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Understanding impacts of military dam destructions on river ecosystems: the case of Ukraine

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Water resources are being heavily affected by armed conflicts, which worldwide have greatly increased in numbers. Rivers and floodplains are used as frontlines, while waters of reservoirs as weapons of war. Military actions on the territory of Ukraine have unprecedent effects on freshwaters and water infrastructure of the country caused by pollution, physical damage and placing of mines along river courses. Since 2022, several dams were destroyed along the Irpen, Oskil, and Inhulets rivers. The most dramatic, however, was a collapse of the Kakhovka dam on the Dnieper river on the 6th of June 2023. This war-induced dam destruction caused drainage of one of the Europe's largest reservoirs, resulting in catastrophic flooding and pollution of the river, estuarine and Black Sea environments. Understanding impacts of such dam destructions during the war time is challenging due to restricted access to affected territories and limited field assessments.

Here I will introduce an innovative framework to assess short and long-term environmental and human-health related impacts of sudden dam destructions using the case of the Kakhovka Dam. Our framework combines results of pre- and post-destruction field surveys, numerical modelling and remote-sensing to outline spatial-temporal scales of the disaster and predicts trends in re-establishment of altered ecosystems. We highlight previously overlooked risks imposed by accumulations of heavy metals in exposed sediments of the former reservoir. Assessment of scenarios to mitigate the pollution and possible solutions are provided. Sudden dam destructions caused by warfare or extreme weather events can be well assessed by our framework, to effectively mitigate risks posed by aging dams around the world.