

Browning of boreal lakes: do public perceptions and governance meet the biological foundations?

Paper authors:

Eerika Albrecht, Olga Hannonen, Carlos Palacin-Lizarbe, Jarno Suni, Laura H. Härkönen, Anssi Vainikka, Niko Soininen, Jussi Kukkonen

Research objectives

The idea is to approach the brownification process from several perspectives (limnology, ecology, environmental law, tourism) to generate a research agenda, build a theoretical framework, and pinpoint the research needs

Utilising the review approach, we identify the gaps of knowledge, and also, the impacts of brownification on lake functioning, recreational use, and public perception

The overall contribution is to build an interdisciplinary understanding of how brownification affects Boreal lakes, current/potential aquatic environment's users, and synthesise this knowledge creating recommendations for improved environmental legislation and ecosystem impact assessment, and forest/wetland management practices

Water browning: From liminological perspective to public perceptions

Brownification is an ongoing process of increasing water-colour resulting from higher organic matter (OM), dissolved organic carbon (DOC) and iron (Fe) content

Causes: climate change and/or decreased sulphate deposition, changes in land use especially on peatland dominated areas

Water browning is not sufficiently integrated into ecosystem-based management → This question is essential for approaching the topic from an environmental law perspective

With stakeholder perception, the situation gets even more complex as aquatic environments users have different preferences (some e.g., fishermen may prefer brown waters for fishing, while other users (swimmers) incline towards more transparent waters)

Research questions:

1. What kind of disturbance does browning cause in freshwater ecosystems?
2. To what extent does browning impact the values and benefits attached to water quality from the perspective of recreational users?
3. Is ecosystem-based management, as introduced in the WFD, accounting the issue of browning?



Methods

Literature review Systematic review

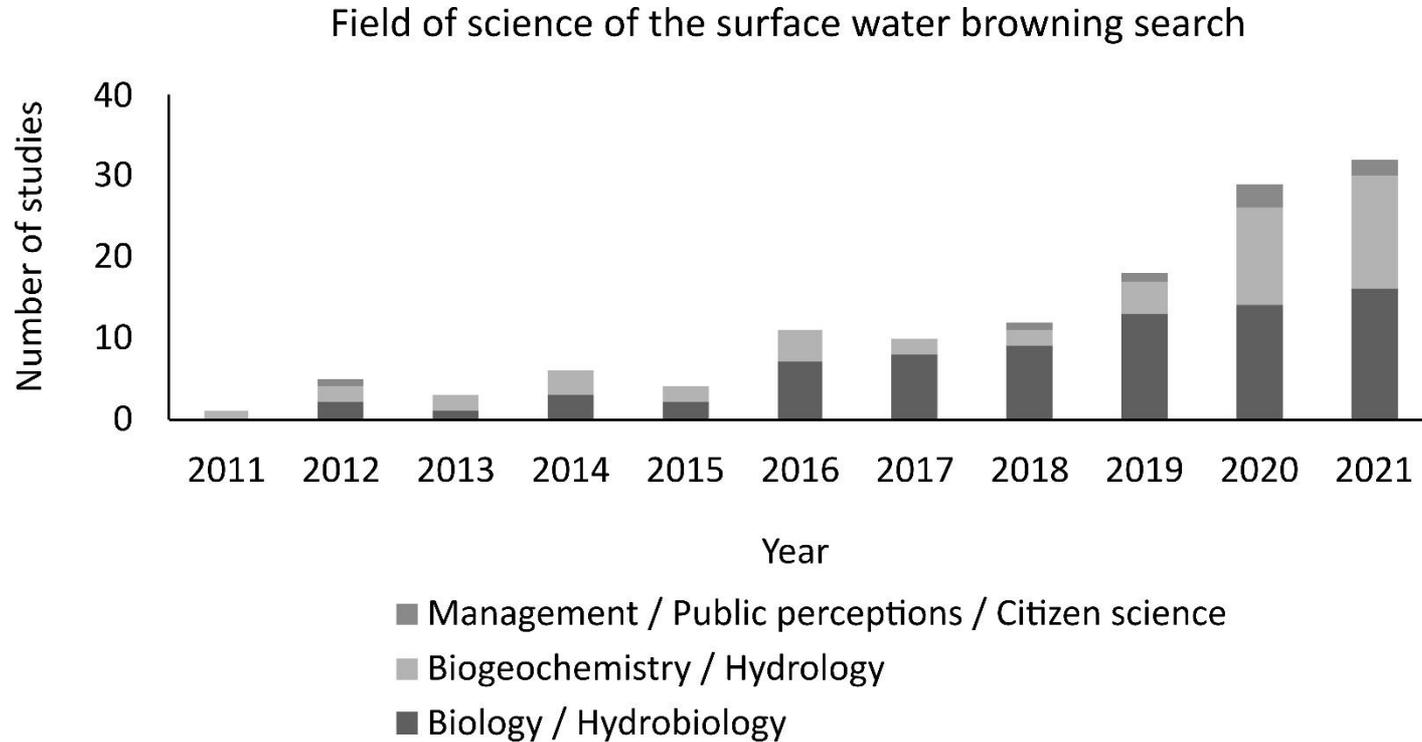
Databases: Web of Science,
Scopus, PubMed, EBSCOHost

N=589

*Questionnaire: Russian tourists
visiting Finland (N=527)*

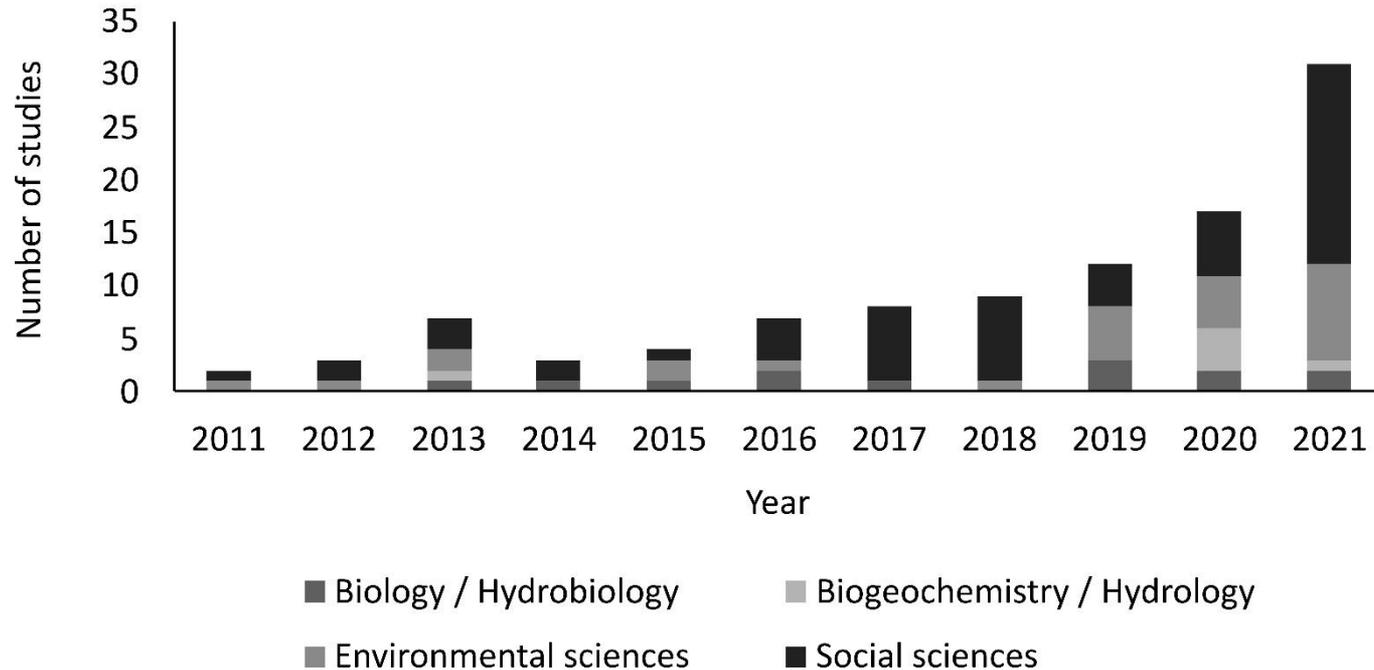
	Browning search	Ecosystem-based management search
Search terms	'browning' or 'brownification,' 'water quality' and 'lake'	'Ecosystem-based management,' 'water quality,' 'public perception OR attitude OR opinion', and 'lake'
Data-bases	Scopus, PubMed, EBSCOHost and Web of Science	

Field of science of the surface water browning search

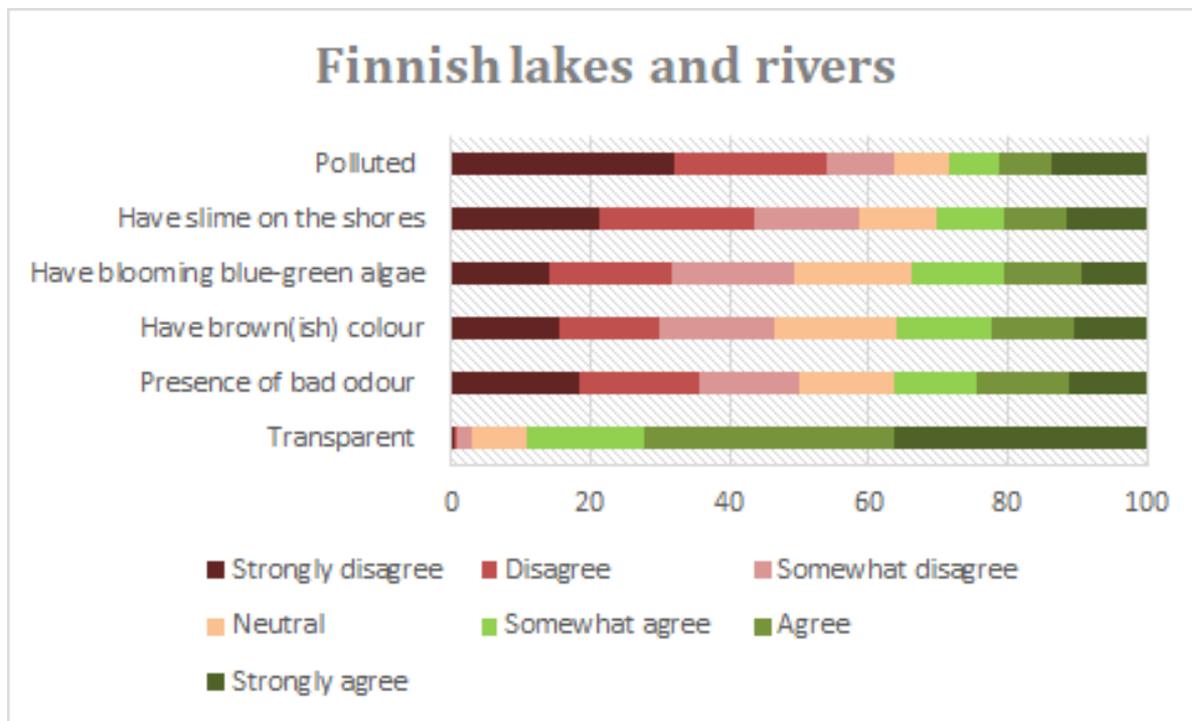


Field of science of the ecosystem-based management search

Field of science of the ecosystem-based management search



Perceptions of Finnish lakes and rivers water quality of the visiting tourists



Factors influencing public perceptions of aquatic ecosystems

(Flotemersch & Aho , 2020)

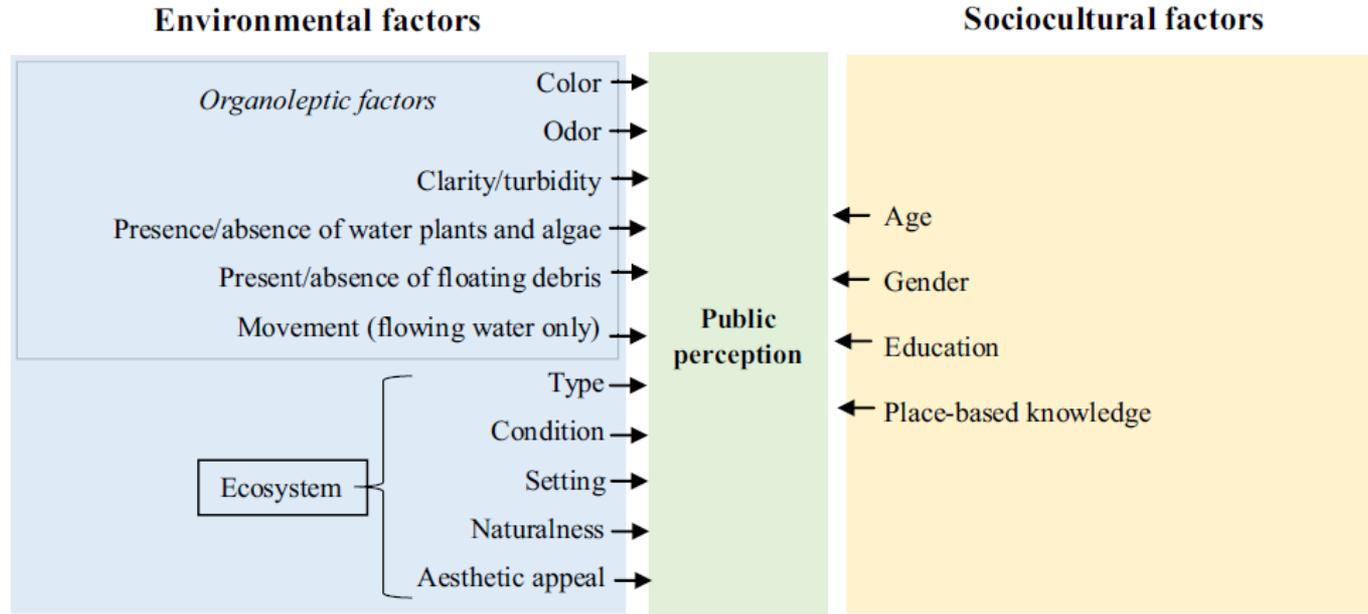


Fig. 1 Factors reported in the literature as influencing public perceptions of aquatic ecosystems

Conclusions

- To the best of our knowledge, this study is first one to combine research on ecological consequences, public perception and ecosystem-based management on water browning
- In summary, browning mostly has detrimental consequences on boreal lakes, as it increases the climate impacts by increasing the green-house gas emissions, reduces the aquatic productivity and lowers the water quality
- In our study, brown colour was noticed by the surveyed tourists, but not considered as particularly important attribute of waters
 - Perception is a subjective category and different people have different perceptions and preferences when it comes to water quality and other characteristics of aquatic ecosystems

Conclusions

- The current EU regulation and ecosystem-based management largely fail to consider the competing interests between terrestrial activities that impose costs on freshwater ecosystems and livelihoods and recreational activities that depend on them
- We recommend that browning-indicators should be included in the biological and chemical monitoring and classifying frameworks of the EU
- Regulatory frameworks for main sources of organic carbon should improved or novel environmental legislation introduced setting constrains for terrestrial activities such as forestry.



Thank you!



UNIVERSITY OF
EASTERN FINLAND

uef.fi