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Great River Landscapes of Western North America: Yukon, Columbia, Snake, Colorado and Rio Grande (A Conversation with Kenneth R. Olson)

Editorial board[1]
Pollution and Diseases

DOI: https://doi.org/10.66659/3ds6k473
Published: June 7, 2026
How to cite: Editorial board. Great River Landscapes of Western North America: Yukon, Columbia, Snake, Colorado and Rio Grande (A Conversation with Kenneth R. Olson). Pollution and Diseases. Repository. 2026. 13 p.
DOI: https://doi.org/10.66659/3ds6k473

Abstract

This interview with Professor Kenneth R. Olson explores the scientific, historical, and environmental themes of his book Great River Landscapes of Western North America: Yukon, Columbia, Snake, Colorado and Rio Grande. The discussion examines how five major western North American river systems have shaped landscapes, settlement, agriculture, navigation, energy production, territorial boundaries, freshwater quality, and ecosystem resilience. Particular attention is given to sediment transport in the Yukon River basin, salmon and sturgeon decline in the Columbia and Snake River systems, the environmental effects of dams and hydropower, the drying of the Colorado River and the Rio Grande, and the need for more resilient river and floodplain management. The interview also emphasizes the political and institutional dimensions of river landscapes: rivers are not only hydrological systems, but also corridors of settlement, conflict, engineering, economic development, and environmental risk. Olson argues that the central lesson of these systems is that change is the only certainty in river landscapes, and that future policy must integrate hydrology, soil science, ecology, agriculture, public health, energy systems, Indigenous and local histories, and governance.

Keywords: Great River Landscapes; Western North America; Yukon River; Columbia River; Snake River; Colorado River; Rio Grande; Soil Science; Sediment Transport; Hydrology; Floodplain Management; River Governance; Salmon Migration; Hydropower; Irrigation; Freshwater Systems; Climate Change; Environmental History; Public Health.

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Key Points

1. The Yukon, Columbia, Snake, Colorado and Rio Grande are not only hydrological systems; they are historical, political, ecological, agricultural and infrastructural landscapes.
2. Large western river systems reveal how soil, water, sediment, climate, food security, navigation, hydropower and settlement are connected.
3. Dams, irrigation systems, navigation projects and energy infrastructure have produced major economic benefits but also long-term ecological consequences, especially for migratory fish and riverine habitats.
4. The Yukon River illustrates the importance of sediment movement in a largely uncultivated basin where snowmelt, permafrost thaw and climate change shape sediment delivery.
5. The Colorado River and the Rio Grande show how climate stress, irrigation demand, urban growth and institutional management can push major rivers toward chronic water scarcity.
6. The central policy lesson is that river management must be based on resilience, because future climatic, hydrological and social risks cannot be fully predicted.

Introduction

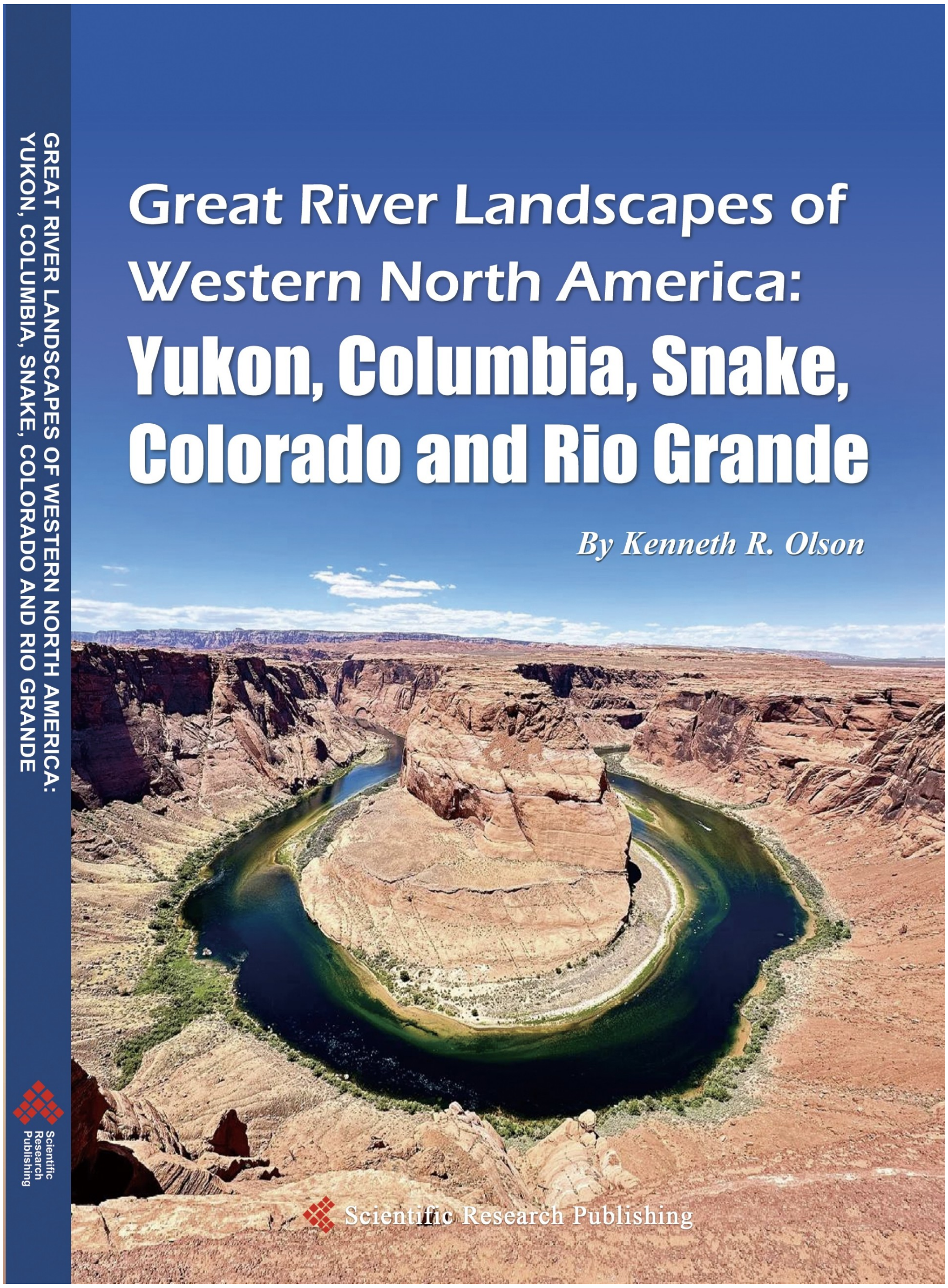
Interview conducted on June 07, 2026.

Prepared for the journal "Pollution and Diseases."

Interview conducted for the journal Pollution and Diseases. This text is part of the Kenneth R. Olson book-interview series. The purpose of the series is to make Professor Olson's long-term research on soils, rivers, floodplains, deltas, freshwater systems, environmental change and public policy accessible to a wider interdisciplinary audience.

Professor Kenneth R. Olson is an American soil scientist, environmental researcher and author whose work connects field-based soil science with geomorphology, environmental history, hydrology, agriculture, public policy and landscape management. In this interview, he discusses the fourth book in the series, focused on the great river landscapes of western North America: the Yukon, Columbia, Snake, Colorado and Rio Grande rivers.

Book title	Great River Landscapes of Western North America: Yukon, Columbia, Snake, Colorado and Rio Grande
Authors	Kenneth R. Olson
Year	2026
Publisher	Scientific Research Publishing, Inc., USA
ISBN	ISBN Paperback: 979-8-89507-610-1 ISBN E-Book: 979-8-89507-611-8
Pages	198 p.



Why This Book Matters Now

A: This book matters now because the great rivers of western North America are no longer only subjects of regional history, hydrology or landscape description. They have become central examples of the global freshwater crisis. The Yukon, Columbia, Snake, Colorado and Rio Grande show how climate change, sediment movement, irrigation demand, hydropower, navigation, urban growth, agricultural production, pollution and public health are connected within the same river systems.

The value of this book lies in its ability to bring together processes that are often studied separately. It shows that rivers are not simply channels of water. They are living socio-ecological corridors shaped by climate, soils, engineering, law, settlement, food systems, energy production and political decisions. The same river can support agriculture, generate electricity, carry sediments, define borders, sustain fish migration, provide drinking water, and at the same time become vulnerable to overuse, pollution, habitat loss and drought.

The book is especially important today because western North America is facing intensifying water stress. The Colorado River and the Rio Grande demonstrate how major rivers can be pushed toward chronic scarcity by the combined pressures of irrigation, urban expansion, climate variability and institutional management. The Columbia and Snake rivers show the long-term ecological consequences of dams, navigation systems and hydropower development, especially for salmon and other migratory fish. The Yukon River illustrates how climate warming, snowmelt and permafrost thaw can alter sediment delivery and reshape northern river landscapes.

For readers concerned with pollution and diseases, the book offers a broader lesson: freshwater degradation is not only an environmental problem. It is also a public-health, food-security and governance problem. Decisions about dams, irrigation, floodplains, land use and pollution control can influence water quality, ecosystem resilience, disease risk and the long-term safety of human communities.

The book matters now because it asks a question that is becoming urgent across the world: how can societies manage large river systems when the future is increasingly uncertain? Its central message is simple but powerful: change is the only certainty in river systems. For that reason, river policy must move beyond short-term engineering solutions and toward resilience, adaptive management and protection of soil and water resources.

INTERVIEW

Q: What is this book about?

A: This book examines five powerful rivers of western North America: the Yukon, Columbia, Snake, Colorado and Rio Grande. These rivers drain vast landscapes and have repeatedly shaped and reshaped the valleys, floodplains, uplands and confluences through which they flow. Their sediment-laden waters interact with tributary systems on their way toward the Pacific Ocean, the Bering Sea, the Gulf of California and the Gulf of Mexico.

Over millennia, climate variability and extreme weather events have carved new channels, exposed bedrock, formed fertile valleys and altered river courses. Because great rivers often become territorial and political boundaries, their historical realignment has also affected state and national borders, sometimes adding land to one jurisdiction while removing it from another.

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

A: After studying the great rivers of eastern North America, I decided to continue westward by following, in part, the route taken by the Lewis and Clark Corps of Discovery (Figure 1). After crossing the Rocky Mountains and the Continental Divide, I traveled along the Snake River to the Columbia River and then onward toward the Pacific Ocean.

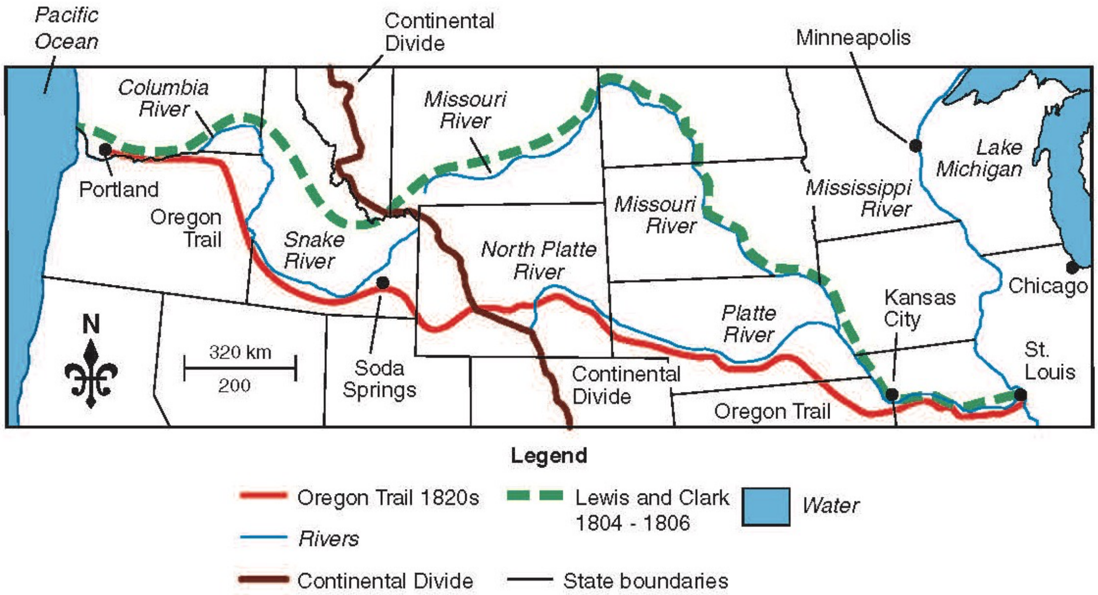


Figure 1. Starting from St. Louis, the Lewis and Clark route and the Oregon Trail via the Missouri, Platte, North Platte, Snake and Columbia rivers. Map created by Mic Greenberg. Published with permission from the Managing Editor of the Open Journal of Soil Science.

After writing about the Columbia and Snake rivers, I expanded the research to include the Yukon, Colorado and Rio Grande. I was struck by the contrast among these basins. The climate of the Yukon has more in common with parts of the Columbia and Snake systems than with the much drier Colorado and Rio Grande basins. As a result, the management challenges and environmental issues differ significantly from one basin to another.

Q: What makes this topic scientifically important?

A: Much can be learned by observing and studying the human and natural systems of river landscapes. I framed the book as a series of short case studies about irrigated agricultural lands, river navigation, upland reservoirs, fish migration, sediment movement, flood risks and landscape management on the Yukon, Columbia, Snake, Colorado and Rio Grande rivers.

Together these cases show that change is the only certainty in river systems. Many factors influence that change: climate, sediment supply, engineering, agriculture, urban growth, energy demand, water law and political institutions. The connection between soil and water creates both vulnerability and opportunity. People differ greatly in their visions for river landscapes and in the ways they use them. Managing for resilience is therefore the best way to prepare for unknown future risks and catastrophes.

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

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

A: The most difficult field challenge was gaining access to the Yukon River watershed. Travel along the Yukon River and into the Yukon Delta (Figure 2) is not possible by ordinary road access. In winter, movement may require dog sleds; in summer, boats are often necessary. There is only one bridge across the approximately 800-mile-long Yukon River in Alaska.

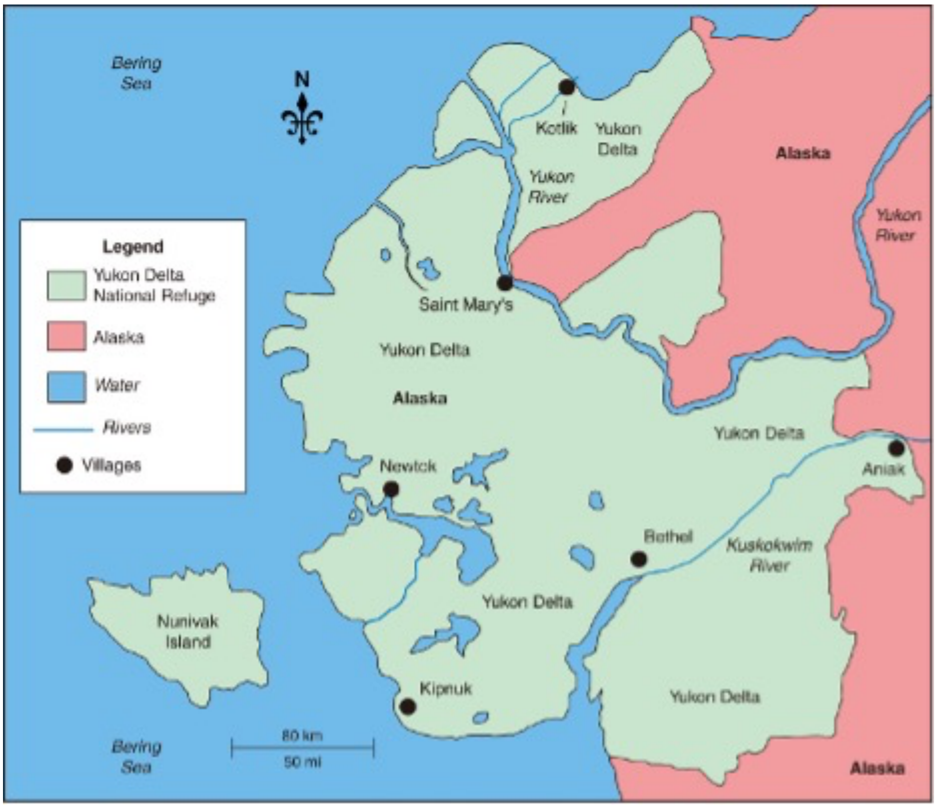

Figure 2. Location of the Yukon River and Delta in Alaska, adjacent to the Bering Sea and the Gulf of Alaska. Map created by Mic Greenberg. Published with permission from the Managing Editor of the Open Journal of Soil Science.

The Dalton Highway, which crosses the Yukon River and continues across tundra and permafrost, is a gravel road. Cracked windshields are a real problem in both Alaska and Canada. When I rented a car in Anchorage, the company would not allow me to take it into Canada because of the gravel-road conditions. A co-author therefore completed part of the field trip to the Yukon headwaters in Canada using train and tour-bus access.

Q: Did anything during the research surprise you?

A: Yes. I was surprised by the amount of sediment in the Yukon River. Most of the Yukon watershed in both Canada and Alaska has not been cultivated. In settled parts of the world, accelerated erosion from land use often contributes much of the sediment delivered to rivers. In the Yukon basin, however, the dominant sediment sources are snowmelt, permafrost thaw and natural geomorphic processes.

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

A: The extent of soil loss and sediment delivery in the Yukon River basin is often underestimated. Physical, chemical and biological processes in the Yukon River and its tributaries influence erosion, sediment transport and sediment delivery to the Yukon Flats, the Yukon Delta and the Bering Sea.

Glacier melt, snowmelt, permafrost thaw, runoff, erosion, transport, deposition and storage of gravelly, sandy, silty and clayey sediments shape habitat distribution and water quality within river channels and floodplains. Ecological functions such as nutrient delivery, migratory cues, breeding habitats and riparian cycles depend on sediment transport at specific times of the year. Rising annual temperatures since the nineteenth century may contribute to higher runoff and increased sedimentation.

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

A: Environmental systems are deeply connected to political and military processes. Historical territorial claims often required the building of forts and settlements. In the eighteenth century, European powers searched for a Northwest Passage that would connect the Pacific and Atlantic oceans through inland North America. British and Spanish expeditions searched the northwest coast for a large river, such as the Columbia or Snake, that might connect to the Missouri River or to Hudson Bay.

A 1798 British map showed a dotted line connecting the Missouri River with the Columbia River through the Rocky Mountains, although no such route existed. Lewis and Clark confirmed in 1805 and 1806 that there was no continuous water passage between these systems. Later, the Hudson's Bay Company controlled much of the Columbia River region, and American attempts to gain territorial control were resisted. The Oregon Treaty of 1846 set the U.S.–Canada boundary at the 49th parallel, while the Columbia River became part of the western boundary framework for the U.S. territories of Washington and Oregon.

Q: What should readers understand after reading this work?

A: Readers should understand that the Yukon, Columbia, Snake, Colorado and Rio Grande are complex and constantly changing landscape systems. Through maps, photographs and case studies, the book shows how climate, population growth, economic development, engineering structures and policy decisions shape river landscapes over time.

The book also interprets great river systems through the interconnected lenses of pollution, disease and the global freshwater crisis. Large rivers should not be treated only as hydrological or economic infrastructure. They are socio-ecological corridors that mediate long-term environmental exposure and public-health risk. Historical land-use decisions, anthropogenic pollution and institutional management strategies all affect freshwater quality and disease dynamics.

Q: Who is this book intended for?

A: The book is intended for public and private landowners and managers who work with great river landscapes in western North America. It is also relevant to soil scientists, hydrologists, geomorphologists, geologists, agronomists, foresters, wetland specialists, conservationists, geographers, urban planners, public-health specialists, economists, sociologists and general readers interested in river systems.

Q: Which chapter is personally most important to you?

A: Chapter 5, on the Rio Grande, is personally important to me. The Rio Grande is shared by Mexico and the United States and has historically provided limited navigation and border security. The river is now drying and needs restoration. If the lower Rio Grande is to recover, it will require increased river flow, improved management, aggressive conservation, efficiency measures in urban areas and on irrigated agricultural lands, and careful binational coordination.

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

A: The Columbia River case shows how geological and landscape resources contributed to the development of a historically rich region of North America. The Columbia River is one of the most biologically diverse freshwater systems in the United States. River trails, cruise ships and recreational infrastructure can help create public attachment to the basin, but development has also imposed ecological costs.

By 1908, there was widespread concern about declining sturgeon and salmon populations in the Columbia basin. Sockeye, coho and Chinook salmon and steelhead migrate upstream to spawn in the streams where they were born. White sturgeon mature slowly and migrate between upstream habitat and the ocean several times during their lives. Dams interrupted the upstream migration of anadromous fish, and the reservoirs created by dams increased the time required for juvenile salmon to reach the ocean, increasing mortality. Some Snake and Columbia River dams use fish ladders (Figure 3) to support upstream migration, but many dams were built without adequate fish-passage structures.

Figure 3. Ice Harbor Dam with a fish ladder on the Snake River, east of the confluence of the Columbia and Snake rivers. Photo credit: Lois Wright Morton. Published with permission from the Managing Editor of the Open Journal of Soil Science.

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

A: Many of the problems are worsening. In the early twentieth century, navigation on the Columbia was seen as an obstacle to the economic development of the Inland Empire region east of the Cascades. Dredging and dam construction disrupted natural river flow but provided electricity, irrigation, navigation and flood-control benefits. At the same time, the establishment of fish canneries in the nineteenth century contributed to dramatic declines in salmon populations.

Before European settlement, the Columbia River supported great runs of salmon and steelhead and abundant wildlife. The ability of the region to sustain large fish and wildlife populations has been reduced. Fish ladders and other fish-passage facilities on Columbia and Snake River dams help, but they do not fully restore the ecological functions of free-flowing river systems.

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 Yukon, Columbia, Snake, Colorado and Rio Grande River basins?

A: Climate change and weather extremes are putting the western half of North America at risk. The greatest impacts are likely to be felt in the Colorado River and Rio Grande (Figure 4) basins. Both rivers face irrigation pressures and periodic drying. Historical Indigenous irrigation systems show that earlier societies developed sophisticated strategies for living with low rainfall, but they also reveal the risks of unsustainable water use.

Figure 4. Balloons over the Rio Grande Valley south of Albuquerque. Photo credit: Kenneth R. Olson. Published with permission from the Managing Editor of the Open Journal of Soil Science.

Little of the Colorado River (Figure 5) now reaches the international border with Mexico near Yuma, Arizona. Intensive consumption, mostly in the United States, has dried the lower river. Since the 1960s, the Colorado River has rarely flowed into the Gulf of California. Its headwater tributaries are a vital source of water for approximately 40 million people, but most years the entire river flow is used for agricultural irrigation and domestic water supply. Restoration efforts appear to be too limited and too late unless a more balanced approach to conservation, efficiency and basin-wide management is implemented

Q: How did irrigation decisions affect farmers and local communities in the Snake River basin, and were their voices adequately considered?

A: The Snake River corridor was critical to U.S. settlement of the Pacific Northwest. Below Shoshone Falls, the lower Snake River supported salmon runs before European and American settlement. In the twentieth century, dams were built to provide cheap river transportation, hydroelectric power and irrigation water. Wheat farmers benefited from river transportation, and settlers benefited from electricity. However, dams, especially those built without adequate fish ladders, together with overfishing and canneries, drastically reduced spawning and fish populations. The controversy surrounding the four lower Snake River dams reflects the difficulty of balancing agricultural, energy, navigation and ecological interests.

Figure 5. Colorado River as it flows through the Grand Canyon area. Photo credit: Jim Lang. Published with permission from the Managing Editor of the Open Journal of Soil Science.

Q: Your book shows that river management is not only a scientific or engineering problem, but also a political, legal, economic and social one. What does this reveal about the limits of expertise in managing large river systems?

A: The Columbia River illustrates the limits of expertise very clearly. Energy production from hydroelectric dams and nuclear power plants was central to the development of the Pacific Northwest. Dams on the Columbia and its tributaries generate about one-third of total U.S. hydropower. Fourteen hydroelectric dams are located on the Columbia main stem, including Grand Coulee Dam, with many more on tributaries.

However, large-scale development created unintended consequences. The Hanford site, established in 1943 as part of the Manhattan Project, produced plutonium for nuclear weapons and became one of the most contaminated nuclear sites in the United States. Reactors used Columbia River water for cooling, and radioactive releases into the river were kept secret until federal documents were declassified in the late 1980s. Hanford later became one of the world's largest environmental cleanup efforts.

Other pollutants in the river include bacteria, chemical pesticides, dioxins, arsenic and polychlorinated biphenyls. Cleanup efforts are underway at sites including Lake Roosevelt, Portland Harbor and Hanford. These examples show that river management cannot be reduced to engineering success. A project may generate electricity, support irrigation and enable navigation while also damaging fisheries, Indigenous fishing sites, water quality and long-term public health.

Q: Which future research directions emerge from this work?

A: The next step is to extend the research from the great rivers of North America to the great rivers of Central and South America. These systems raise related questions about sediment, irrigation, flooding, delta change, food security, biodiversity, climate stress and public health.

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

A: River and floodplain policy should be built around resilience. Future risks and catastrophes cannot be fully predicted, but river systems can be managed in ways that preserve adaptive capacity, protect soil and water resources, reduce exposure, and balance social, economic and ecological needs.

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

A: Change is the only certainty in river systems.

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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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