

Developing a Safe Operating Space framework for water resources in the Danube River basin

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International Institute of Applied System Analysis



EGU2025/Vienna



The Danube river basin

Danube River Basin District



- 19 countries
- 801,000 km²

Main challenges:

- Water quantity
- Water quality
- Groundwater management
- Biodiversity



The Danube river basin

These challenges are projected to intensify due to climate and societal changes in the coming decades.





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Jamshid Jalali ^a, Nishan Bhattarai ^b, Jillian Greene ^a, Tao Liu ^c, Oskar Marko ^d, Mirjana Radulović ^d, Molly Sears ^e, Sean A. Woznicki ^a Ӓ 🖾

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First published: 15 January 2024 | https://doi.org/10.1111/ddi.13808 | Citations: 1

Sonja C. Jähnig and Sami Domisch contributed equally. Editor: Murilo Dias

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Journal of Environmental Geography 11 (3-4), 25-36.

DOI: 10.2478/jengeo-2018-0010 ISSN 2060-467X



FUTURE PROJECTIONS OF WATER SCARCITY IN THE DANUBE RIVER BASIN DUE TO LAND USE, WATER DEMAND AND CLIMATE CHANGE

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Research article, received 17 September 2018, accepted 31 October 2018

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River Research and Applications

SPECIAL ISSUE PAPER 👌 Open Access 🛛 🚱 😱

Management challenges related to long-term ecological impacts, complex stressor interactions, and different assessment approaches in the Danube River Basin

T. Hein 🔀 A. Funk, F. Pletterbauer, W. Graf, I. Zsuffa, G. Haidvogl, R. Schinegger, G. Weigelhofer

First published: 25 January 2018 | https://doi.org/10.1002/rra.3243 | Citations: 40



What is the Safe Operating Space (SOS)?



Image Source: Time, https://time.com/5930093/amsterdam-doughnut-economics/

A sustainability concept for the complex Earth System (including for water resources).

Social foundation

- Environmental/Ecological ceiling
- Environmentally safe and socially just space for humanity to thrive



Develop a SOS framework for the Danube river basin

Support water planning and management at local to regional levels

- Ensure a sufficient and reliable supply of water
- Both for human activity and natural ecosystems











Castelletti, Xia et al., unpublished; modified by Silvia Artuso







Castelletti, Xia et al., *unpublished*; modified by Silvia Artuso



MODEL	Function	Process	Indicator	[I-DIMENSIONAL
Globa	Regulatory functionality	Natural flow regime	Monthly mean flow alteration	OPERATING SPAC
		Longitudinal connectivity	Structural connectivity index	Safe
Local i	Water state	Uphold state	Aquifers recharge rate	Increasing Risk
		Drought resilience	Resilience index	TIGH NISK
		Extreme flood events	High pulses duration	,0 ⁵
**		Ecosystem state	% of implemented eflows	
		Sectoral water demand	Water supply reliability	
	Water supply	Agricultural demand	% of met demand	1 .
managemet		Renewable supply	Share of demand met by renewable	Indicators
FUTURE	Productivity	Navigation	Navigable days/year	
ADA PA		Habitat	Habitat availability	
	Chemical loads	Chemical status	WFD limits of P and N concentrations	



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SOS

Nate







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How can the SOS be used for water management?



Pathways that are consistently remain within the safe zone for all key indicators

There is an obvious tradeoff between the performance of Sector A and sector B

Spot the precise points at which changes in actions or scenarios results in large shift in safety





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Castelletti, Xia et al., unpublished



Thank you very much for your time!

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This project has received funding from the European Union's Horizon Europe research and innovation programme under grant agreement no. 101059264.



Integrated water modelling system (IWMS) for the Danube basin

Community Water Model (CWatM)



https://cwatm.iiasa.ac.at/

Community Water Model (CWatM) is a hydrological model simulating the water cycle daily at global and local levels, historically and into the future, maintained by IIASA BNR Water Security group.

CWatM assesses water supply, demand, and environmental needs, including water management and human influence within the water cycle. CWatM includes an accounting of how future water demands will evolve in response to socioeconomic change and how water availability will change in response to climate and management.

CWatM is open-source and community-driven, and its modular structure facilitates integration with other models.

