Behavior in China YU ZHANG, JIAHUI TANG, JIE WANG, WANG ZHANG .....	939

29. Research on the Evolutionary Game of Multi-Body Co-Innovation in Green Innovation Ecosystems XUE ZHAO, HUA ZOU .....	949
30. Research on the Impact of Green Credit Policy on the Intelligent Transformation of Heavily Polluting Enterprises XUAN ZHOU, DEJIA YUAN, ZHENG WEI GENG .....	963
31. Environmental Vulnerability Assessment of Rainstorm Waterlogging Disaster in Underground Railway YE ZHOU, WEI HUANG .....	977
32. Experimental Study on Composition and Optic of Secondary Organic Aerosol Generated by Aqueous Photooxidation of Toluene in Presence of Copper Ions MINCONG ZHU, MINGQIANG HUANG, LIMEI ZHANG, SHUNYOU CAI, WEIXIONG ZHAO, CHANGJIN HU, XUEJUN GU, WEIJUN ZHANG .....	985

## NOTES TO AUTHORS

The following types of articles will be published:

- Full length research paper – describing original research;
- Short Communication – short research articles intended to present exciting findings that will have a major impact in environmental science;
- Reviews – should be a critical evaluation of the current stage of research on a particular environmental problem;
- Invited accelerated articles – stimulating the up-to-date research;

The submitted manuscripts, which must not have been published elsewhere, will be reviewed by The Editorial Board Members of the “Polish Journal of Environmental Studies,” assisted by Referees.

Authors of papers involving experiments with animals are requested to include the opinion and approval of Local Committee of Ethics.

### The recommended order of presentation

- **T i t l e.**
- Author's name and affiliations, e-mail address.
- **A b s t r a c t.** An abstract stating the results and the novel aspects of the work and findings.
- **K e y w o r d s.** Up to 5 keywords or key phrases, indicating the topic of importance in the work.
- **I n t r o d u c t i o n.** An introductory statement of the subject under investigation with any essential historical background.
- **E x p e r i m e n t a l P r o c e d u r e s.** Working details must be given concisely; well-known operations should not be described in detail.
- **R e s u l t s.** These could be presented in tabular or graph form, with appropriate statistical evaluation.
- **D i s c u s s i o n o f R e s u l t s.** The consolidation of the study and general implications should be presented and discussed with up-to-date scientific literature.
- **C o n c l u s i o n s.** Should include significance of the findings and recommendations for future work.
- **A c k n o w l e d g e m e n t s.**
- **U n i t s a n d N o m e n c l a t u r e.** The SI system of units and current internationally recognized (IUPAC) chemical nomenclature should be used. Common trivial names may be used, but should first be defined in terms of IUPAC nomenclature.
- **R e f e r e n c e s** should be indicated in the text by consecutive numbers and the full references should be listed in the same order at the end of the article in the following form:

***In the year 2023 Index Citation Report:  
Impact Factor: 1.400***

ISO Abbrev. Title: Pol. J. Environ. Stud.

*The “Polish Journal of Environmental Studies” is indexed and abstracted in: Chemical Abstracts; Ulrich's International Periodicals Directory; R.R., Bowker; USA; CAB International, Oxon, U.K.; Environmental Abstracts, Congressional Information Service, Maryland, USA; Zoological Record-BIOSIS, U.K.; International Soil Reference and Information Centre, the Netherlands; AGRIS EAO – Central Agricultural Library, Warsaw, Poland; Current Contents/Agriculture; Biology and Environmental Sciences; Sciences Citation Index Expanded; EBSCO Information Services; ELSEVIER Bibliographic Databases; AGRO Data Bases.*

***Visit us at: <http://www.pjoes.com>***

***Our e-mail: [officehard@pjoes.com](mailto:officehard@pjoes.com)***

HARD Publishing Company Olsztyn, POLAND  
Linguistic edition: Mark Macznik "COPYMARK"

Composition: Jolanta Czaplą

Technical edition and technical verification: dr. Elena Bisetto

Printing: "GUTGRAF" Olsztyn, Poland

## References

1. KŁOS-WITKOWSKA A. Enzyme-based fluorescent biosensors and their environmental, clinical and industrial applications. *Pol. J. Environ. Stud.* **24** (1), 19, **2015**.
2. CHEN T. Y., LAI P. Y. A comparative study of energy utilization efficiency between Taiwan and China. *Energ. Policy.* **38** (5), 2386, **2010**.
3. HEPEL M., ZHONG C. J. Functional nanoparticles for bioanalysis, nanomedicine and bioelectronics devices. *ACS symposium series*; 1112, USA, **2012**.

### The following parameters should be used for manuscript preparation:

- Spacing 1.5, font size 12, and a margin of 2.5 cm on all four sides of the paper
- Tables and figures should be included after references
- The most popular word processor file formats are recommended

## Proofs

Proofs should be carefully checked by corresponding Author and returned on time to Editors.

### On-line manuscript submission

Please create an account and log in at:

**[www.editorialsystem.com/pjoes](http://www.editorialsystem.com/pjoes)**

In the case of any problem, please do not hesitate to contact with us via e-mail:

[office@pjoes.com](mailto:office@pjoes.com)

After submission, each manuscript will be assigned an editorial number that authors should use in all correspondence with journal staff.

## Payment

The price of publishing in “Polish Journal of Environmental Studies” is **35 EURO + 0% VAT** and **140 PLN + 8% VAT** per one page of manuscript for foreign and Polish Authors, respectively. Each Figure and each Table is considered as one page of manuscript. The fee for each Figure in colour is 70 EURO. The price includes high quality PDF of article, which will be send to corresponding Author.

### SUBSCRIPTION INFORMATION

"Polish Journal of Environmental Studies"  
(ISSN 1230-1485)  
is published bimonthly since 1996.  
Subscription rates for Volume 34 (2025) are:  
Institutions: 288 EURO + 0% VAT  
(six issues per year)  
Individuals: 96 EURO + 0% VAT  
(six issues per year)

### INFORMACJE O PRENUMERACIE

„Polish Journal of Environmental Studies”  
(ISSN 1230-1485)  
jest dwumiesięcznikiem od 1996 roku.  
Roczna prenumerata tomu 34 (2025) wynosi dla:  
Instytucji: 360 PLN + 8% VAT (6 numerów w roku)  
Indywidualnych odbiorców: 144 PLN + 8% VAT  
(6 numerów w roku)

### ORDER FORM of "Polish Journal of Environmental Studies"

Volume:  
Year:  
Number of issues:  
Institution:  
- name  
- address  
- VAT number

Please send the order to:  
"Polish Journal of Environmental Studies"  
"HARD" Publishing Company  
WENGRIS 71  
10-718 OLSZTYN, POLAND  
e-mail: officehard@pjoes.com

Method of payment:  
Please send payments to the account of  
Polska Kasa Opieki S.A., Oddział Olsztyn, Poland  
number: **PL 19124015901111000014317981**  
SWIFT: PKOPPLPW

**ISSN 1230-1485**

### FORMA ZAMÓWIENIA PRENUMERATY „Polish Journal of Environmental Studies”

Numer tomu:  
Rok:  
Ilość egzemplarzy:  
Instytucja zamawiająca:  
- Nazwa  
- Adres  
- Nr NIP

Zamówienie należy przesłać na adres:  
„Polish Journal of Environmental Studies”  
Redakcja HARD Publishing Company  
ul. WENGRIS 71  
10-718 OLSZTYN  
e-mail: officehard@pjoes.com

Sposób opłacenia:  
Proszę przekazać opłatę na rachunek  
Polska Kasa Opieki S.A., Oddział Olsztyn  
numer: **19124015901111000014317981**