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Integrated environmental management: tools and applications

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Department of Environmental Engineering and Management

WORKSHOP: ENVIRONMENTAL MANAGEMENT & ENVIRONMENTAL EDUCATION. RESULTS, POLICIES, SYNERGIES, AND GOOD PRACTICES
Bucharest University of Economic Studies, 3-4 November 2022

Environmental Education – OERs for Rural Citizens (EnvEdu – OERs)

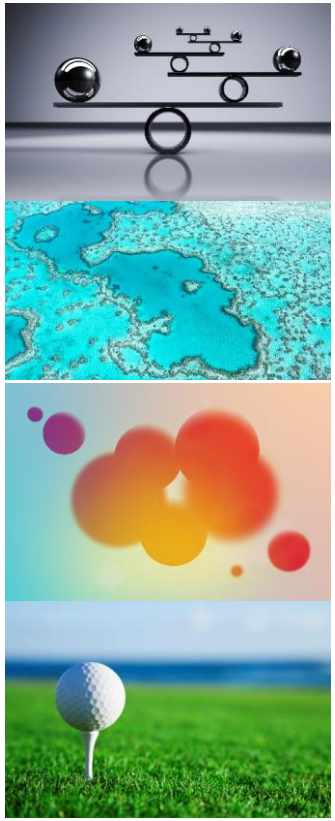
CONTENT

- Tools for environmental management
- Impact assessment applications

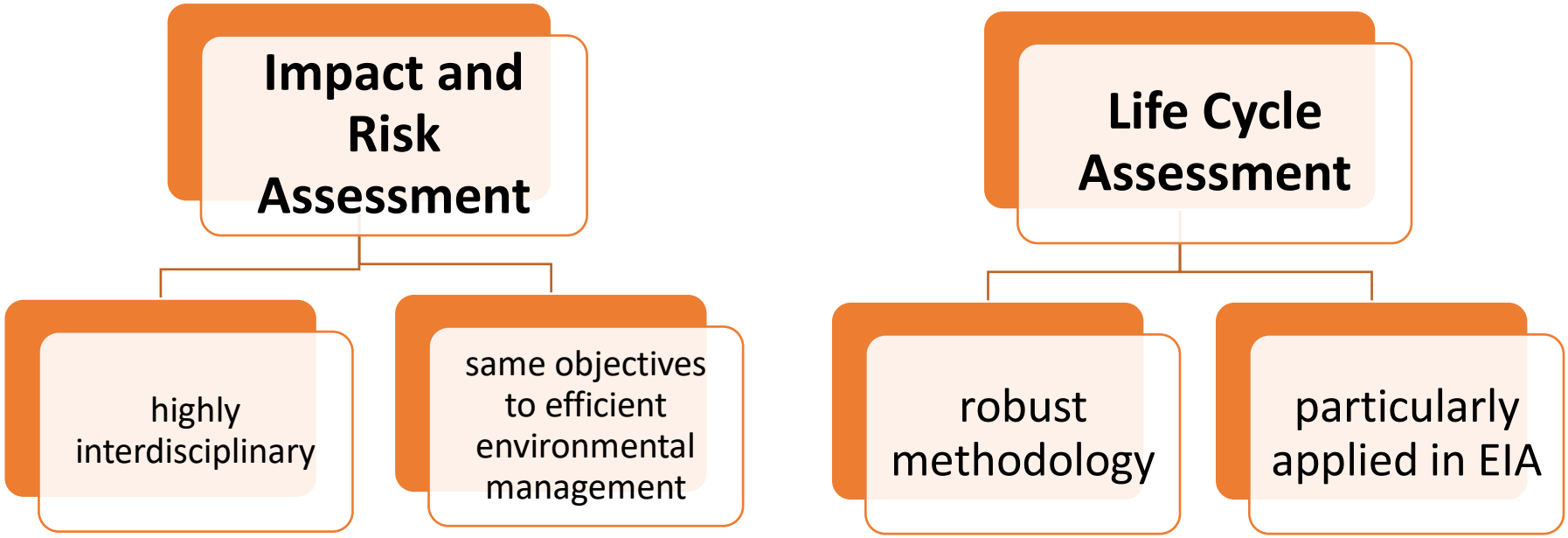
- Prut River basin cross border pollution monitoring and impact assessment

- Siret River basin - Priority Pollutants Monitoring and Water Quality Assessment

- Priority Pollutants Effects on Aquatic Ecosystems Evaluated through Ecotoxicity, Impact, and Risk Assessments

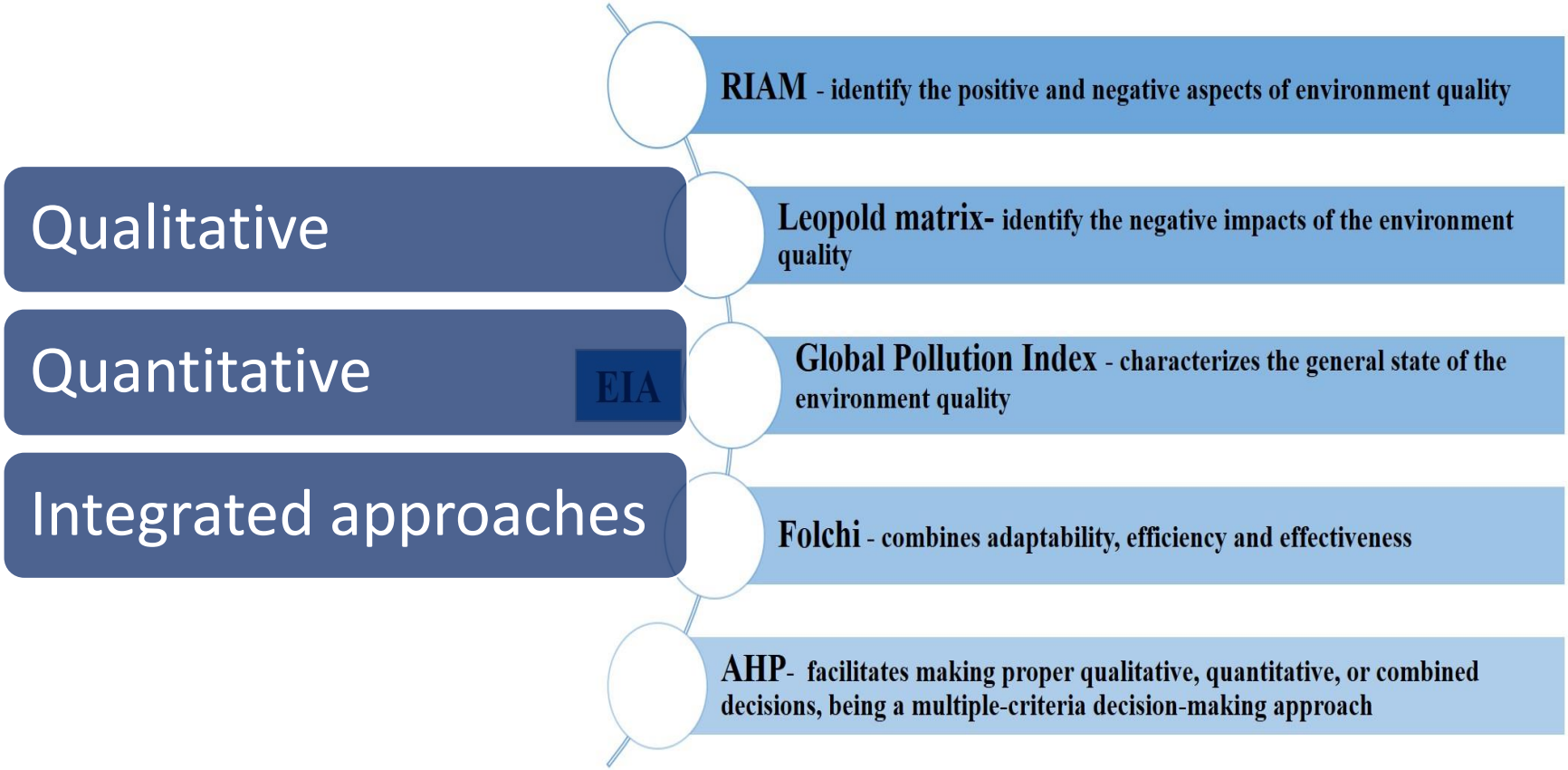


Tools for Environmental Management



Environmental Impact and risk assessment (chapter), **Sluser** B, Plavan O, Teodosiu C., in book *Assessing Progress toward Sustainability (eds. Teodosiu C, Hospido A., Fiore S),* Elsevier Ed., **2022**.

Environmental Impact Assessment (EIA)



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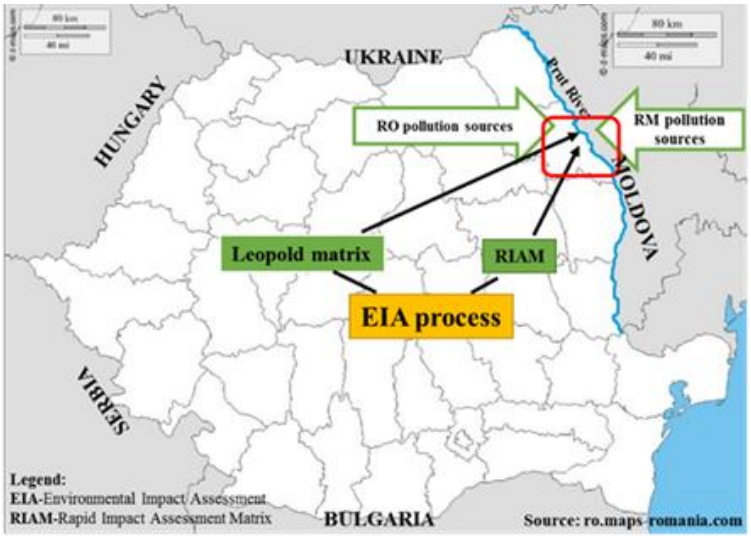
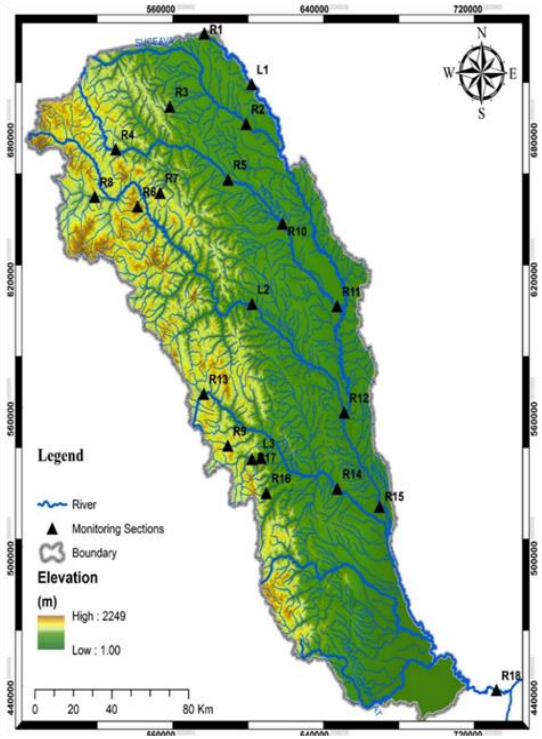
Applications – case studies





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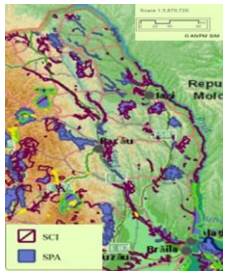

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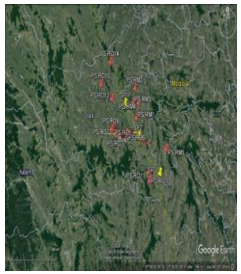

(c)

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Prut River basin cross border pollution monitoring and impact assessment

Environmental monitoring and impact assessment of Prut river cross-border pollution, Neamtu R., **Sluser** B., Plavan O, Teodosiu C., **Environmental Monitoring and Assessment Journal**, (2021), DOI: 10.1007/s10661-021-09110-1

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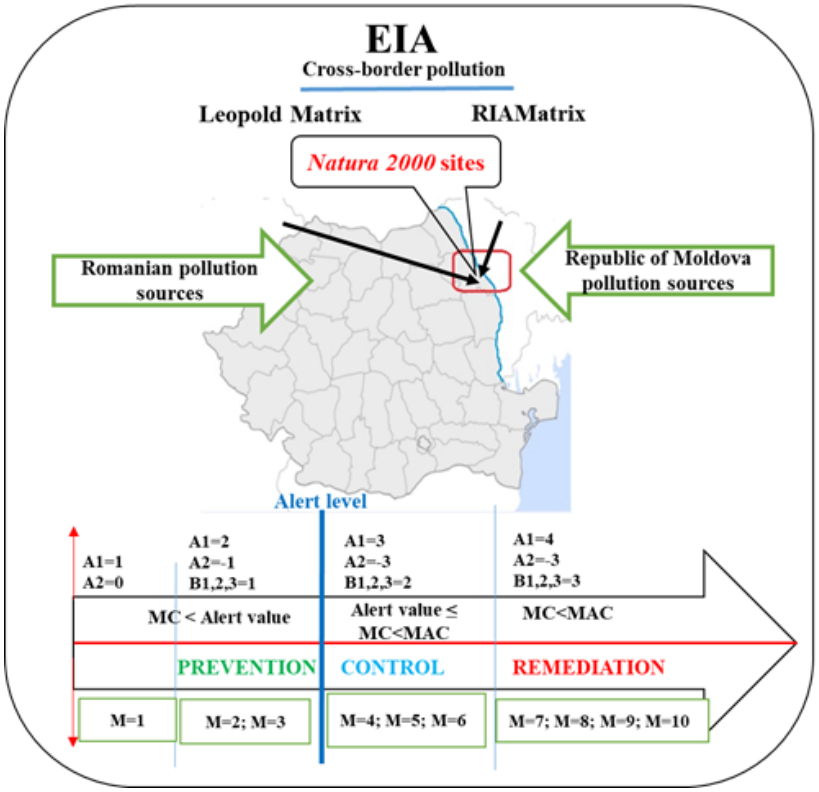
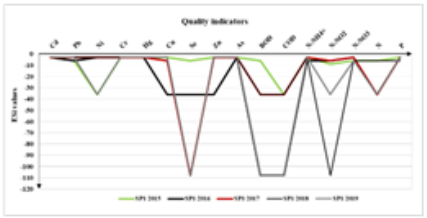
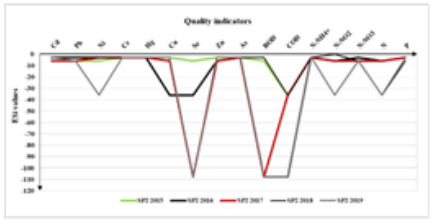
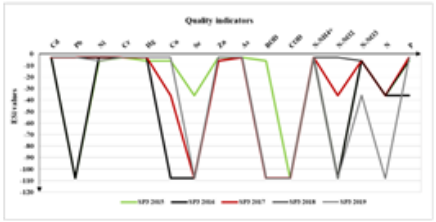
Aim: to assess the environmental impacts of the anthropic cross border activities, based on the Prut river water pollution and 16 quality indicators









- Overall image of water pollution in the cross-border area
- Water pollution levels highly increased on both sides of the river
- EIA by both methods revealed high scores in case of organic pollution
- The high scores of environmental impacts underlined the need for common policies and monitoring procedures.

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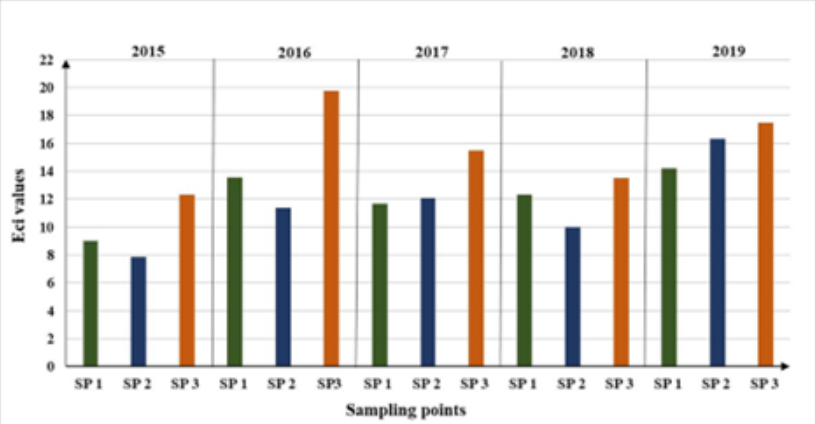
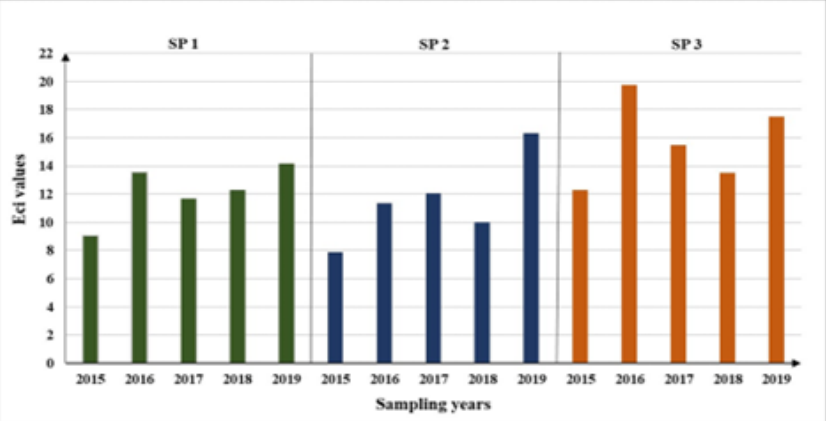
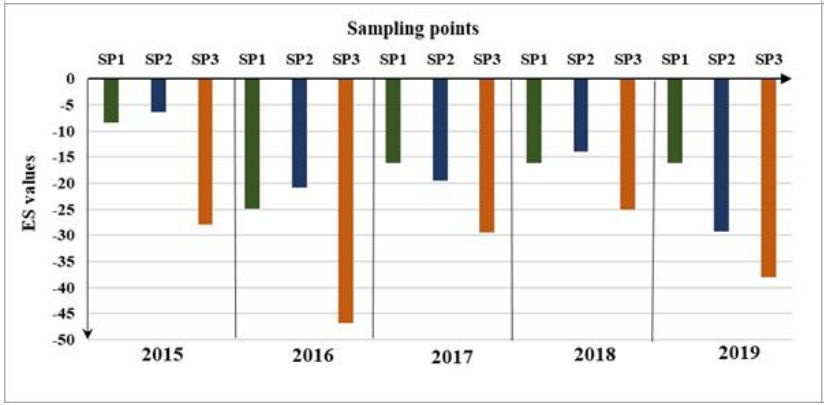
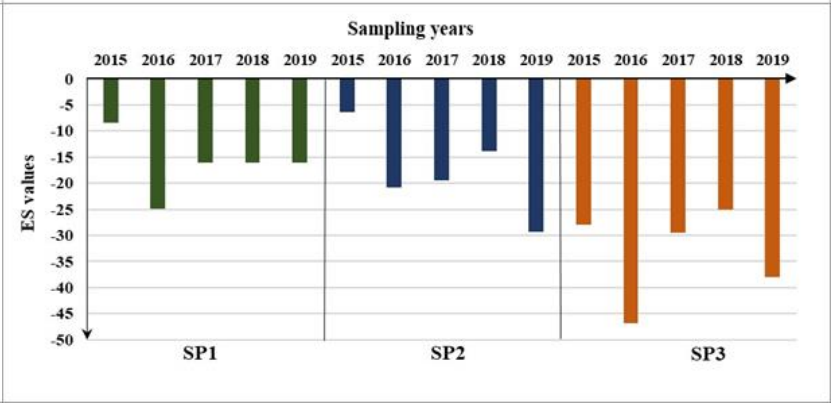
Results









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Conclusions

The cross-border pollution impact assessment in many cases is difficult to be conducted, mainly if the environmental component that it is referred to is water or air and, moreover, if the involved countries do not have to meet the same environmental standards.

The Prut river is the water cross border between three countries: Republic of Moldova, Romania, and Ukraine, from which Romania is full member of the European Union (out of 27 countries), while the other two are members of the European Council (out of 47 countries).

The environmental standards that need to comply with are different from one country to another.

SIRET RIVER BASIN - PRIORITY POLLUTANTS MONITORING AND WATER QUALITY ASSESSMENT

Priority Pollutants Monitoring and Water Quality Assessment in the Siret River Basin, Romania. Zait, R.; **Sluser**, B.; Fighir, D.; Plavan, O.; Teodosiu, C., **Water**, 2022, 14, 129.
https://doi.org/10.3390/w14010129

The aims of this study:

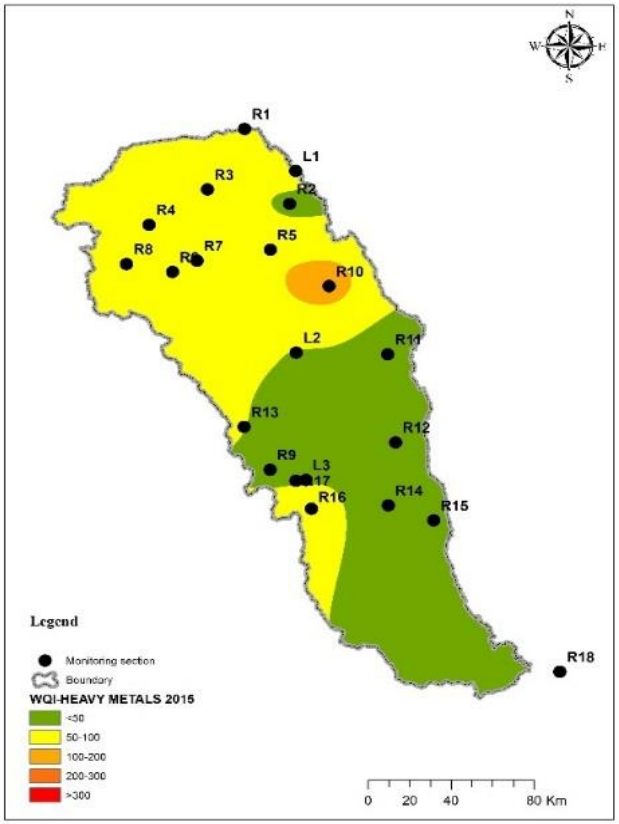
i) The **monitoring of the priority organic and inorganic pollutants** from the Siret River basin, Romania, in the view of the implementation of the WFD requirements, and

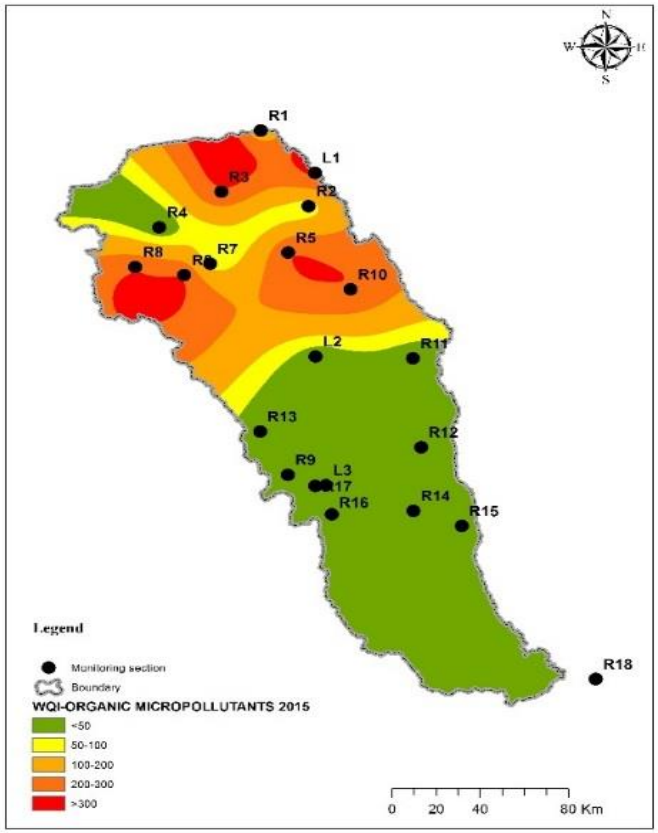
ii) The **evaluation of the water quality of the Siret River basin**, based on measured concentration of the organic and inorganic priority pollutants using the WQI method, with the purpose to establish the water quality status that will contribute to the Second river basin management plan evaluation.

The survey was conducted during the period 2015-2020, considering 21 sampling points: 18 river sections and 3 lake sections.

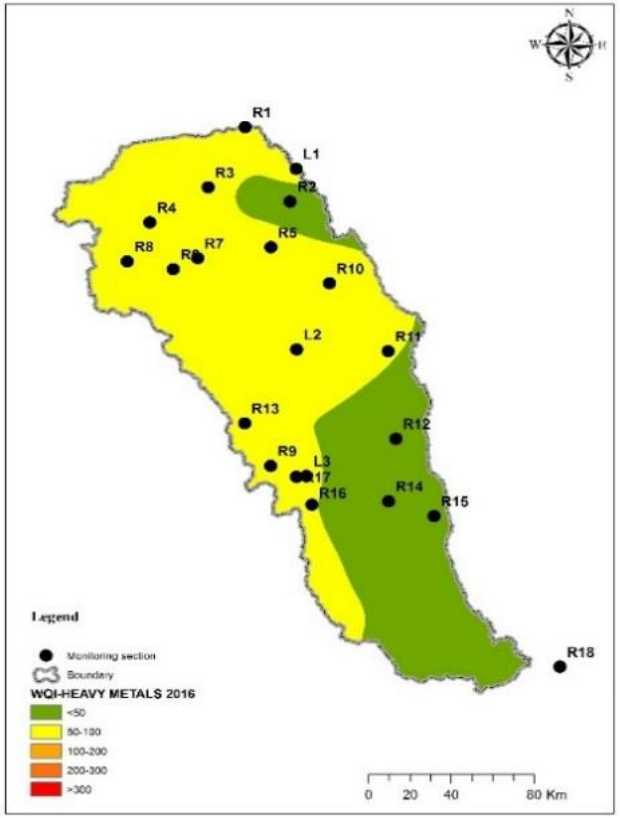
An important role of this study is that the Siret river basin includes Sites of Community Importance, Natura 2000 sites.

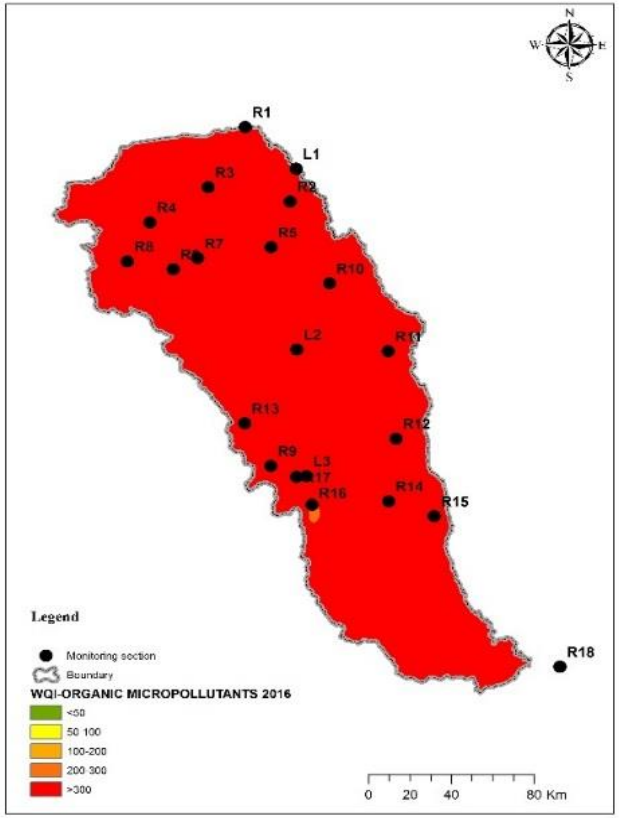
Results: inorganic and organic pollutants, 2015





Results: inorganic and organic pollutants, 2016





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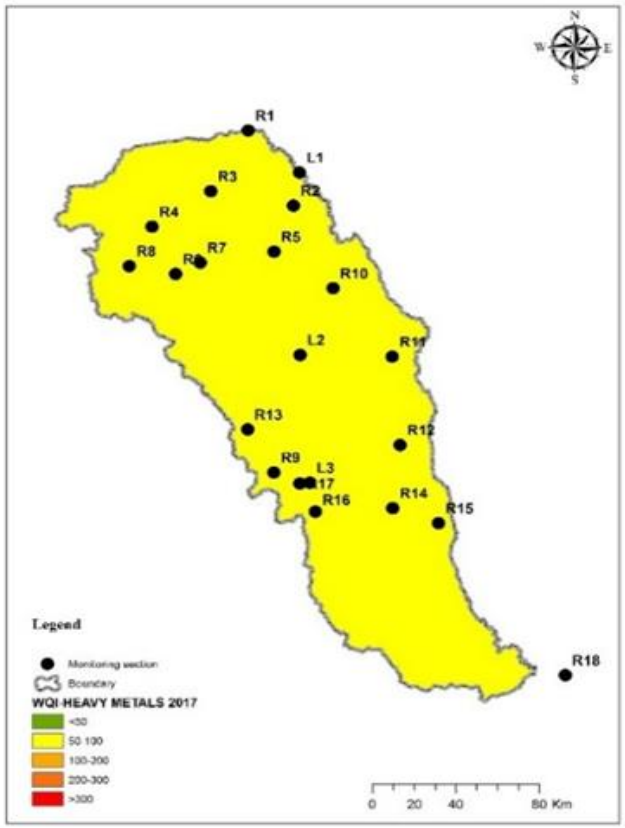
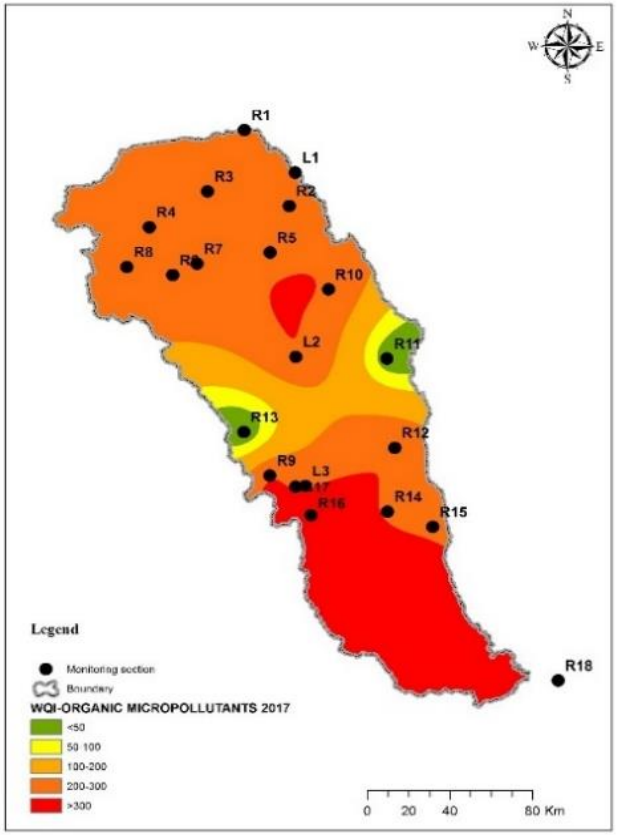
Results: inorganic and organic pollutants, 2017





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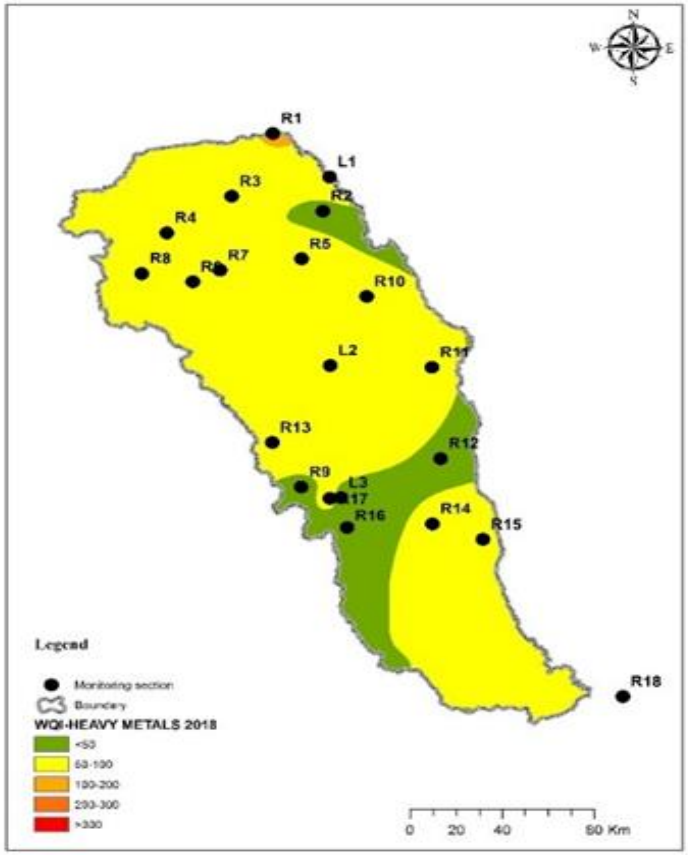
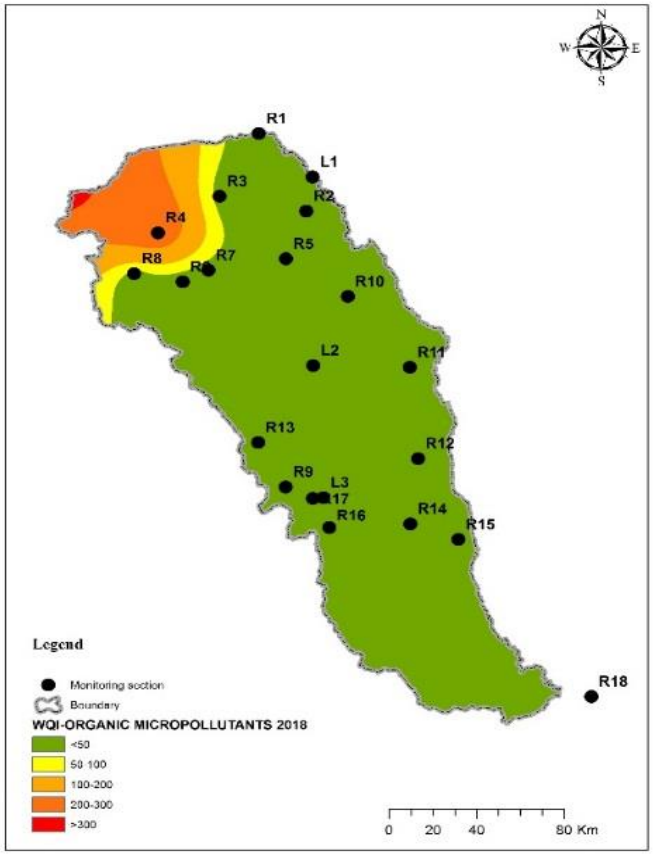
Results: inorganic and organic pollutants, 2018





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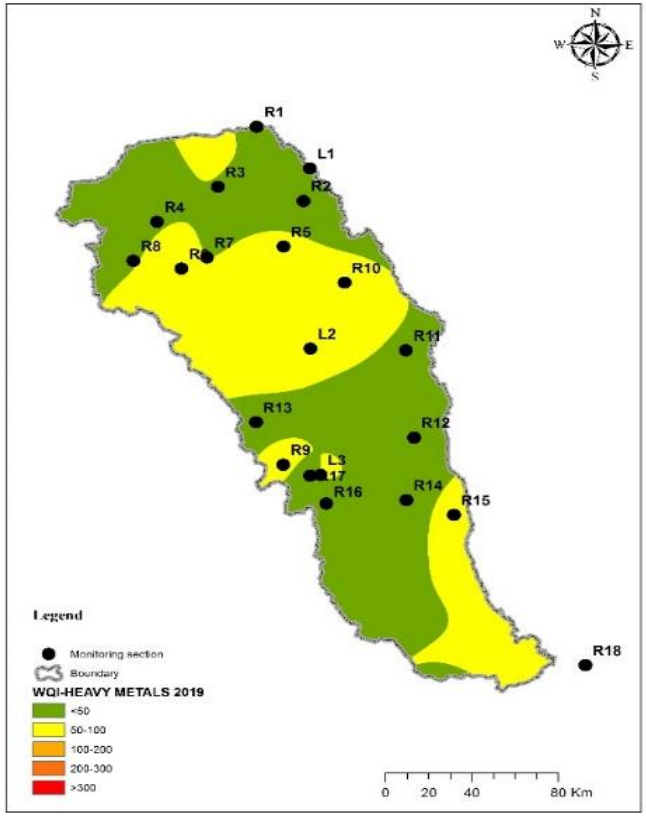
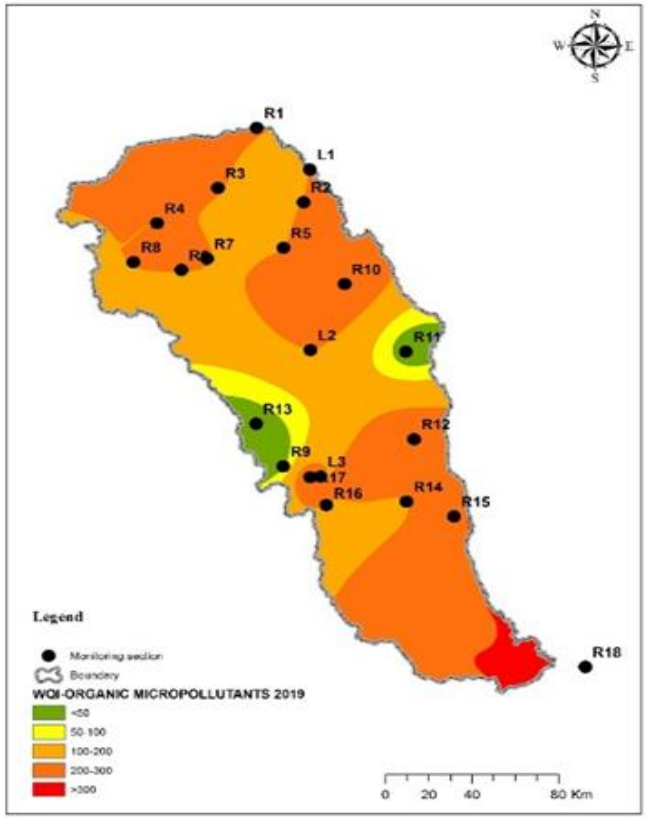
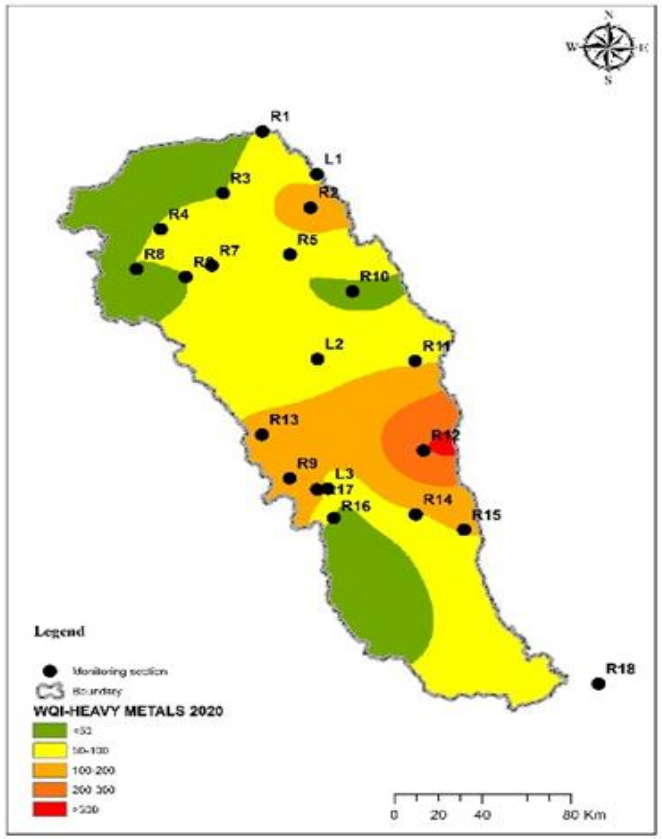
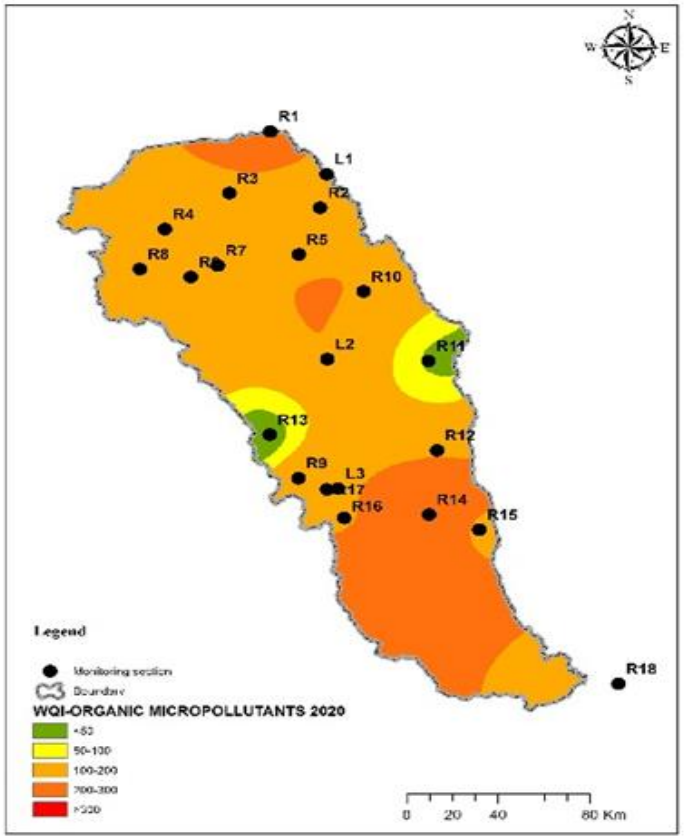
Results: inorganic and organic pollutants, 2019





Results: inorganic and organic pollutants, 2020





Conclusions

- This study successfully showed that the monitoring of priority pollutants (heavy metals and organic micropollutants) is a very important stage in assessing the water quality suitable for drinking water within the Siret River basin.
- The results showed a wide variety of pollution over the river basin, with the maximum allowed concentrations exceeded in certain sampling sections for most water quality indicators.
- The polycyclic aromatic hydrocarbons were measured in all sampling points with high impact on water quality.

PRIORITY POLLUTANTS EFFECTS ON AQUATIC ECOSYSTEMS EVALUATED THROUGH ECOTOXICITY, IMPACT, AND RISK ASSESSMENTS

Priority pollutants effects on aquatic ecosystems evaluated through ecotoxicity, impact, and risk assessments, R.Zait, D.Fighir, B.**Sluser**, O.Plavan, C.Teodosiu, **Water** 2022, 14(20), 3237; https://doi.org/10.3390/w14203237.

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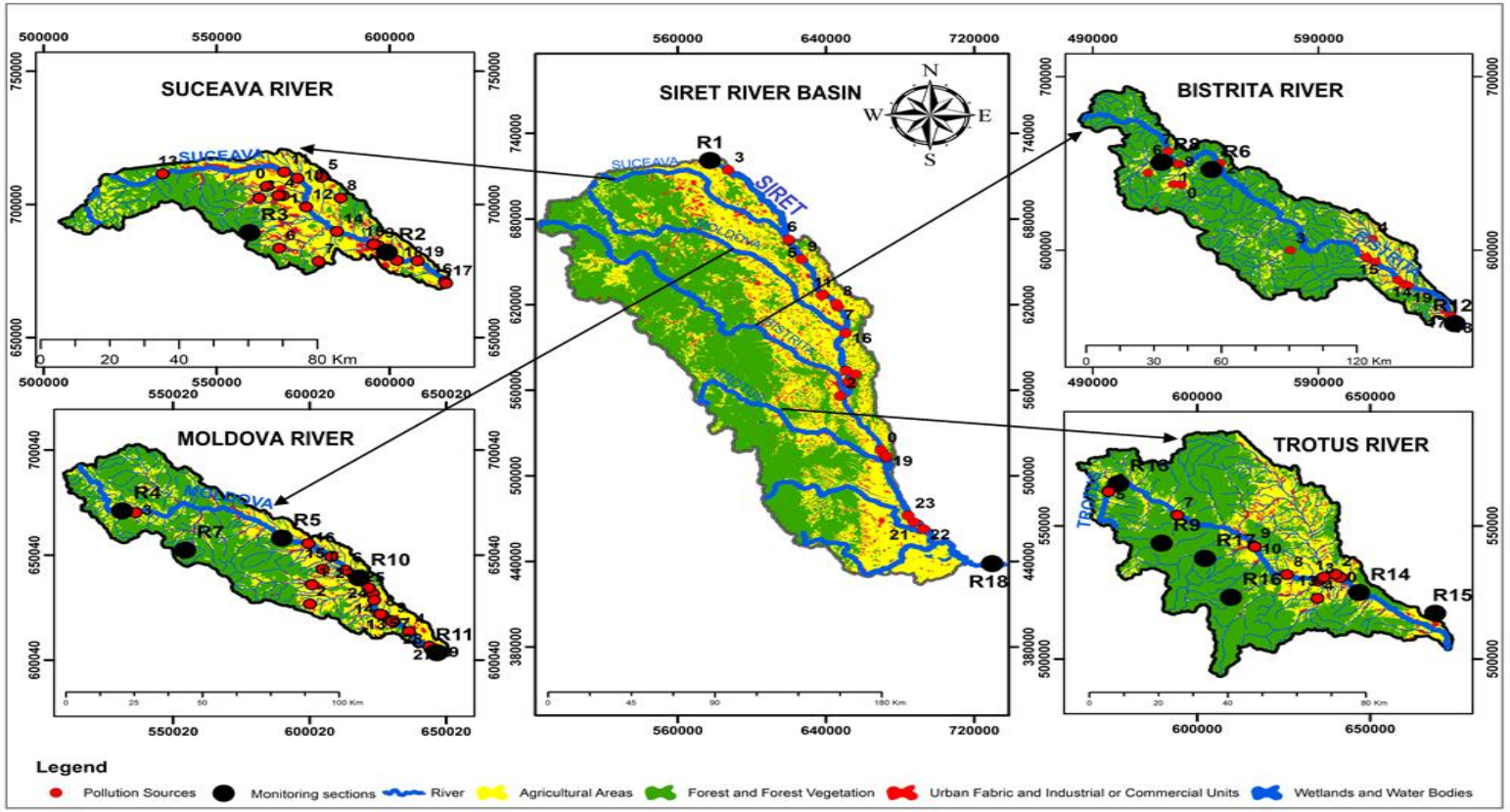
The aims: to assess the ecological and health hazards, and integrated impact and risk assessment, based on the ecotoxicity and exposure factors of each priority pollutant in aquatic ecosystem



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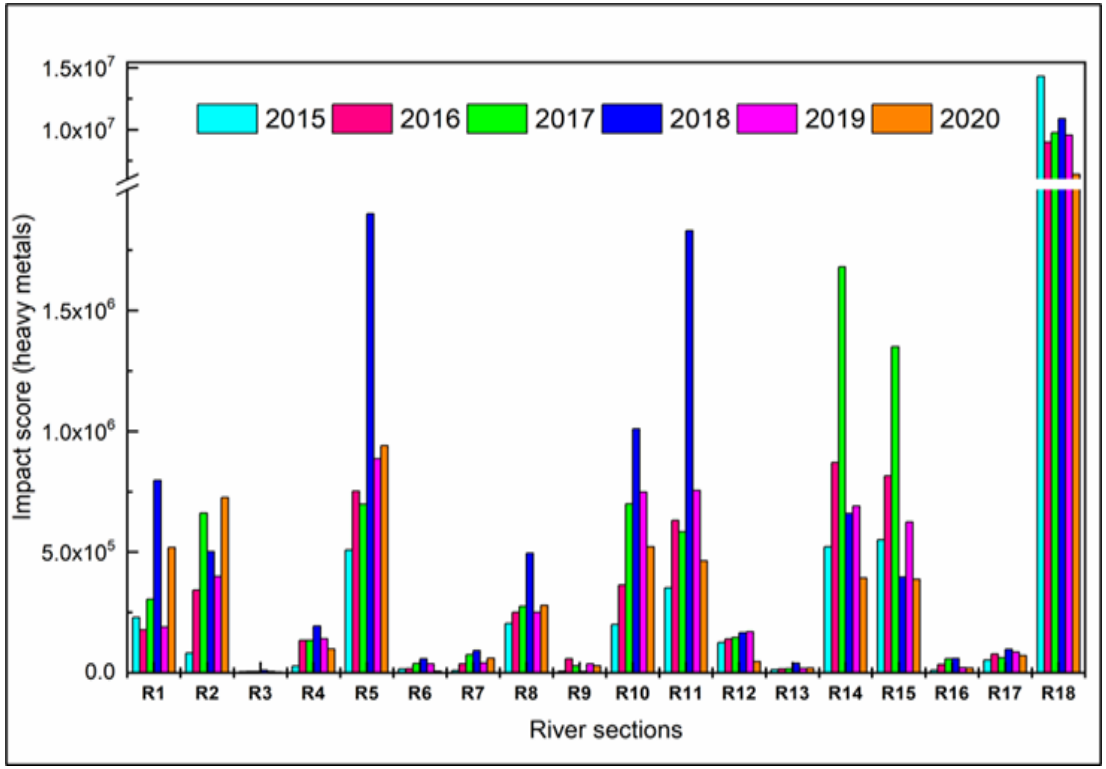
Results – health hazards, carcinogenic impact of inorganic pollutants (heavy metals)



There is a significant carcinogenic health risk of the river water consumption and use, especially in the R18 river section.

The highest impact scores were obtained in 2015 in R18 and the impact increased in the period 2015-2017 followed by a decrease until 2020.

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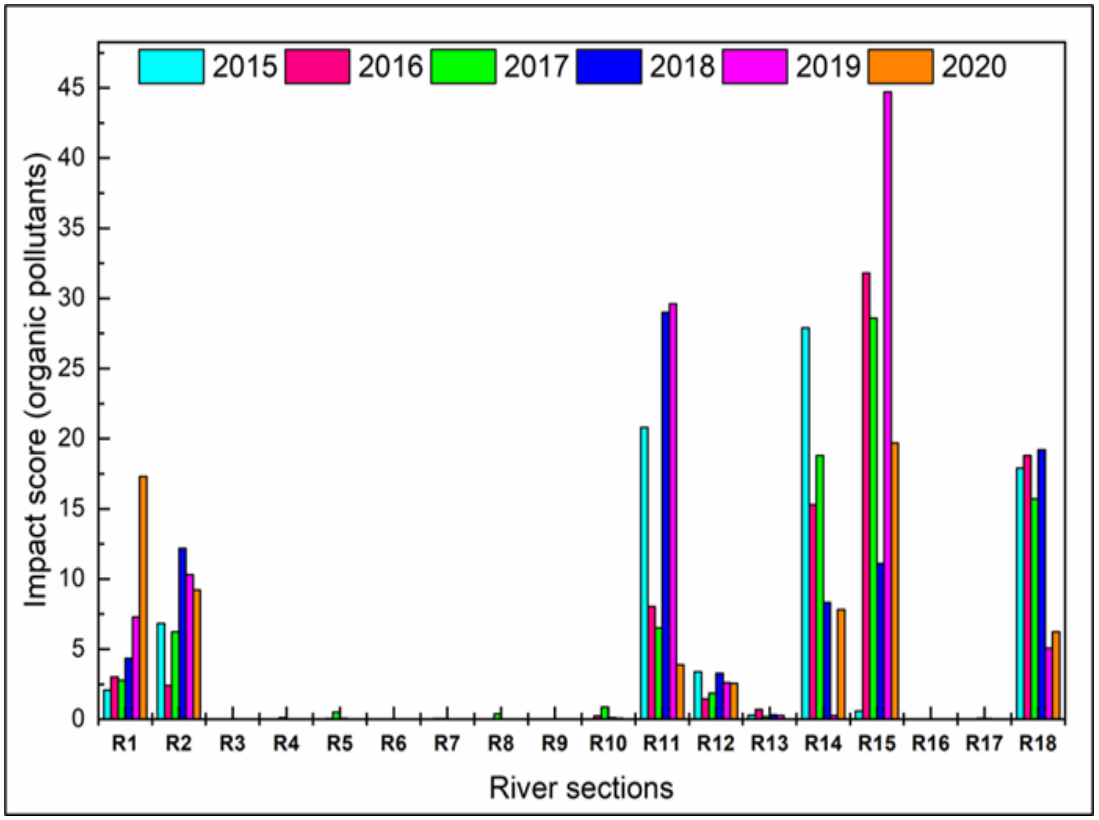
Results – health hazards, non-carcinogenic impact of organic pollutants



- the impact scores decreased in 2020, apart from those registered for the R1 river section.

- significant contributions can be observed for Di-(2-ethylhexyl)-phthalate (DEHP) and lindane (γ-HCH).

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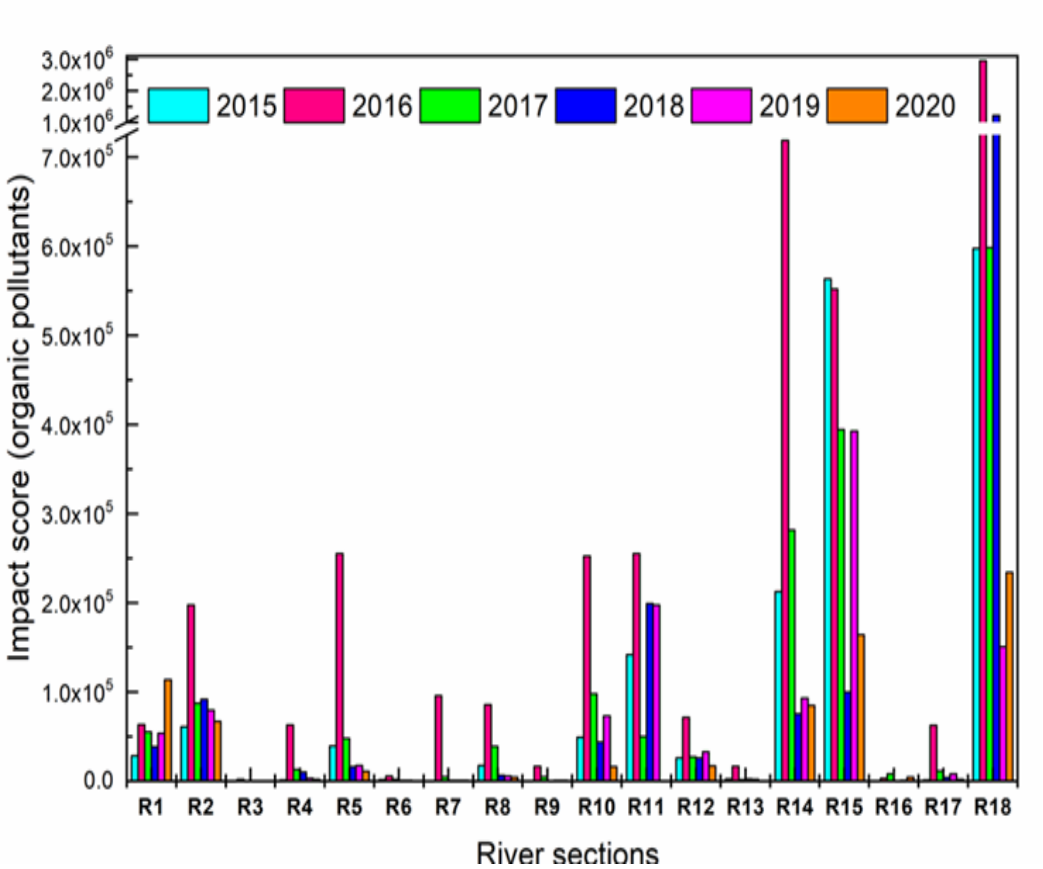
Results – ecological hazards (ecotoxicity)



- the highest contribution to the total impact score was given by lead (Pb), which also had the highest ecotoxicity effect factor

- The total impact scores ranged for heavy metals higher than for organic pollutants.

- the ecological impact and health hazards are mostly due to the inorganic priority pollutants (heavy metals) as compared to the organic micropollutants results.

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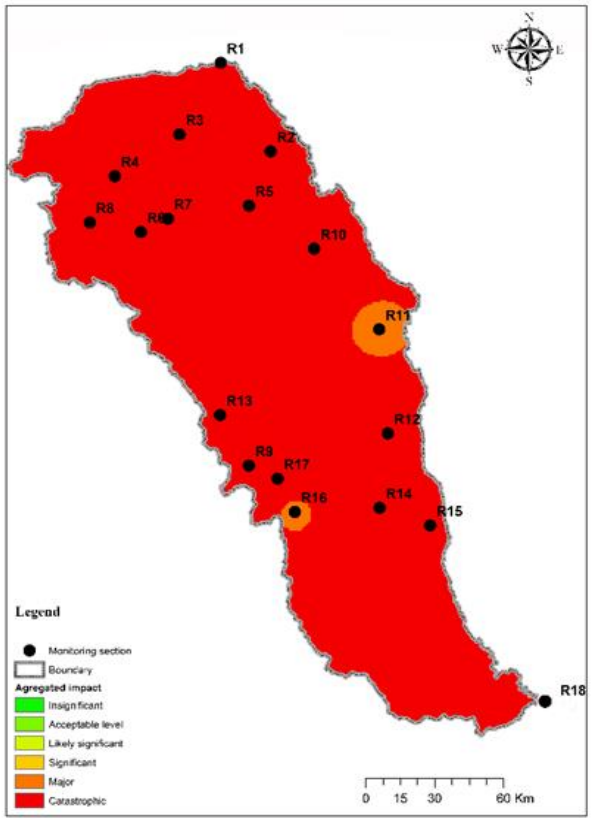
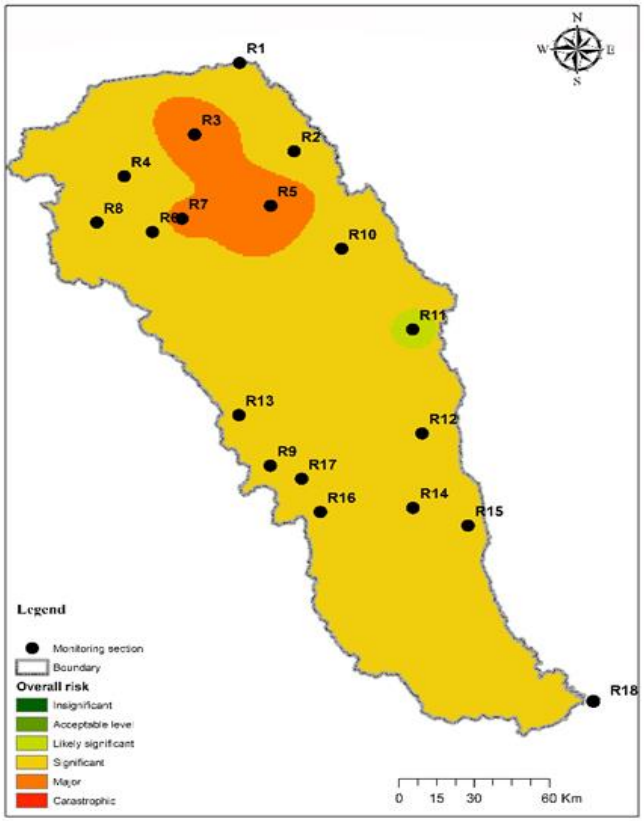
Results – integrated environmental impacts and risks





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Conclusions

- The risk of exposure to the priority pollutants from the water systems was quantified as a direct function of the measured concentration of a certain priority pollutant, its alert threshold, and its exposure factor.

- The results proved that even at river basin scale **there is a major to catastrophic impact on water quality,** and the overall risk exposure is mainly likely significant.

- The main contributors to this severe situation are Cd, Ni, As, Hg, Benzo(a)anthracene and Benzo(a)pyrene, especially since the river section (R3) is used for drinking water supply.

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https://doi.org/10.1007/s10661-021-09110-1

Environmental monitoring and impact assessment of Prut River cross-border pollution

Roxana Neamtu · Brindusa Sluser · Oana Plavan · Carmen Teodosiu

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Abstract The cross-border rivers management is a challenge for the involved countries, especially if they do not have the same type of legislation. The negative effects on water quality are quantified by using environmental impact assessment tools. Thus, the quantification of impacts that could affect the human health, ecosystem equilibrium, and biodiversity is based on monitoring of the water quality indicators. An increased attention should be paid to the toxic pollutants resulted from various activities that may affect the aquatic environment and human health on short and long term. This study approaches the cross-border impact assessment of heavy metals, organic, and nutrient pollution in the case of two countries (Romania and Republic of Moldova), the Prut River being the natural border. The methodology considered a specific area of the Prut River on both river sides, based on specific water quality indicators. The studied area covers sampling points from North to South within Iasi County and Republic of Moldova, in the Prut River cross-border section. To assess the pollutants' impacts, the improved Leopold Matrix and the Rapid Impact Assessment Matrix were adapted and applied. The results offered an overview on water pollution level and impacts on the Prut River cross-border area, for the 5-year period (2015–2019). There is a major negative impact generated in the Southern part of the studied area, in the case of the following indicators: copper, selenium, organic substances, with an increased level of pollution recorded in the last 2 years (2018, 2019). The conclusion of this research is that even if both countries follow the international protocols concerning cross-border pollution, they still have to comply to different environmental standards which approach differently the pollution levels and the significant impacts on water quality.

Keywords Cross-border pollution · Environmental impact assessment · Surface water quality · Priority pollutants

Introduction

According to the international regulations and agreements, the cross-border cooperation requires a strong involvement of all public administrative and political structures, in order to identify and solve the problems that could appear at the border (Castanho, 2019). Previous studies that analysed the cross-border water

Supplementary Information The online version contains supplementary material available at https://doi.org/10.1007/s10661-021-09110-1.

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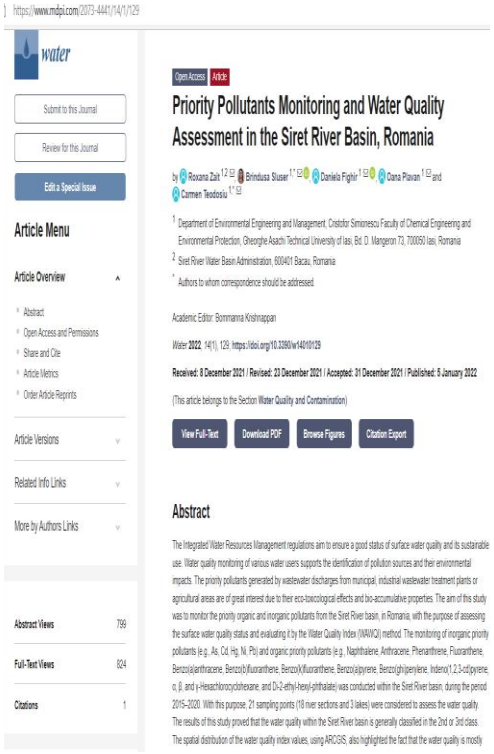

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Priority Pollutants Monitoring and Water Quality Assessment in the Siret River Basin, Romania

by Roxana Zait [1,2], Brindusa Sluser [1,*], Daniela Fighir [1], Oana Plavan [1] and Carmen Teodosiu [1,*]

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(This article belongs to the Section Water Quality and Contamination)

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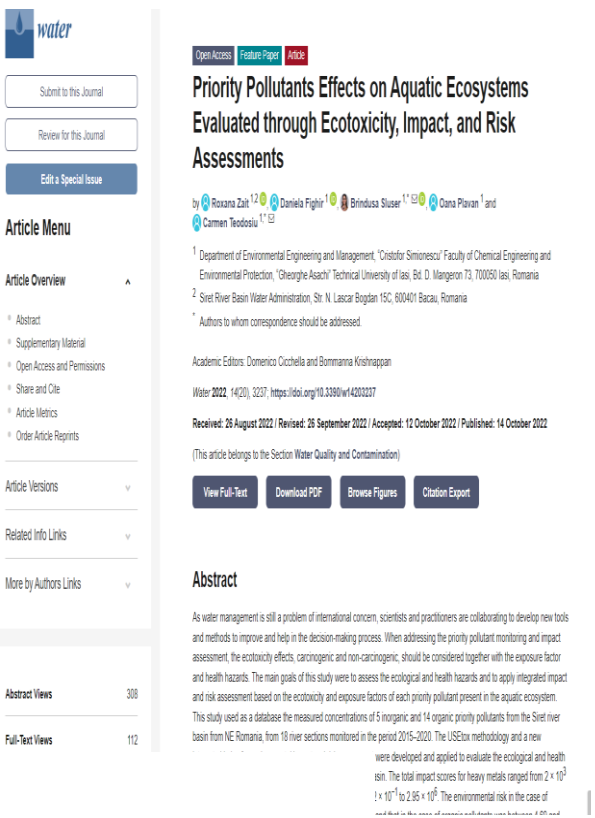
Abstract

The Integrated Water Resources Management regulations aim to ensure a good status of surface water quality and its sustainable use. Water quality monitoring of various water users supports the identification of pollution sources and their environmental impacts. The priority pollutants generated by wastewater discharges from municipal, industrial wastewater treatment plants or agricultural areas are of great interest due to their eco-toxicological effects and bio-accumulative properties. The aim of this study was to monitor the priority organic and inorganic pollutants from the Siret River basin, in Romania, with the purpose of assessing the surface water quality status and evaluating it by the Water Quality Index (WAWQI) method. The monitoring of inorganic priority pollutants (e.g., As, Cd, Hg, Ni, Pb) and organic priority pollutants (e.g., Naphthalene; Anthracene; Phenanthrene; Fluoranthene; Benzo(a)anthracene; Benzo(b)fluoranthene; Benzo(k)fluoranthene; Benzo(a)pyrene; Benzo(ghi)perylene; Indeno(1,2,3-cd)pyrene; α, β, and γ-Hexachlorocyclohexane; and Di-2-ethyl-(hexyl-)phthalate) was conducted within the Siret River basin, during the period 2015–2020. With this purpose, 21 sampling points (18 river sections and 3 lakes) were considered to assess the water quality. The results of this study proved that the water quality within the Siret River basin is generally classified in the 2nd or 3rd class. The spatial distribution of the water quality index values, using ARCGIS, also highlighted the fact that the water quality is mostly



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Priority Pollutants Effects on Aquatic Ecosystems Evaluated through Ecotoxicity, Impact, and Risk Assessments

by Roxana Zait [1,2], Daniela Fighir [1], Brindusa Sluser [1,*], Oana Plavan [1] and Carmen Teodosiu [1,*]

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Received: 26 August 2022 / Revised: 26 September 2022 / Accepted: 12 October 2022 / Published: 14 October 2022

(This article belongs to the Section Water Quality and Contamination)

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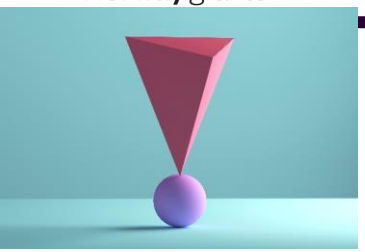
Abstract

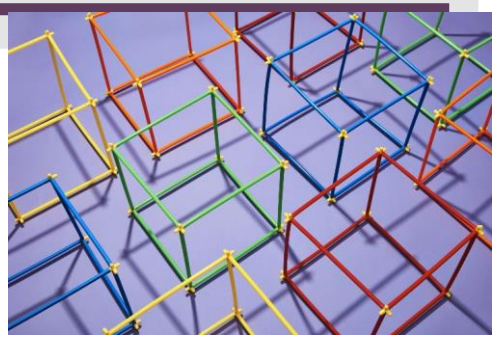
As water management is still a problem of international concern, scientists and practitioners are collaborating to develop new tools and methods to improve and help in the decision-making process. When addressing the priority pollutant monitoring and impact assessment, the ecotoxicity effects, carcinogenic and non-carcinogenic, should be considered together with the exposure factor and health hazards. The main goals of this study were to assess the ecological and health hazards and to apply integrated impact and risk assessment based on the ecotoxicity and exposure factors of each priority pollutant present in the aquatic ecosystem. This study used as a database the measured concentrations of 5 inorganic and 14 organic priority pollutants from the Siret river basin from NE Romania, from 18 river sections monitored in the period 2015–2020. The USEtox methodology and a new

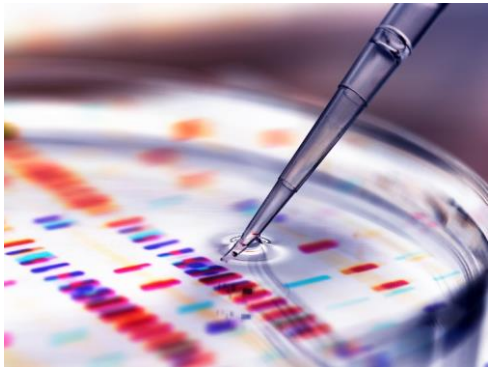
were developed and applied to evaluate the ecological and health
isin. The total impact scores for heavy metals ranged from 2×10^{3}
1×10^{-1} to 2.95×10^{6}. The environmental risk in the case of



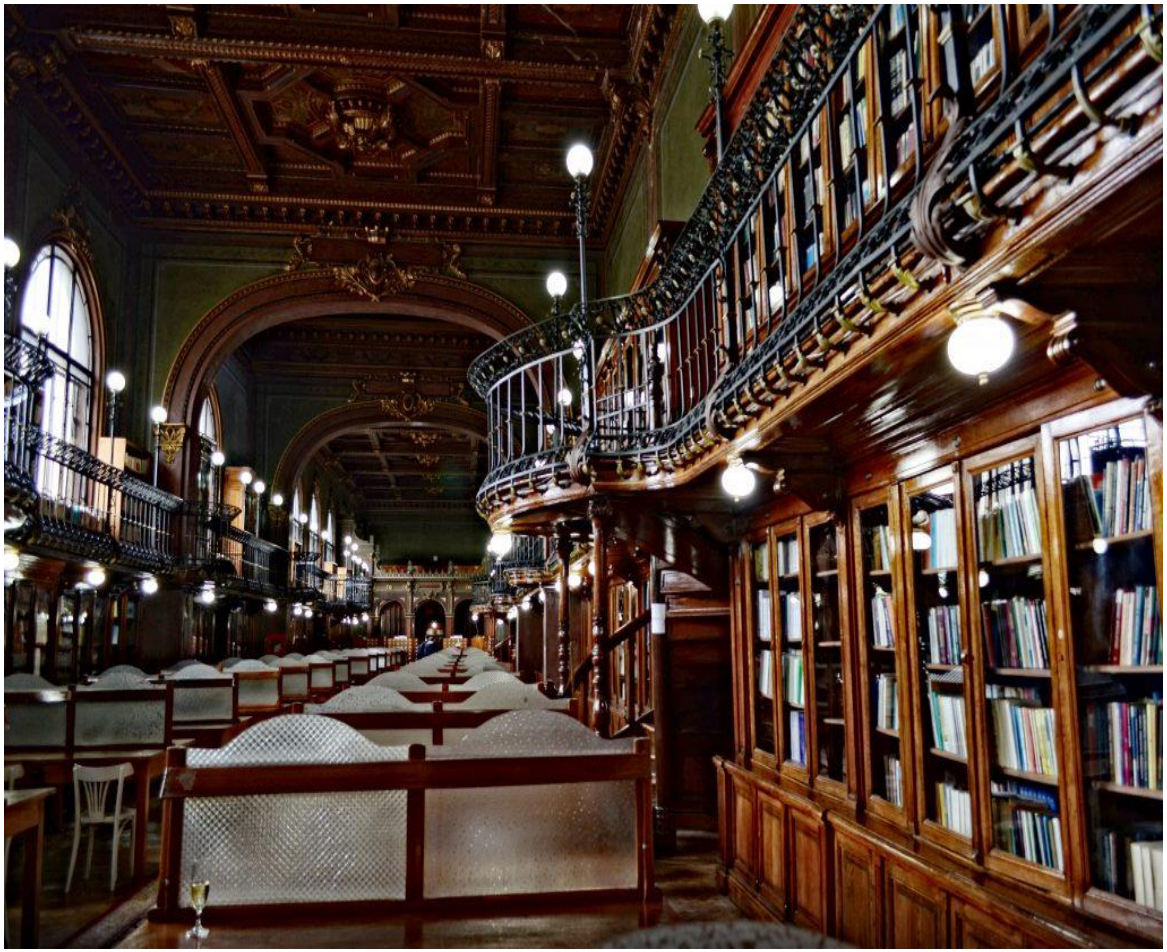
Further work …

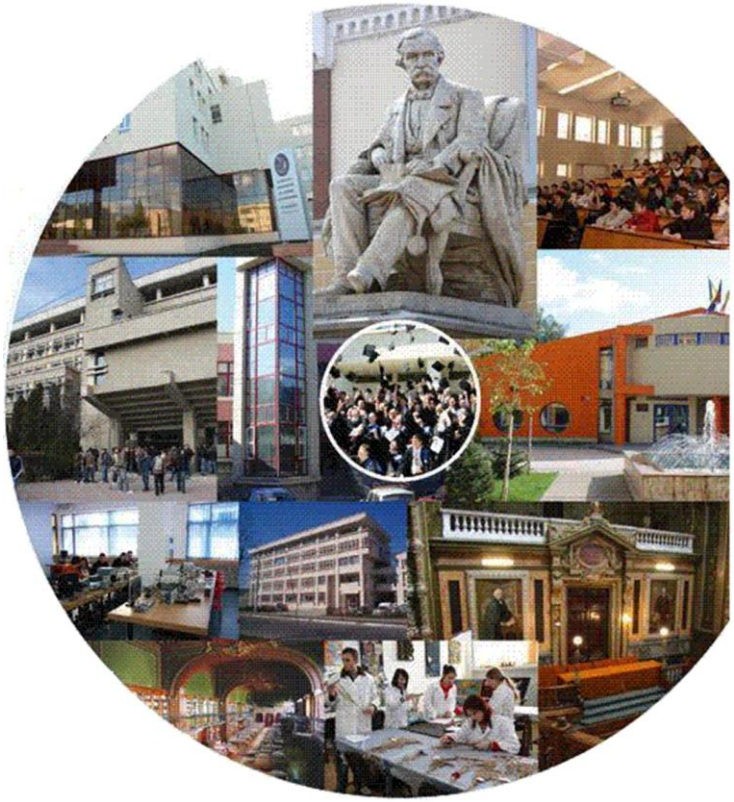
- Integrated environmental management tools and policies towards sustainability
- Circular economy and waste management
- Eco-design and ecolabeling
- Modelling and simulation of water / air quality
- Water quality monitoring and impact/risk assessment
- Development / implementation of new techniques / technologies / pilot scale for environmental protection, pollution prevention, waste valorisation etc.





Iceland Liechtenstein Norway grants





Thank you for your kind attention!

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