frontiers | Frontiers in Environmental Science

TYPE Editorial
PUBLISHED 30 January 2023
DOI 10.3389/fenvs.2023.1143706

OPEN ACCESS

EDITED AND REVIEWED BY
Diego Copetti,
National Research Council of Italy, Italy

*CORRESPONDENCE
Doru Bănăduc,
ad.banaduc@yahoo.com

SPECIALTY SECTION
This article was submitted to Freshwater Science, a section of the journal Frontiers in Environmental Science

RECEIVED 13 January 2023
ACCEPTED 16 January 2023
PUBLISHED 30 January 2023

CITATION
Bănăduc D, Barinova S, Cianfaglione K and Curtean-Bănăduc A (2023), Editorial: Multiple freshwater stressors—Key drivers for the future of freshwater environments. *Front. Environ. Sci.* 11:1143706. doi: 10.3389/fenvs.2023.1143706

Editorial: Multiple freshwater stressors—Key drivers for the future of freshwater environments

Doru Bănăduc[1]*, Sophia Barinova[2], Kevin Cianfaglione[3] and Angela Curtean-Bănăduc[1]

[1]Applied Ecology Research Center, Faculty of Sciences, Lucian Blaga University of Sibiu, Sibiu, Romania, [2]Institute of Evolution, University of Haifa, Haifa, Israel, [3]FGES, Université Catholique de Lille, Lille, France

KEYWORDS

freshwater, stressors, key drivers, impact, effects

Editorial on the Research Topic
Multiple freshwater stressors—Key drivers for the future of freshwater environments

In the global major concern about freshwater as a strategic sustainable natural resource and generator of secondary resources in our century stressors, threats, risks, management, protection, and conservation (Bănăduc et al., 2022; Peña-Ramos et al., 2022), in a challenging climate change context (Bănăduc et al., 2021; Capon Samantha, 2021), this editorial highlights the contributions in this respect to the Frontiers Research Topic "*Multiple freshwater stressors—Key drivers for the future of freshwater environments*."

Due to its unique and needed features, water is the key element in the origin, continuity, and evolution of life on our planet. Water is ubiquitous, even in organisms, and for that, it is a key of knowledge of the Earth and Universe (Maruyama et al., 2013; Goncharuk and Goncharuk, 2019).

Water may seem abundant, but less than 1% of the Earth's water can be used to meet human needs (Longo and York, 2009). Human population growth is a main cause for water scarcity and declining water quality, in the context in which the world's human population is growing (Ehrlich and Ehrlich, 2009). Human needs for water and demand of limited water resources will exacerbate these problems (Boretti and Rosa, 2019). Limitations to water availability are among the main reasons for conjecturing about a future border to the human activities and growth of the world population.

The aim of this Research Topic (Bănăduc et al., 2021) was to highlight varied freshwater stressors which can be used as indicators and precursors of freshwater ecosystem degradation. These create a complex matrix of stressors, which plays a driving role in changing freshwater ecosystems, and need to be studied using identification, inventory, assessment of interactions and impacts, monitoring, and management techniques within different spatial and temporal contexts. This Research Topic stressed the importance of this subject area and the implications of the research results for environmental restoration, protection, and conservation practice. Any identifiable change in environmental conditions that causes strain on the health and functioning of the freshwater ecosystem was approached as a freshwater stressor. These stressors induced freshwater environmental change and degradation, leading to the loss of varied taxa, strains and species, habitats, biocenoses, and ecosystems, with a high negative impact on the natural dynamic equilibrium and associated natural resources and services.

One study of the Research Topic revealed the fact that the increasing water demand due to population growth and urbanization causes cities in arid and semiarid regions in China to face increasing water scarcity (Dang et al.). Understanding the spatiotemporal patterns of water consumption and its driving factors was found to be considerably important in formulating public policy and alleviating the urban water crisis. Spatiotemporal variations of water consumption in 42 cities in Northwest China were identified, and their influencing factors were determined. Results indicate that *per capita* household water consumption decreased by 9.5% from 2003 to 2020, with significant spatiotemporal variations decreasing in cities with medium consumption but increasing in cities with low and high consumption. The influencing factors vary across the three types of cities. An increase in the capacity of water supply and popularization of washing machines are the main reasons for the rise in water consumption for low- and high-consumption cities, whereas the implementation of water-saving activities and improvements of the reuse rate are the main reasons for reduction of water consumption for medium-consumption cities.

Another research was concluded based on the species composition of algae in the Lena River delta and uses their properties as indicators of organic water pollution as evidence of water ecosystem stress in the high Arctic region (Gabyshev et al.). The results of the study revealed 700 species from 10 phyla. Analysis indicates that hydrological conditions are the main factor, which can also be a stressor regulating the spatial structure of the species composition of algal communities. The distribution of groups of indicators of organic pollution, the trophic state, and the type of nutrition of algal cells along the main water channels suggests that now a possible source of organic pollution may be the effect of mixing river and saline waters during high tide. This was evidenced by an increase in the number of mixotrophic organisms and indicators of the increased trophic state. Therefore, integral bioindication, as a method that reveals hidden connections in the ecosystem, can be used for monitoring in this period when accentuated development of the oil industry is seen in the Arctic region.

One paperwork study changes in fish species composition, distribution, and diversity caused by a cascade dam construction, based on the Someșul Cald River area study case in Romania (Lațiu et al).. Cascade dam constructions act as a freshwater stressor both on short and long terms. The most abundant species in both sections was *Salmo trutta*. The most abundant family was Salmonidae, with 66.2%. The species that contributed most to the dissimilarities between the two affected river sections were *Thymallus thymallus*, *Barbus carpathicus*, *Cottus gobio*, and *Squalius cephalus*, their summed contribution to the dissimilarity being larger than 50%. The analyzed environmental variables influenced the distribution of some fish species. Alpha and beta diversity distribution on the elevation gradient showed that stations close to reservoirs had more species than the other stations, clearly showing that the distance from the lake/reservoir is influencing species richness.

Another research focused on benthivorous fish disturbance and nitrogen loading as two main factors that influence the community structure of submersed macrophytes (Yu et al.). An outdoor mesocosm experiment was conducted to examine the individual and combined effects of these two factors on the growth of two submersed macrophytes of different growth forms, i.e., the rosette-forming *Vallisneria natans* and the canopy-forming *Myriophyllum spicatum*. The research reveals that the interactive effects of fish disturbance and high N are synergistic and/or antagonistic, suggesting the same stressor interaction may vary from synergistic to antagonistic, depending on the response variables and growth forms of the macrophytes. The research contributes to the understanding of how different factors can interact with each other and affect submersed macrophytes in aquatic ecosystems. This is timely and relevant knowledge, considering the range of multiple stressors involved in the decline of aquatic ecosystems worldwide at present.

A last study examines the ecological sustainability of the Velika Morava River Basin (Serbia, Central Balkans) under modern conditions of multiple freshwater stressors, including climate change (Simić et al.). The impact of stressors on the ecological services of the river basin was considered, including drinking water, irrigation, recreation, tourism, ecotourism, and fishing. In order to assess the ecological sustainability of the river basin, a modification of the ESHIPPO model was performed. The structure of ichthyocenosis is used as the basic biological indicator for the ecological assessment. The assessment of river basin sustainability was obtained based on the impact of multiple factors, including habitat change, invasive species, pollution, human population growth (social factors), and the over-exploitation of resources. The structure of the proposed model is based on general and easily measurable indicators, which enables its application in any river basin in the world. The results of the model indicate that 80% of the studied basin is ecologically unsustainable and that its potential environmental services are greatly reduced.

Author contributions

All authors listed have made a substantial, direct, and intellectual contribution to the work and approved it for publication.

Conflict of interest

The authors declare that the research was conducted in the absence of any commercial or financial relationships that could be construed as a potential conflict of interest.

Publisher's note

References

Bănăduc, D., Simić, V., Cianfaglione, K., Barinova, S., Afanasyev, S., Öktener, A., et al. (2022). Freshwater as a sustainable resource and generator of secondary resources in the 21st century: Stressors, threats, risks, management and protection strategies, and conservation approaches. *Int. J. Environ. Res. Public Health* 19, 16570. doi:10.3390/ijerph192416570

Bănăduc, D., Sas, A., Cianfaglione, K., Barinova, S., and Curtean-Bănăduc, A. (2021). The role of aquatic refuge habitats for fish, and threats in the context of climate change and human impact, during seasonal hydrological drought in the saxon villages area (transylvania, Romania). *Atmosphere* 12 (9), 1209. doi:10.3390/atmos12091209,

Boretti, A., and Rosa, L. (2019). Reassessing the projections of the world water development report. *NPJ Clean. Water* 2, 15. doi:10.1038/s41545-019-0039-9

Capon Samantha, J. (2021). Future of freshwater ecosystems in a 1.5°C warmer world. *Front. Environ. Sci.* 9, 784642. doi:10.3389/fenvs.2021.784642

Ehrlich, P. R., and Ehrlich, A. H. (2009). The population bomb revisited. *Electron. J. sustain. Dev.* 1, 63–71.

Goncharuk, W., and Goncharuk, V. V. (2019). Water is everywhere. It holds everything, even a key to understanding the universe. D. I. Mendeleev's law is the prototype of the universe constitution. *J. Water Chem. Technol.* 41, 341–346. doi:10.3103/s1063455x19060018

Longo, S. B., and York, R. (2009). Structural influences on water withdrawals: An exploratory macro-comparative analysis. *Hum. Ecol. Rev.* 16 (1), 75–83. Available at: http://www.jstor.org/stable/24707738 (Accessed August 27, 2022).

Maruyama, S., Ikoma, M., Genda, H., Hirose, K., Yokohama, T., and Santosh, M. (2013). The naked planet Earth: Most essential pre-requisite for the origin and evolution of life. *Geosci. Front.* 4, 141–165. doi:10.1016/j.gsf.2012.11.001

Peña-Ramos, J. A., López-Bedmar, R., Sastre, F. J., and Martinez-Martinez, A. (2022). Water conflicts in sub-saharan africa. *Front. Environ. Sci.* 10, 863903. doi:10.3389/fenvs.2022.863903