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Great River Landscapes of Western Asia and Eastern Europe: Volga, Dnieper, Danube, and Rhine (A Conversation with Kenneth R. Olson)

Editorial board[1]

Pollution and Diseases

DOI: https://doi.org/10.66659/ttv2jt84

Published: July 09, 2026

How to cite: Editorial board. Great River Landscapes of Western Asia and Eastern Europe: Volga, Dnieper, Danube, and Rhine (A Conversation with Kenneth R. Olson). Pollution and Diseases. Repository. 2026. 14 p.

DOI: https://doi.org/10.66659/ttv2jt84

Abstract

This interview discusses the seventh volume in Kenneth R. Olson's book series, which examines the Volga, Dnieper, Danube, and Rhine River landscapes as interconnected natural, historical, political, and engineered systems. The discussion emphasizes long-term changes in river morphology, floodplain use, navigation, hydropower, soil and water resources, and the social consequences of river regulation. Particular attention is given to the Dnieper River watershed, including the environmental implications of the Chernobyl nuclear power plant accident and the 2023 destruction of the Kakhovka Dam; the Danube as a transboundary river shaped by settlement, trade, and governance; the Volga as a central water-supply and navigation system for Russia; and the Rhine as a highly industrialized river affected by stream capture, urbanization, and microplastic pollution. The interview presents large river management as a complex socio-ecological problem that cannot be addressed by engineering expertise alone. It argues for resilience-based river and floodplain management, improved interdisciplinary research, and governance frameworks that integrate environmental protection, food and water security, navigation, energy development, and community impacts.

Keywords: Volga River; Dnieper River; Dnipro River; Danube River; Rhine River; river landscapes; transboundary watersheds; stream capture; Kakhovka Dam; Chernobyl; microplastics; soil erosion; floodplain management; water security; resilience.

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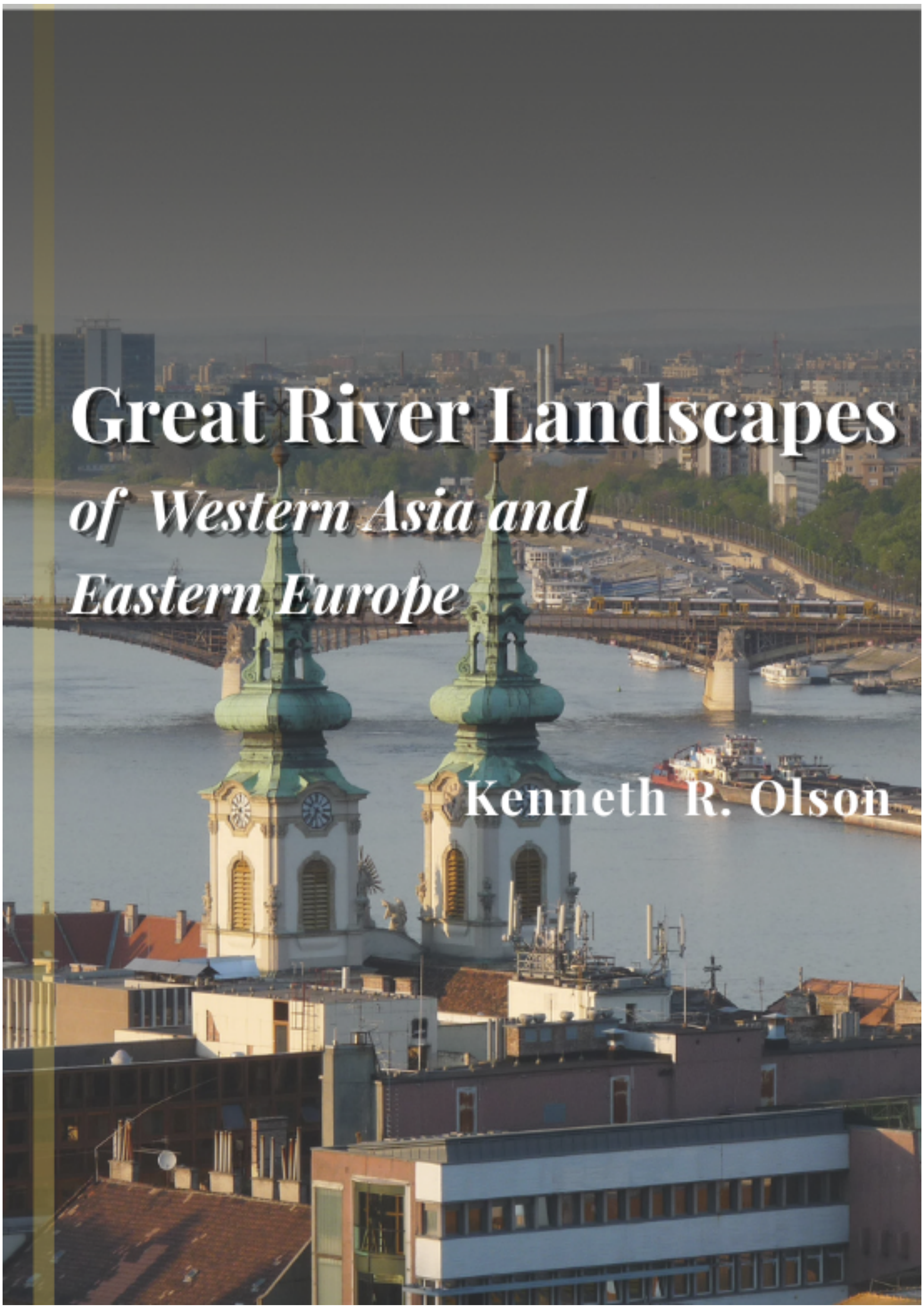

Book title	Great River Landscapes of Western Asia and Eastern Europe: Volga, Dnieper, Danube, and Rhine
Authors	Kenneth R. Olson
Year	2026
Publisher	Pollution & Diseases Book Series
ISBN	ISBN 978-80-909865-2-7 (paperback) eISBN 978-80-909865-3-4 (PDF)
Pages	143 p.

Key Points

1. The Volga, Dnieper, Danube, and Rhine are not only waterways but long-term socio-ecological corridors shaped by climate, sediment dynamics, settlement, trade, warfare, and engineering.
2. The Dnieper case links hydropower, irrigation, drinking-water supply, radionuclide contamination, and the environmental consequences of the Kakhovka Dam destruction.
3. The Danube and Rhine illustrate the challenges of transboundary governance, navigation, pollution control, and long-term geomorphic change, including stream capture.
4. The Volga case demonstrates how large-scale state infrastructure can secure urban water supply while producing major social and environmental costs.
5. Future river management should be based on resilience, interdisciplinary evidence, and explicit attention to communities, ecosystems, food security, and long-term watershed stability.

Introduction

Interview conducted on June 25, 2026.

Prepared for the journal "Pollution and Diseases."

Professor Kenneth R. Olson is an American soil scientist, environmental researcher, and author whose work focuses on great river landscapes, environmental degradation, flooding, war-related ecological damage, and freshwater systems around the world. In this interview, he reflects on decades of interdisciplinary research, the environmental consequences of war, and the future of the world's great rivers and deltas.

Why This Book Matters Now

This book matters now because great river landscapes are becoming central to some of the most urgent environmental, political, and social questions of the twenty-first century. The Volga, Dnieper, Danube, and Rhine are not only rivers; they are water-supply systems, navigation corridors, agricultural foundations, energy sources, cultural landscapes, and geopolitical boundaries. Their condition affects food security, drinking-water availability, public health, economic stability, and the resilience of communities living within their watersheds.

The timing is especially important because recent events have shown how quickly river systems can be transformed by war, infrastructure failure, climate variability, and pollution. The destruction of the Kakhovka Dam in 2023 demonstrated that damage to one major hydraulic structure can produce cascading consequences for floodplains, settlements, irrigation networks, drinking-water systems, agricultural production, and contaminated sediments. In the Dnieper watershed, these risks are further complicated by the long-term legacy of the Chernobyl nuclear power plant accident.

At the same time, the Danube and Rhine show that even highly studied and managed European rivers remain vulnerable to transboundary governance challenges, industrial pollution, navigation pressures, flood risk, microplastic contamination, and long-term geomorphic change. The Volga case adds another dimension: large-scale hydraulic engineering can secure urban water supplies and economic development, but it can also impose major social and environmental costs through reservoir construction, resettlement, ecosystem alteration, and sediment disruption.

For these reasons, the book is timely not only as a scientific study, but also as a practical warning. It shows that river management cannot be reduced to engineering solutions alone. Large rivers are coupled socio-ecological systems in which soil, water, infrastructure, communities, agriculture, industry, and political decisions interact over long periods. Managing them requires interdisciplinary evidence, transparent governance, long-term monitoring, and policies built around resilience rather than short-term control.

The book therefore matters now because it helps readers understand that the future of great rivers will depend on how societies balance development with restoration, navigation with ecological protection, energy production with watershed stability, and emergency decisions with long-term consequences. Its central message is clear: river landscapes are dynamic, vulnerable, and essential systems, and their management must begin from the recognition that change is inevitable.

INTERVIEW

Q: What is this book about?

A: The book examines four major river landscapes: the Volga, Dnieper, Danube, and Rhine. These rivers have shaped the landscapes through which they flow, the confluences where they mix with tributaries, and the deltaic or coastal systems into which they discharge (Figure 1-2). Their channels, floodplains, and sediment regimes have been altered over time by climate variability, extreme weather, settlement, agriculture, navigation, hydropower, and other forms of human engineering.

Historically, lands adjacent to these rivers were often low-lying floodplains that were seasonally inundated. During the last century, however, many stretches were transformed into agricultural and industrial corridors through levees, locks, dams, floodwalls, reservoirs, and canals. The book uses case studies, maps, and photographs to assess how river landscapes have been modified and how future management can better protect soil and water resources while balancing social, economic, and ecosystem needs.

Q: Why did you decide to write this book specifically?

A: My earlier work on soil erosion in Russia examined the use of cesium-137 (137Cs) from the Chernobyl nuclear power plant accident as a time marker. The radionuclide plume traveled hundreds of miles before being deposited by rainfall on cultivated and forested lands near Tula, where soil radiation levels were far above normal background values. That research was funded through the NATO Partner Program and involved collaboration among the University of Illinois, the College of Agricultural, Consumer and Environmental Sciences, the Department of Natural Resources and Environmental Sciences, and the Moscow State University Faculty of Geography (1-5).

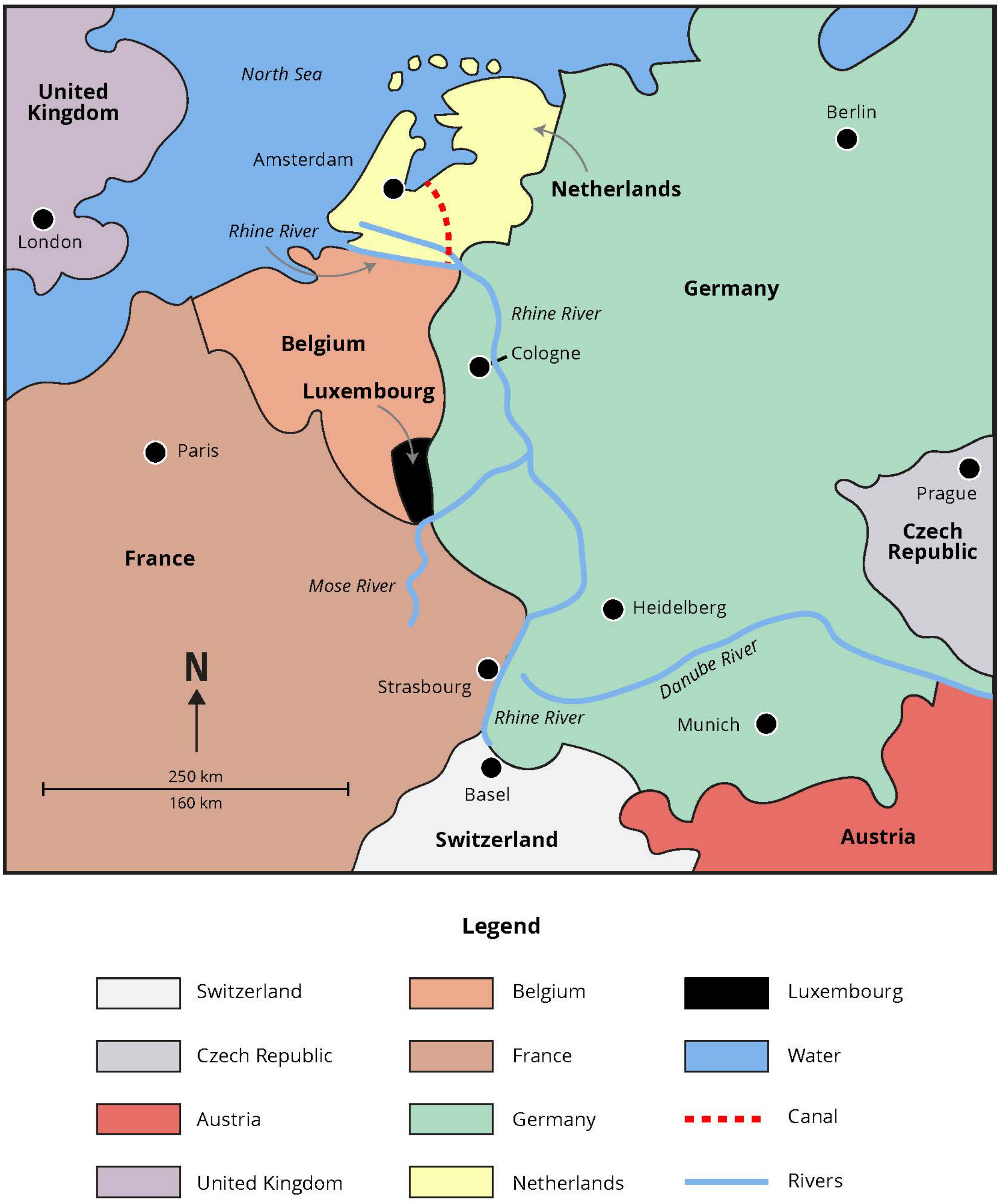

Figure 1. Map of stream capture of the Danube River headwaters by the Rhine River. Map credited to Mic Greenberg. Reprinted with copyright permission of the Managing Editor of the Open Journal of Soil Science.

Figure 2. Satellite image of the Danube Delta in Romania. Reprinted with copyright permission of the Managing Editor of the Open Journal of Soil Science.

I later extended this interest to the Volga (6), Dnieper, Danube, and Rhine Rivers (Figure 3). In 2025, fieldwork in the Dnieper and Volga watersheds was not possible because of the Russia-Ukraine war. However, previous field visits in Russia, including areas surrounding Moscow, Tula, and Belgorod, provided background for analyzing these river landscapes.

Q: What makes this topic scientifically important?

A: The book is scientifically important because it brings together river morphology, soil erosion, floodplain processes, water quality, radionuclide transport, hydropower development, and transboundary governance. The Dnieper River watershed is especially significant because it was affected by the Chernobyl nuclear power plant accident and, decades later, by the destruction of the Kakhovka Dam (7). Radionuclides entering aquatic systems may be dispersed, deposited in bottom sediments, taken up by aquatic plants and benthic organisms, and transferred through fish and drinking-water or irrigation pathways.

Figure 3. Map of Western Asia and Eastern Europe. Map credited to Mic Greenberg. Reprinted with copyright permission of the Managing Editor of the Open Journal of Soil Science.

The Kakhovka Dam destruction also illustrates the cascading effects of infrastructure failure: flooding of settlements and farmland, disconnection of canal systems, disruption of drinking-water supplies, reduction of irrigation capacity, and potential redistribution of contaminated sediments. Comparisons with the 2011 Birds Point-New Madrid Floodway levee breaches in the United States can inform restoration planning, but the Dnieper case includes additional risks associated with Chernobyl-derived radionuclides. The broader scientific problem is therefore not only hydrological or engineering-based; it also concerns soil productivity, food security, public health, and long-term watershed recovery.

Q: Which regions or case studies are central to the book?

A: The central case studies are the Volga, Dnieper, Danube, and Rhine (Figure 4) River systems. The Danube River basin is a major example of long-term settlement, invasion, navigation, trade, and transboundary governance (8). Its banks supported early cultures, fortresses, and major cities such as Vienna, Budapest (Figure 5), Belgrade, and Ruse. Because the river flows through or borders multiple countries, its management requires cooperation on water quality, navigation, flood risk, fisheries, and ecological protection.

The Dnieper case focuses on hydropower, irrigation, navigation, Chernobyl-related contamination, and the 2023 Kakhovka Dam destruction. The Volga case examines the river as a Russian water-supply, navigation, and economic lifeline. The Rhine case emphasizes industrialization, navigation, microplastic pollution, and the geomorphic process by which the upper Danube is gradually being captured by the Rhine through karstic sinkholes and underground flow pathways (9).

Figure 4. Rhine Falls at the bend in the Rhine River, with Neuhausen am Rheinfall, Switzerland, in the background. Photo credit: Sergey Chernyanskii. Reprinted with copyright permission of the Managing Editor of the Open Journal of Soil Science.

Figure 5. The Danube River at Budapest, with island, bridge, and boats. Reprinted with copyright permission of the Managing Editor of the Open Journal of Soil Science.

Q: What were the most difficult aspects of the research?

A: The most difficult aspect was access to the Dnieper watershed during the Russia-Ukraine war, especially after the 2023 Kakhovka Dam destruction. Direct field observation was not possible. It was also difficult to secure co-authors who could safely work within the watershed or country. Potential co-authors eventually withdrew because of concerns for their own safety and the safety of their families.

Q: Did anything during the research surprise you?

A: One surprising point was the extent to which Moscow depends on the Volga River system for water. The Ivan'kovskoye Reservoir on the Volga is connected to the Moscow River by the 137 km Moscow Canal. Commissioned under Joseph Stalin, the canal was built with prison labor and required approximately four and a half years to complete. It includes 11 locks and passes through villages, forests, and farmland north of Moscow.

The canal had major economic and urban significance because it helped solve Moscow's water-supply problem by bringing comparatively clean Volga water into the city. At the same time, its construction and the wider system of reservoirs in the Volga basin had severe social and environmental costs, including forced labor, village flooding, and population resettlement.

Q: Which environmental processes described in the book are the most underestimated?

A: Stream capture is one of the most underestimated processes. In southern Germany, the Rhine and Danube compete for water (Figure 1). The upper Danube flows across the porous limestone of the Swabian Alb, where part of its water disappears into sinkholes and underground channels before re-emerging at the Aachtopf and eventually contributing to the Rhine system.

The Rhine lies at a lower elevation and has already captured part of the drainage that formerly contributed to the ancient Danube. During low-flow periods, the upper Danube may carry little surface water beyond the Danube Sink to the Danube Delta (Figure 2). Over long geomorphic timescales, continued underground erosion of the limestone may further reduce the upper Danube's flow and increase the relative capture of its headwaters by the Rhine. This process is gradual, but it has important implications for watershed boundaries, ecological continuity, navigation, and long-term water availability.

Q: How are environmental systems connected with political or military processes in this topic?

A: The Dnieper case provides the clearest example. The Kakhovka Dam was destroyed on 6 June 2023 during the Russia-Ukraine war. Its destruction caused widespread flooding, affected settlements and farmland, lowered reservoir and canal water levels, and disrupted systems that supplied drinking water and irrigation to large areas of southern Ukraine (7).

Before the war, canal networks connected to the Kakhovka Reservoir supported water supply, irrigation, and agricultural production. After the reservoir was lost, several canal networks became disconnected from their feeder source. The result was not only a hydraulic problem but also a food-security, public-health, and regional-development problem. The Dnieper watershed is further complicated by existing radioactive contamination risks associated with Chernobyl and other nuclear-related sites. Thus, military decisions and damaged infrastructure can rapidly transform the environmental conditions of an entire watershed.

Q: What should readers understand after reading this work?

A: Readers should understand that river landscapes are dynamic systems in which natural processes and human decisions interact over long periods. Change is the only certainty in river systems. Climate variability, sediment movement, channel adjustment, infrastructure, agricultural development, industrial pollution, and political conflict all influence how river landscapes function.

The connection between soil and water creates both vulnerability and opportunity. People also differ in their visions for river landscapes: some emphasize navigation and energy, others agriculture, urban water supply, fisheries, cultural heritage, or ecological protection. Managing for resilience is therefore a practical way to prepare for future risks and catastrophes that cannot be fully predicted.

Q: Who is this book intended for?

A: The book is intended for public and private landowners, river-basin managers, and policy specialists concerned with the great river landscapes of Western Asia and Eastern Europe. It may also be useful for soil scientists, sociologists, conservationists, wetland specialists, human and physical geographers, urban planners, public-health specialists, economists, geomorphologists, geologists, hydrologists, agronomists, foresters, and readers interested in river landscapes more broadly.

Q: Which chapter is personally most important to you?

A: Chapter 2, on the Dnieper River, is personally the most important. The Dnieper rises in Russia's Valdai Hills and flows south through Belarus and Ukraine to the Black Sea. It supports navigation, hydropower, irrigation, urban water supply, and agricultural production. It also passes through a landscape affected by the Chernobyl nuclear power plant accident and by the 2023 destruction of the Kakhovka Dam.

This chapter brings together several of the book's central concerns: radionuclide movement through water and sediment, dam and reservoir management, canal dependence, floodplain damage, agricultural productivity, drinking-water security, and the difficulty of restoring a river system after war-related infrastructure destruction.

Q: How does this book relate to current global environmental challenges?

A: The book relates directly to environmental and food-security challenges because each river system supports agriculture, water supply, navigation, urban development, and ecosystems. The Rhine, for example, is one of Europe's most important commercial waterways and passes through a highly industrialized and urbanized corridor. Industrial wastewater, urban runoff, overfishing, shoreline engineering, and microplastic pollution are major concerns (9).

The Dnieper case shows how damage to reservoirs and canals can affect irrigation, crop production, drinking-water access, and long-term soil productivity. The Danube case illustrates the difficulty of coordinating water-quality, navigation, and flood-risk policies across many countries. The Volga case demonstrates the tension between urban water supply, national economic development, and the social costs of large-scale hydraulic engineering. Taken together, these case studies show that food and water security depend on maintaining both the ecological integrity and the social functionality of river landscapes.

Q: Are the problems discussed in the book improving or worsening today?

A: Many of the problems appear to be worsening or becoming more complex. The Rhine contains high levels of microplastic pollution between Rotterdam and Basel, and river-borne plastics contribute to marine pollution in the North Sea. Microplastics, defined as particles smaller than 5 mm, may be ingested by organisms and can enter aquatic food webs (9).

Other pressures are also increasing. Climate variability can intensify flood and drought extremes; reservoirs and dams can alter sediment transport; industrial and urban development can increase water-quality risks; and military conflict can damage critical infrastructure. These pressures interact rather than occur in isolation. As a result, river management must address cumulative risks rather than single causes.

Q: Climate change and increasing climate variability are making river systems less predictable in many parts of the world. How might these changes affect the Volga, Dnieper, Danube, and Rhine, especially flood frequency, drought risk, sediment trapping, soil erosion, agricultural productivity, stream capture, and the long-term reliability of waterways?

A: Climate variability is likely to amplify existing river-management challenges. More frequent or intense floods can increase bank erosion, sediment redistribution, floodplain damage, and contamination risks. Longer or more severe droughts can reduce water depth, limit navigation, increase pollutant concentrations, and heighten competition among drinking-water supply, irrigation, hydropower, and ecosystem needs.

Reservoirs and dams may reduce some flood peaks, but they also trap sediment and can alter downstream channel form, delta stability, and soil fertility. In agricultural regions, this can affect both floodplain productivity and irrigation reliability. The Danube-Rhine stream-capture process adds a slower geomorphic dimension: although it unfolds over long timescales, reduced low-flow reliability may make the effects of headwater losses more visible. The long-term reliability of these waterways will therefore depend on integrated basin-scale planning rather than isolated engineering interventions.

Q: How did the decision to build the Moscow Canal affect farmers and local communities in adjacent uplands, and were their voices adequately considered in the decision-making process?

A: Local voices were not adequately considered. The Moscow Canal was a state-led modernization project designed to bring Volga (Figure 3) water to Moscow and to support navigation and economic development. It was built under Stalin using forced prison labor, and many workers died during construction.

The canal and related reservoirs transformed villages, forests, and farmland north of Moscow. In the Volga basin more broadly, reservoir construction required the flooding of settlements and the resettlement of villagers. Some Orthodox churches and partially submerged structures remain as visible reminders of these transformations. The project therefore solved a major urban water-supply problem while imposing substantial social and landscape costs on rural communities.

Q: Your book shows that river management is not only a scientific or engineering problem, but also a political, legal, economic, and social one. Even in countries with advanced science and strong public institutions, military and emergency decisions can have unintended consequences.

What does this reveal about the limits of expertise in managing large river systems?

A: It shows that technical expertise can reduce risk but cannot remove uncertainty, political conflict, or competing social values. The comparison between the 2011 Birds Point-New Madrid Floodway levee breaches and the 2023 Kakhovka Dam destruction is useful because both cases involved deliberate or human-induced infrastructure failure and major floodplain impacts. However, the Dnieper case includes additional complications, including wartime conditions, damaged drinking-water and irrigation systems, food-production impacts, and possible redistribution of Chernobyl-derived radionuclides (7).

Expertise can help identify likely pathways of damage, restoration priorities, and monitoring needs. It cannot, by itself, guarantee that decisions will be socially legitimate, politically accepted, or ecologically harmless. Large river systems require interdisciplinary science, transparent governance, emergency planning, and long-term investment in both communities and ecosystems.

Q: If you could recommend one major change in river and floodplain management policy based on this book, what would it be?

A: I would recommend that river and floodplain policy be organized around resilience. This means preparing for risks that cannot be predicted fully, protecting soil and water resources, maintaining ecological connectivity where possible, reducing pollution, and ensuring that development decisions account for long-term social and environmental consequences.

Q: Which future research directions emerge from this work?

A: Future research should expand comparative analysis of the Volga, Dnieper, Danube, and Rhine as coupled social-ecological systems. Priority topics include sediment trapping by reservoirs, contaminant transport, radionuclide redistribution, microplastic pollution, floodplain soil recovery, stream capture, drought impacts on navigation, and the social consequences of resettlement and river engineering.

A second research direction is the development of more integrated restoration frameworks for damaged river landscapes. These frameworks should combine soil surveys, sediment and contaminant monitoring, hydrological modeling, ecological assessment, and social research on livelihoods, water access, and community resilience.

Q: If readers remember only one idea from the book, what should it be?

A: Change is the only certainty in river systems. River management must begin from that fact.

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The Editorial Board of the journal "Pollution and Diseases" wishes you continued scientific success, new discoveries, and inspiration in your work.

Conflict of Interest

The authors declare no conflict of interest.

Acknowledgments

Not applicable.

Funding

This research received no external funding.

Data Availability Statement

No new data were created or analyzed in this study.

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