



AGROSYM

BOOK OF PROCEEDINGS



*XVI International Scientific Agriculture Symposium
"Agrosym 2025"
Jahorina, October 2-5, 2025*



AGRO 2025
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**XVI International Scientific Agriculture Symposium
“AGROSYM 2025”**



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FOREWORD

The world is facing a range of crises that require policymakers to base their decisions on scientific data and evidence to effectively address them. Issues such as climate change, loss of biodiversity, degradation of natural resources (e.g. land and water), ongoing conflicts, persistent inequalities, and economic disruptions are progressively weakening the ability of agri-food systems to ensure food security and nutrition for all. Research plays a vital role in providing evidence and technical expertise, acting as a facilitator and policy broker in the development of agri-food strategies, investment planning, innovation policies, and other important policy processes. Additionally, research is essential for generating the knowledge, evidence, and resources required to promote responsible and inclusive innovation. It also offers support to a range of stakeholders, including farmers' organizations, businesses, and civil society groups. Integrating research with long-term policy strategies can enhance the acceptance and adoption of innovations in the agri-food sector, particularly when these innovations are promoted through inclusive platforms. To achieve a sustainable impact at scale, it is essential to improve collaboration in agri-food research and innovation. Scientific events and gatherings can be crucial in reaching this objective.

The International Agriculture Symposium AGROSYM has served as an annual forum for sixteen years, facilitating global scientific discussions on agriculture, food, rural development, the environment, and forestry. This symposium offers an excellent opportunity to share ideas, strengthen existing networks, establish new academic connections, and stimulate dialogue among academia, public institutions, the private sector, and civil society organizations. Participants engage in discussions about recent global and regional trends in the agri-food sector. The multidisciplinary findings presented at AGROSYM contribute to the dissemination of knowledge and best practices among all stakeholders in the agri-food chain, including farmers, extension agents, researchers, and policymakers. Additionally, the symposium emphasizes the importance of agriculture and food science as vital components of many national research strategies, impacting the broader community as well.

This Book of Proceedings from the 16th International Scientific Agricultural Symposium “AGROSYM 2025” encompasses articles which illustrate a wide range of research and insights across the comprehensive spectrum of agricultural disciplines. These articles address the following themes: 1) Plant production, 2) Plant protection and food safety, 3) Organic agriculture and agroecology, 4) Environmental protection and natural resources management, 5) Animal husbandry, 6) Rural development and agro-economy, and 7) Forestry and agroforestry.

We wish to express our heartfelt appreciation to all authors, reviewers, and colleagues who assisted in preparing this Book of Proceedings. Our special thanks go to co-organizers, partners, and sponsors for their unwavering support and collaboration.

We hope this multidisciplinary and international collection of research findings serves as a valuable resource for all stakeholders and encourages continuous dialogue and exchange to facilitate the transition towards sustainable, resilient, and inclusive agri-food systems.

East Sarajevo, 1 November 2025

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ECOLOGICAL STATUS EVALUATION OF SERBIAN SURFACE WATERS BASED ON PHOSPHORUS CONCENTRATIONS

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Abstract

This study used total phosphorus (tot-P) and orthophosphate (o-PO₄) concentrations to determine whether the surveyed water bodies met the criteria for good ecological status which provide conditions for the life and protection of fish and can be used for drinking water supplying, recreation, irrigation and industrial purposes. Both components are essential nutrients for the life activities of aquatic organisms, such as growth and primary productivity. This research presents the Environmental Protection Agency's surface water quality data for 2016–2022, with evaluations based on the limit values set out in the “Official Gazette of RS,” No. 50/2012. Surface water quality was evaluated at 79 monitoring sites covering 47 distinct watercourses, as well as at six locations within the canal network and two reservoirs. Obtained results suggest good ecological status in the majority of monitored water bodies except several profiles which fell short of the good ecological status benchmarks. Hetin proved to be the most compromised location, followed by Nis, Vrbica, Raska, Kraljevo, the Ljubicevo bridge, and Bagrdan. The highest levels of pollution were observed at the Hetin and Nis profiles in 2020. Watercourses such as Stari Begej, Nisava, Zlatica, Ibar, and Velika Morava consistently surpassed the minimum ecological quality standards throughout the study period, likely as a result of industrial and urban discharges and agricultural runoff. Although elevated phosphorus and orthophosphates concentrations were detected at certain profiles, overall pollution trends remained relatively low across most monitored water bodies. Temporal trends of both parameters indicate increase in organic phosphorus levels.

Keywords: *Total phosphorus; Orthophosphates, Surface water pollution; Ecological status.*

Introduction

Phosphorus is a critical mineral nutrient for all living organisms and primarily occurs in the form of organic phosphates that are produced as byproducts of biological processes, as well as in the form of inorganic orthophosphates and polyphosphates. Inorganic forms of phosphorus arise from the biological mineralization of organic compounds, runoff from agricultural lands, through municipal and industrial wastewater (Guo et al., 2023) and orthophosphate is the only form of phosphorus that autotrophs can directly take up. Mineral and organic compounds of phosphorus are essential for the life activities of aquatic organisms, which include growth and their primary productivity (Mitrović, 2021). Agricultural nutrient runoff, chiefly from overusing nitrogen and phosphorus-based fertilizers is the leading pollutant of surface waters indicating that up to 80 % of nutrients in surface waters are derived from agricultural activities (Savic et al., 2022). Rain or irrigation can wash these excess nutrients off fields and into nearby rivers, lakes and streams, creating several environmental problems. The mechanisms underlying their leaching and runoff from agricultural fields are highly intricate, challenging to quantify and manage, and are influenced by various factors, including topography, climatic conditions, land use practices, and drainage systems, among others (Savic et al., 2022).

When there is an increased concentration of nutrients in freshwater lakes, reservoirs, streams (as a result of anthropogenic activities), a process of intense phytoplankton development occurs, commonly referred to as algal blooms or eutrophication (Correll, 1999). This phenomenon affects the reduction of oxygen content in the water in two ways. The first is that the large number of algae covers the surface of the aquatic ecosystem, hindering the dissolution of sufficient amounts of oxygen from the atmosphere and preventing the influx of sunlight, which weakens the process of photosynthesis. The second way in which the concentration of dissolved oxygen in the water decreases is through the decomposition of phytoplankton, which consumes a significant amount of dissolved oxygen. In the absence of oxygen, anaerobic conditions are created in the aquatic environment, threatening the survival of aquatic microorganisms. Elevated concentrations of different phosphorus forms also compromise the safety of water for drinking, swimming and vulnerable ecosystems (Zhang et al., 2023).

Ideally, managing nutrient pollution involves measuring and controlling phosphorus inputs to an entire aquatic ecosystem. For a simpler approach, however, monitoring total phosphorus concentrations, including particulate forms in surface waters provides a practical indicator of nutrient status. Assessing surface water quality is a vital element of overall environmental monitoring and management. The Water Framework Directive (WFD) establishes a strategic basis for future water policy across the European Union and in candidate nations like Serbia. As the principal legal instrument governing water resources, the WFD has driven revisions to surface water monitoring programs, all with the overarching goal of achieving and maintaining good ecological status throughout Europe’s waters.

The WFD marked a significant breakthrough in European water management by establishing a unified, coordinated approach to safeguarding water resources throughout the Europe. Under the WFD, European waters are grouped into major river basins that are managed jointly by the member states involved. Successful transboundary river basin governance depends on close cooperation among all participating countries, so the Directive aims to align and harmonize water-protection rules across borders. Regular monitoring and high-quality data collection are essential for pinpointing pollution sources, observing trends over time, and deploying effective remediation measures to improve overall water status. In Serbia, the Environmental Protection Agency has been harmonizing its surface-water monitoring program with WFD standards since 2012.

For this research a total phosphorus (tot-P) and orthophosphates (o-PO₄) concentrations were applied to assess whether the quality class of the observed water bodies meets the standards for good ecological status which provide conditions for the functioning of ecosystems, the life and protection of fish (cyprinids) and can be used for the following purposes: supplying drinking water with prior treatment of filtration and disinfection, bathing and recreation, irrigation and industrial use (process and cooling water).

Materials and Methods

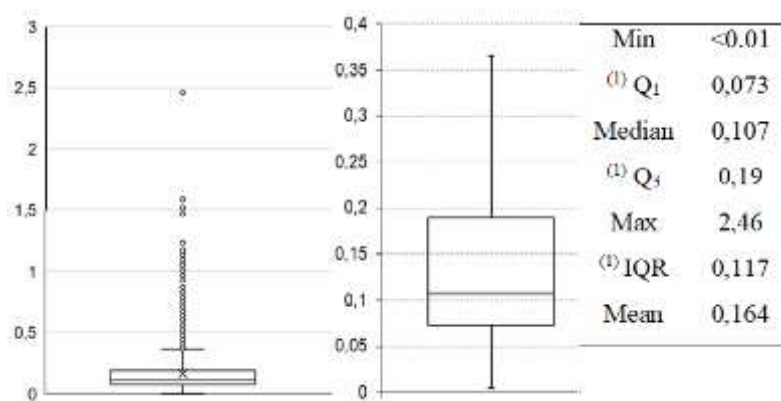
Water quality assessment typically involves the comparison of measured parameter values against established standards or guidelines. In Serbia, concentrations of total phosphorus and orthophosphate in surface water samples are evaluated in relation to the threshold values (TV) specified in the Regulation on Threshold Values for Pollutants in Surface and Ground Waters and Sediments, along with deadlines for compliance (Official Gazette of RS No. 50/2012). This regulation is designed to align with the recommendations of the WFD. The TV serves as the environmental quality standard (EQS), which is quantified as the permissible concentration of an individual pollutant, a group of pollutants, or pollution indicators within surface and groundwater to safeguard environmental integrity and human health.

The afore mentioned regulation categorizes various types of water bodies, each accompanied by specific threshold values. Upon comprehensive data review, it was determined that the majority of water body types mandated criteria of 0.2 mg/L for total phosphorus and 0.1 mg/L for orthophosphates. Accordingly, these threshold values were employed in the analysis of the results.

In this paper, the surface water quality data from the Serbia’s Environmental Protection Agency’s 2016–2022 reports are summarized. These bring together data on biological quality elements used to gauge ecological status or ecological potential alongside physicochemical, chemical, and microbiological water-quality parameters measured in rivers and reservoirs throughout the Republic of Serbia. Surface water quality was evaluated at 79 monitoring sites covering 47 distinct watercourses, as well as at six locations within the canal network and two reservoirs.

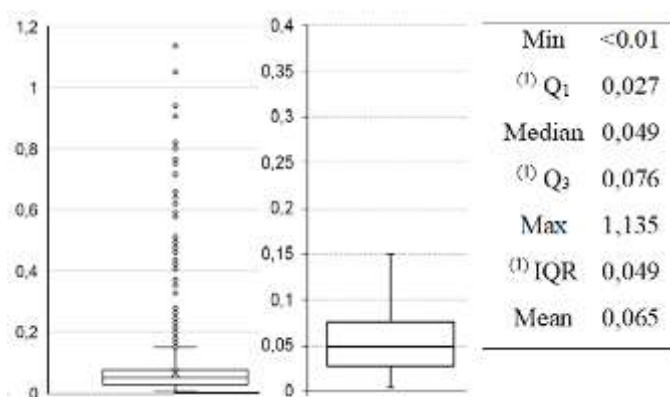
Results and Discussion

Box-plots, descriptive statistics and TV of the tot-P and o-PO₄ concentrations detected in the surface waters from 2016-2022 in Serbia are depicted in Figures 1 and 2.



(1) Q1- value under which 25% of data points are found when they are arranged in increasing order. Q3- is the value under which 75% of data points are found when arranged in increasing order. Interquartile Range (IQR): the difference between Q3 and Q1.

Figure 1. Box-plots, descriptive statistics and TV of the tot-P concentrations (mg/L) detected in the surface waters from 2016-2022 in Serbia



(1) Q1- value under which 25% of data points are found when they are arranged in increasing order. Q3- is the value under which 75% of data points are found when arranged in increasing order. Interquartile Range (IQR): the difference between Q3 and Q1.

Figure 2. Box-plots, descriptive statistics and TV of the o-PO₄ concentrations (mg/L) detected in the surface waters from 2016-2022 in Serbia

The peak recorded concentrations for the two observed parameters occurred at Hetin (o-PO₄: 1.13 mg/L in 2020) and Nis (tot-P: 2.46 mg/L) profiles. The highest average concentrations of both parameters are listed in Table 1. It is noticeable that the same profiles Hetin and Nis also stand out as the most contaminated locations, with mean values exceeding the TV throughout the almost entire monitoring period.

It is important to note that the Stari Begej is characterized by a markedly low flow rate (about 0.05 m³/s) and a reduced water level. These hydrological conditions result in elevated pollutant levels within the stream. The observed high concentrations of observed contaminants are likely attributable to the influence of agricultural activities in the surrounding areas, which may contribute to nutrient runoff and pollutants entering the waterway.

Table 1. Profiles with the highest values of average tot-P and o-PO₄ concentrations measured in surface waters from 2016-2022 in Serbia

Profile	River	Catchment	o-PO ₄ , mgP/L	tot-P, mg/L
Tresh values (TV)			0.1	0.2
Hetin	Stari Begej	Tisa	0.38	0.51
Nis	Nisava	Morava	0.15	0.43
Vrbica*	Zlatica	Tisa	0.16	0.23
Raska	Ibar	Zapadna Morava	0.10	0.36
Kraljevo	Ibar	Zapadna Morava	0.08	0.25
Ljubicevo bridge	Velika Morava	Danube	0.09	0.26
Bagrdan	Velika Morava	Danube	0.08	0.27

*The water body type (Type 5) has the TV 0.2 mg/L for o-PO₄ and 0.3 mg/L for tot-P

Very high phosphorus concentrations were detected in the rivers Zlatica, Ibar (profiles Kraljevo and Raska) and Velika Morava (Ljubicevo bridge and Bagrdan profiles) due to long-term organic pollution and increased turbidity. Contaminants are mostly introduced into these water bodies via point sources (industrial and urban effluents) as well as diffuse sources (agricultural runoff) along their entire length (Xie et al., 2014).

About 23 % of the total samples for total phosphorus and 13 % for orthophosphate exceeded the guideline threshold values (TV), so they failed to meet the criteria for good ecological status. A small number of water bodies accounted for most of these exceedances, resulting in classifications of moderate, poor or even bad ecological status. In particular, the Hetin profile repeatedly recorded levels that led to a bad ecological status, indicating the surface water is unusable for any purpose, and the same was observed at the Nis and Vrbica profiles.

Temporal trends and descriptive statistics of the both parameters over the monitored period are presented in the tables 2, 3 and figures 3, 4.

Table 2. Descriptive statistics of the tot-P concentrations (mg/L) recorded in the surface waters of Serbia from 2016 to 2022

	2016	2017	2018	2019	2020	2021	2022
Minimum	0.013	0.011	<0.010	<0.010	<0.010	<0.010	<0.010
1st Quartile: Q ₁	0.073	0.067	0.068	0.062	0.085	0.076	0.081
Median	0.122	0.110	0.105	0.104	0.134	0.117	0.123
3rd Quartile:							
Q ₃	0.179	0.169	0.162	0.160	0.247	0.211	0.236
Maximum	1.516	0.860	1.230	0.940	2.460	1.120	1.585
Mean	0.157	0.141	0.136	0.140	0.212	0.185	0.187

An analysis of the median total phosphorus values presented in Table 2 and Figure 3 reveals a slight upward trend over the study period. A noticeable decline was observed during the initial four years (2016-2019). However, in the subsequent year, all statistical parameters generally displayed elevated values (Table 2).

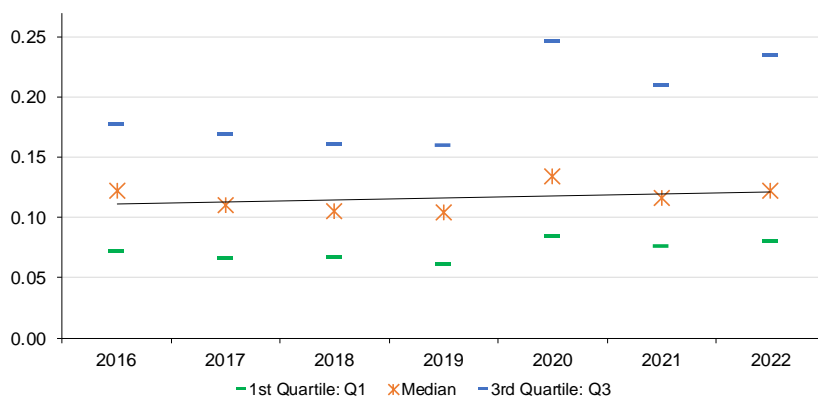


Figure 3. Temporal trend of the median tot-P concentrations (mg/L) recorded in the surface waters of Serbia from 2016 to 2022

Conversely, the median values for orthophosphate demonstrate a slight downward trend (Figure 4, Table 3), indicating that the observed increase in total phosphorus is likely attributable to an elevation in organic phosphorus levels.

Table 3. Descriptive statistics of the o-PO₄ concentrations (mgP/L) recorded in the surface waters of Serbia from 2016 to 2022

	2016	2017	2018	2019	2020	2021	2022
Minimum	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005
1st Quartile:							
Q1	0.031	0.025	0.029	0.027	0.030	0.026	0.025
Median	0.051	0.044	0.049	0.049	0.053	0.045	0.045
3rd Quartile:							
Q3	0.076	0.077	0.073	0.083	0.080	0.070	0.080
Maximum	0.940	0.755	0.830	0.575	1.135	0.825	1.050
Mean	0.069	0.066	0.063	0.068	0.067	0.061	0.063

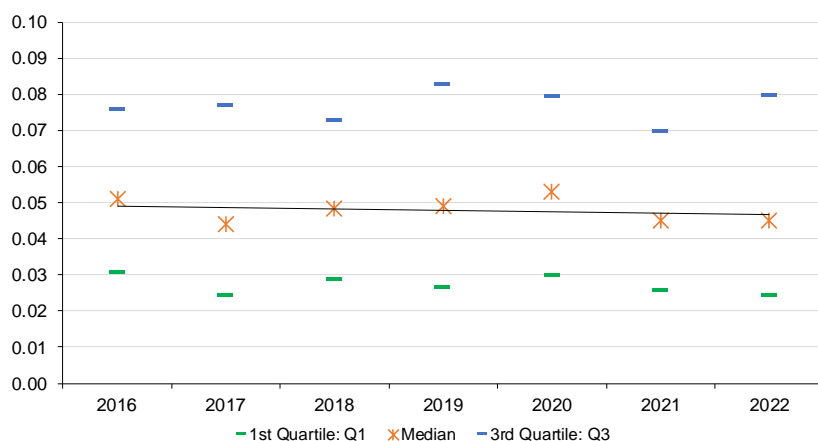


Figure 4 Temporal trend of the median o-PO₄ concentrations (mgP/L) recorded in the surface waters of Serbia from 2016 to 2022

Conclusions

The quality of surface waters in Serbia is being studied due to the importance for the local ecosystem and human activities such as: irrigation, recreation, and fishing. Their quality directly impacts biodiversity, agriculture, and the health of the population. Research on the quality includes the analysis of various chemical and microbiological parameters, including

levels of nutrients such as total phosphorus (tot-P) and orthophosphate (o-PO₄), bacterial contaminants, and other pollutants. It has been observed that the concentrations of these pollutants are often linked to agricultural activities in the surrounding area, as well as to wastewater discharged into the river. Furthermore, considering the increasing pressures from urbanization and industrialization, research on water quality is becoming increasingly important to identify potential problems and take appropriate protective measures. Various studies and monitoring programs are conducted in cooperation with local institutions and environmental protection organizations, contributing to the sustainable management of water resources in Serbia. This study demonstrated that, in terms of phosphorus concentrations relative to the relevant regulatory thresholds, several monitoring sites were determined to be below the standards for achieving good ecological status. Hetin emerged as the most problematic site, followed by Nis, Vrbica, Raska, Kraljevo, Ljubicevo bridge, and Bagrdan. The highest pollution levels were recorded at the Hetin and Nis locations in 2020.

This signifies a severely degraded aquatic ecosystem, with very low possibility of biodiversity and high levels of pollutants. Water bodies such as: Stari Begej, Nisava, Zlatica, Ibar and Velika Morava, failed to achieve the minimum ecological quality standards as elevated concentrations were observed almost during the whole period and may result from contamination likely linked to industrial and urban effluents and agricultural runoff.

Generally, the continuous monitoring of surface water quality in Serbia ensures compliance with regulatory standards aimed safeguarding environmental and human health. While elevated total phosphorus and orthophosphates concentrations do exist, overall trends suggest good ecological status in the majority of monitored water bodies.

Median tot-P and o-PO₄ values calculated for each year suggest that the observed increase in total phosphorus is likely attributable to an elevation in organic phosphorus levels as a consequence of the organic pollution.

References

- Correll, D. L. (1999). Phosphorus: A Rate Limiting Nutrient in Surface Waters. *Poultry Science*, 78(5), 674–682. <https://doi.org/10.1093/ps/78.5.674>
- Guo, J., Bian, R., Guan, A., Cao, X., Peng, J., Wu, X., Wang, D., Qi, W., Liu, H., & Qu, J. (2023). Assessment and Identification of Primary Factors Controlling Yangtze River Water Quality. *ACS ES and T Water*, 3(5), 1329–1340. <https://doi.org/10.1021/acsestwater.2c00645>
- Mitrović, T. Đ. (2021). Chemometric methods for the prediction of river water quality parameters and pollutants degradation. University of Belgrade Faculty of technology and metallurgy.
- Savic, R., Stajic, M., Blagojević, B., Bezdan, A., Vranesevic, M., Jokanović, V. N., Baumgertel, A., Kovačić, M. B., Horvatinec, J., & Ondrasek, G. (2022). Nitrogen and Phosphorus Concentrations and Their Ratios as Indicators of Water Quality and Eutrophication of the Hydro-System Danube–Tisza–Danube. *Agriculture (Switzerland)*, 12(7). <https://doi.org/10.3390/agriculture12070935>
- Xie, J., Zhang, X., Xu, Z., Yuan, G., Tang, X., Sun, X., & Ballantine, D. J. (2014). Total phosphorus concentrations in surface water of typical agro- and forest ecosystems in China, 2004–2010. *Frontiers of Environmental Science & Engineering*, 8(4), 561–569. <https://doi.org/10.1007/s11783-013-0601-5>
- Zhang, H., Zhou, X., Lv, X., Xu, X., Weng, Q., & Lei, K. (2023). Exploration of the factors that influence total phosphorus in surface water and an evaluation of surface water vulnerability based on an advanced algorithm and traditional index method. *Journal of Environmental Management*, 342. <https://doi.org/10.1016/j.jenvman.2023.118155>