

Water Resources in the Anthropocene: Cause for War or Cooperation?

Dr. Waseem Ahmad Qureshi *

Abstract

With the collective effect of the ever-growing human population, deterioration of water quality, increased pollution, climate change, the changing water cycle, increased water scarcity, and intense competition for freshwater resources, it is predicted that wars in the future will be fought over freshwater instead of oil. A race to construct mega water-storage projects has already begun among co-riparian states, including between Pakistan and India and between India and China, to gain more control over their transboundary shared freshwater. Such contests are already giving birth to political turmoil and international disputes, which can evolve into wars among riparian states. The narrative that states will engage in future wars over freshwater is called the “water wars thesis.” However, a counternarrative has also been emerging that argues that, instead of water wars, empirical data suggests that water cooperation in the form of bilateral or multilateral agreements and treaties will prevail over resort to armed conflict. Likewise, water scarcity can be effectively managed by sustainably developing and preserving freshwater resources, by controlling the human population, and by increasing the trade of virtual waters. Therefore, this paper seeks to strike a balance in this battle of narratives by exploring the key arguments of both factions to answer whether there will be full-fledged water wars taking place in the future. If so, which factors will instigate them? If not, then what will prevent them? The paper will also discuss the role of water cooperation, which is essential for dissipating the possibility of future wars among states.

* Advocate Supreme Court of Pakistan

Introduction

Freshwater resources, in particular rivers, are the most valuable natural resources for human beings for fulfilling the basic necessities of life, such as drinking and other essential domestic requirements.¹ However, as the human population rises exponentially, the demand for water is also increasing.² Consequently, the per capita availability of freshwater is falling.³ It is estimated that, by 2050, population growth will be sole the cause of a 73% decrease in the per capita availability of freshwater since 1950.⁴ Therefore, many countries are facing issues in meeting the increasing demand for freshwater.⁵ Moreover, the growing scarcity of freshwater is also creating a worrisome situation for states about the present and future availability of freshwater, especially in their transboundary freshwater resources.⁶ This scenario can raise tensions among co-riparian states in the future over the apportionment of their transboundary freshwater resources if the scarcity of freshwater grows significantly.⁷ It is predicted that regions facing a combination of political instability and scarcity of freshwater may ultimately engage in armed conflict over a state's need to secure a larger share of their transboundary freshwater resources.⁸ The international media has named Middle Eastern countries as likely places for these potential armed conflicts, such as Israel versus Palestine and Jordan; Turkey versus Iraq

1. See Frederick Boltz et al., *Healthy Freshwater Ecosystems: An Imperative for Human Development and Resilience*, in 35 STOCKHOLM INT'L WATER INST., WATER FOR DEVELOPMENT: CHARTING A WATER WISE PATH 34 (Anders Jägerskog et al. eds., 2015).

2. See MARK W. ROSEGRANT ET AL., INT'L FOOD POLICY RESEARCH INST., WORLD WATER AND FOOD TO 2025: DEALING WITH SCARCITY 1–2 (2002).

³ LESTER R. BROWN ET AL., BEYOND MALTHUS: NINETEEN DIMENSIONS OF THE POPULATION CHALLENGE 37 (Linda Starke ed., 1999); see also Ashok Swain, *Water Wars: Fact or Fiction?* 33 FUTURES 769, 779 (2001).

4. BROWN ET AL., *supra* note 3, at 37; Swain, *supra* note 3, at 779.

5. See generally ROSEGRANT ET AL., *supra* note 2, at 3–12 (explaining different issues and challenges countries are facing due to freshwater scarcity).

6. Swain, *supra* note 3, at 769.

7. See BRAHMA CHELLANEY, WATER, PEACE, AND WAR 244 (2013); see also Swain, *supra* note 3, at 769.

8. Cf. Swain, *supra* note 3, at 770 (citing freshwater scarcity as a source of tension between co-riparian states that has the potential to culminate into armed conflict but has not yet been realized).

and Syria; and Egypt versus Ethiopia and Sudan.⁹

Population growth is seen as one of the main causes for concern regarding water scarcity and water conflicts.¹⁰ The use of water is increasing globally due to the surge in the population.¹¹ It is therefore projected that, because of population increase alone, catering to food needs will require the global use of water to increase by 650% within the 125 years from 1900 to 2025.¹² It is often said that water is the new oil, because the wars of the coming century will be fought for water.¹³ One view of the water wars has adopted a neo-Malthusian stance,¹⁴ which is a negative perspective of the future possibility of water and war. This view says that since water wars have happened in the past, the growing population and scarce water will inevitably result in water wars in the future.¹⁵ On the other hand, the opposing standpoint gives a more positive stance on the future prospects of the world, arguing that water cooperation through treaties will prevail over water wars.¹⁶

In order to strike a balance between these conflicting narratives, and to explore the possibility of future water wars, this paper is divided into three sections. After providing an introduction to the whole paper in Section 1, Section 2 will give an overview of the Anthropocene, or the effect of humans on the natural water cycle due to the ongoing management of freshwater resources. This section is divided into four subsections. Section 2.1 will list instances of water cooperation among states, and Section 2.2 will explore humanity's struggle to cater for the increasing demand for freshwater usage. Afterwards, Section 3 will discuss the water wars thesis and the political significance of freshwater as a natural resource in relation to water wars. The section will examine the most

9. *Id.*

10. CHELLANEY, *supra* note 7, at 29.

11. *Id.*

12. See CHELLANEY, *supra* note 7, at 34, for more details on this projection.

13. Jan Selby, *Oil and Water: The Contrasting Anatomies of Resource Conflicts*, 40 GOV'T & OPPOSITION 200, 201 (2005).

14. See BROWN ET AL., *supra* note 3, at 124–26.

15. Johan Jansson, *The Water Wars: A Summer Game or Serious Business? A Qualitative Content Analysis of the Narratives Behind the Debate* 28–31 (2018) (unpublished master thesis, Linnæus University) (on file with Digitala Vetenskapliga Arkivet).

16. Muhammad Mizanur Rahaman, *Water Wars in 21st Century: Speculation or Reality?* 4 INT'L J. SUSTAINABLE SOC'Y (SPECIAL ISSUE) 4–5 (2012); see also *id.* at 32–35 (synthesizing other scholarship supporting a cooperative perspective on the future of water scarcity).

fundamental arguments that contend that water is indispensable and equivalent to oil in hypothetical terms. Later, Section 4 will discuss the contrary view: that cooperation, rather than conflict, will become the norm.

I. The Anthropocene

The Anthropocene epoch, a relatively new term, is used to indicate the era in which humankind has become a major geological force that rivals that of nature.¹⁷ The Anthropocene is the contemporary geological era, in which scientists believe that we, humans (*Anthropos*), have greatly altered planet Earth's functioning.¹⁸ Such activities of the humans can be regarded as a catastrophic or contributing to the environmental crisis.¹⁹

A. *Dwindling Freshwater Resources*

Humanity is struggling over the quantity and the quality of freshwater resources, and the human population is growing rapidly.²⁰ History shows that humans have even abandoned whole cities when freshwater resources were not sustained.²¹ For instance, according to Brahma Chellaney, the city of Fatehpur Sikri in India, which at one time was described as more populous than London, was abandoned by its entire population due to scarce water resources.²² Similarly, by 2025, Sanaa, the capital city of Yemen, is predicted to have a similar fate and become a ghost town because its water resources are diminishing quickly.²³ Sanaa has a population of 2 million people and is pumping out its groundwater 400% faster than can naturally be replenished.²⁴ Sanaa is not alone in having meek prospects of survival due to the exhaustion of water resources. Abu Dhabi, the capital of the oil-rich United Arab Emirates ("U.A.E."), is also projected to "exhaust its groundwater reserves

17. JEREMY J. SCHMIDT, *WATER: ABUNDANCE, SCARCITY, AND SECURITY IN THE AGE OF HUMANITY* 3 (2017).

18. ERLE C. ELLIS, *ANTHROPOCENE: A VERY SHORT INTRODUCTION* 1 (2018).

19. See JEREMY DAVIES, *THE BIRTH OF THE ANTHROPOCENE* 2 (2016).

20. BROWN ET AL., *supra* note 3, at 37.

21. CHELLANEY, *supra* note 7, at 3.

22. *Id.*

23. *Id.*

24. *Id.*

by midcentury.”²⁵ Quetta, Pakistan, is predicted to meet a similar fate earlier than that, due to its dwindling groundwater levels, if water is not apportioned to it by other means.²⁶

Nevertheless, the availability of water for drinking purposes is not the main cause of concern; rather, it is the agricultural and industrial use of freshwater that is worrisome.²⁷ On the one hand, agricultural use employs 86.9% of freshwater worldwide; on the other hand, industrial use pollutes freshwater streams and rivers,²⁸ leaving water unsuitable for domestic use. Future prospects for the survival of many regions — for instance, cities like Benghazi, Misrata, Sirte, and Tripoli in Libya — are even grimmer as they are already surviving on fossil groundwater transported from the Sahara Desert.²⁹ Increasing water consumption is exhausting these resources, which had been accidentally found when searching for petroleum fossil fuels.³⁰

B. Meeting Water Demand

As the human population is increasing exponentially, the demand for water is also increasing, and the per capita availability of water is decreasing.³¹ It is estimated that between 1950 and 2050 per capita water availability will decrease by 73% as a result of population growth alone.³² This concern is making states place water security in their national security agendas. The supply of freshwater is nearly exhausted in the transboundary Nile, Yellow, and Colorado Rivers. In addition to surface waters, groundwater aquifers are also shrinking faster than they can be refilled by rainwater.³³ Moreover, in many regions, the freshwater left for drinking and domestic purposes is being polluted by hazardous chemicals discharged as industrial waste by factories without treatment.³⁴ Therefore, it is the need of the hour to take care of the available freshwater,

25. *Id.*

26. *Id.*

27. See Swain, *supra* note 3, at 771–72 (discussing usages of water and including data); see also CHELLANEY, *supra* note 7, at 7–9 (expounding the usage and scarcity of water).

28. Swain, *supra* note 3, at 771.

29. See CHELLANEY, *supra* note 7, at 3–6.

30. *Id.* at 4.

31. See BROWN ET AL., *supra* note 3, at 37.

32. See *id.*

33. Swain, *supra* note 3, at 780.

34. *Id.* at 771.

primarily by preventing pollution and by sustainably managing freshwater resources.

Population growth is also seen as one of the major causes of water scarcity. Global population reached its first billion in 1804, the second in 1927 (i.e., after 123 years), the third in 1960 (after 33 years), the fourth in 1974 (after only 14 years), the fifth in 1987 (after only 13 years), the seventh in 1999 (12 years) and the eighth in 2011 (12 years).³⁵ However, water resources are finite, so the ever-increasing population will only translate into decreasing the per capita availability of freshwater.³⁶

The use of freshwater for different purposes, such as irrigation for crop production, is increasing globally due to the surge in the population.³⁷ It is therefore projected that due to population increase alone, the global use of water will have increased by 650% in the 125 years from 1900 to 2025, increasing at the rate of approximately 4,000 billion cubic meters every year.³⁸

C. *Water Management Endeavors and Their Implications*

Humans have altered the natural world to a great extent. For example, 50 to 80% of freshwater in United Kingdom rivers is actually treated water from sewers and toilets.³⁹ On the other hand, up to 50% of the water flowing in the streams in Canada is millennia-old glacial water released by the shrinkage in the glaciers.⁴⁰ The fossil fuels burned in vehicles and factories by humans have increased the pace of glacial melting.⁴¹ Thus, humans are responsible for disturbing the natural hydrological cycle in the ecosystem in terms of affecting the natural flows of water in rivers and streams.⁴² For example, intensive agriculture activities by Soviet authorities is the main cause of

35. CHELLANEY, *supra* note 7, at 29.

36. *See id.* at 28–31 (detailing the scarcity of a critical resource necessary for an ever-burgeoning population).

37. *Id.* at 31.

38. *Id.* at 34.

39. SCHMIDT, *supra* note 17, at 2.

40. *Id.*

41. *See* G. TYLER MILLER, JR & SCOTT E. SPOOLMAN, *LIVING IN THE ENVIRONMENT: CONCEPTS, CONNECTIONS, AND SOLUTIONS* 501 (16th ed. 2008).

42. Velma I. Grover, *Introduction: Impact of Climate Change on Water and Health*, in *IMPACT OF CLIMATE CHANGE ON WATER AND HEALTH* 3, 5–6 (Velma I. Grover ed., 2013).

water shortages in the Aral Sea.⁴³ As a consequence of such human interventions, the hydrological system is also not stable.⁴⁴ Therefore, contrary to the popular human belief that science has enabled us to efficiently manage natural waters, hydrologists maintain that water is unmanageable.⁴⁵

To counter the harmful impacts of human-caused alterations in the natural global hydrological system, scientists suggest that humans should now work toward “safe operating spaces,” where mankind would live in the natural geochemical cycles using freshwater in accordance with the natural dynamics of the climate.⁴⁶ That is, humans must explore new ways to manage waters in such a way as not to harm the natural hydrological cycle, because, in the ongoing Anthropocene, the modern ways of managing waters are detrimental for our planet, and subsequently for our own survival.⁴⁷

According to a claim in 2015, the human impact on water has been underestimated by as much as 20 percent.⁴⁸ Many manmade problems of water management are connected to the economy, culture, geology and geography.⁴⁹ For instance, the human cultural evolution toward liberal lives has created paradoxical results while fighting for the humanitarian cause. In 2010, the United Nations declared water a basic human right, along with the right to sanitation.⁵⁰ The international community celebrated its success as a triumph over the privatization of water and the market-driven governance of water. This rejoice ended soon after, when then-Secretary-General Ban Ki-moon said that the human right to water was not contradictory to the privatization of water but in fact it was supposed to be sustained through market-driven practices.⁵¹ Later, experts found that this contradiction was mainly

43. Brian Clark Howard, *Aral Sea's Eastern Basin is dry for First time in 600 Years*, NATIONAL GEOGRAPHIC (Oct. 2, 2014), <https://www.nationalgeographic.com/science/article/141001-aral-sea-shrinking-drought-water-environment>.

44. *Id.* at 3.

45. *Id.*

46. *Id.*

47. *See id.* at 2–3.

48. *Id.* at 3.

49. *See id.*

50. Catarina de Albuquerque, *Water and Sanitation are Human Rights: Why Does It Matter?*, in INTERNATIONAL LAW AND FRESHWATER: THE MULTIPLE CHALLENGES 48, 56 (Laurence Boisson de Chazournes et al. eds., 2013).

51. *See* SCHMIDT, *supra* note 17, at 5.

propounded in considering access to water a human right, because all human rights such as property and public rights have a common heritage of being dependent on market transactions.⁵²

There have been a number of theories on the idea of water management and on controlling water for the political maintenance of power in a region. Thinkers of all sorts have connected water management with political, hegemonic, and social controls within the fabric of society; such works include *Water: The Epic Struggle for Wealth, Power, and Civilization* (2010), *Elixir: A History of Water and Humankind* (2011), and *The Big Thirst: The Secret Life and Turbulent Future of Water* (2011).⁵³ However, some of the key variables and factors in these works have been overlooked and missed, such as climate change, which is only used in modern rhetoric. Though water may have been mismanaged in the greed of humanity, it is pertinent to note that water as a necessity of life has also been used by humans to provide for life, for innovations, for technologies, and for political and economic growth. Consequently, while some of the misfortunes of water management can be put down to mankind's lust for power, some of its calamities were unintentional or unexpected.⁵⁴ Dr. Jeremy Schmidt, an expert on water governance, has rightly observed:

The outcomes of those accomplishments—mega-dams, irrigation systems, industrial processes, and municipal waterworks—are having unintended consequences. Mastery over nature is pushing rivers, lakes, and entire ecosystems off balance. Indeed, it has pushed hydrologic systems to the point where the very idea of “natural balance” is in question. Now we must rethink water management itself, particularly the idea that there will be grand solutions to the challenge of managing water.⁵⁵

The situation is also not so kind in the developed world. For instance, water scarcity is at a peak at Los Angeles, Las Vegas, and Phoenix in the United States,⁵⁶ and under stress in Alabama, Florida, and Georgia.⁵⁷ The seriousness of this issue

52. *Id.*

53. *Id.* at 23.

54. *Id.* at 23, 26.

55. *Id.* at 26.

56. See CHELLANEY, *supra* note 7, at 4.

57. *E.g.*, Florida v. Georgia, 138 S. Ct. 2502, 2508–10, 201 L. Ed. 2d 871 (2018) (describing a decades-long dispute of water use in the Apalachicola–

can be comprehended by the 2012 drought in the United States, which would have been unimaginable a few decades ago.⁵⁸ In Texas and California, water use exceeds the replenishment of groundwater, which means that humanity is using future resources to cater to its present needs.⁵⁹ The exploitation of the Great Lakes, which fulfill the needs of more than 40 million Americans and Canadians, is also a cause of concern in this age of water scarcity.⁶⁰ Similarly, arid regions in Spain are also facing water stress.⁶¹

D. The Issues in Regionally Available Quantity and Quality of Freshwater

The availability of freshwater in human settlements is, generally, not systematically planned in accordance with demand.⁶² The Global North has 80% of fresh runoff water sources but have only small settlements.⁶³ On the other hand, the majority of the world's urban settlements are in arid and semiarid regions, where population is exponentially increasing but the supply of water is scarce because 70–85% of rainwater evaporates due to high temperatures.⁶⁴ Moreover, in developing agrarian states (like India and Pakistan), more than 85% of water resources are used for agricultural purposes and only about 4% of freshwater is used for domestic purposes.⁶⁵ Another problem is the availability of unpolluted waters, because industry that uses freshwater, such as textile factories, return polluted waters back to rivers. Even the developed world, with industry, is fighting for the quality control of freshwater.⁶⁶ For instance, Hungary and Slovakia's struggle for control over the

Chattahoochee–Flint River Basin); *see also id.* at 4 (noting that Alabama and Florida dispute Atlanta's use of Lake Lanier).

58. CHELLANEY, *supra* note 7, at 4.

59. *Id.*

60. *Id.*

61. *Id.*

62. *See Swain, supra* note 3, at 771 (arguing that population growth occurs in tropical and arid regions irrespective of erratic water availability).

63. *Id.*

64. Water evaporates more quickly in arid areas. In Southern Africa, for example, 85% of average rainfall evaporates. Swain, *supra* note 3, at 771.

65. *Id.*; World Trade Organization, *Groups in the Negotiations*, http://www.wto.org/english/tratop_e/dda_e/negotiating_groups_e.htm#grp002b (listing India and Pakistan as members of the “Asian Developing Members” group in the World Trade Organization) (last visited Oct. 21, 2020).

66. *Id.* at 771–72.

Danube's river freshwater has been recently settled in the International Court of Justice ("ICJ").⁶⁷ There have been similar water conflicts over the control of water quality in the Columbia, Rhine, Colorado, and Paraná Rivers in the Americas and Europe.⁶⁸

On the other hand, in addition to the quality of waters, there have been several disputes over the quantity of shared waters. These disputes have mainly arisen over the sharing of waters in the transboundary rivers of the Zambezi, Mekong, Nile, Jordan, Euphrates, Ganges, and Indus, in Africa and Asia.⁶⁹ These disputes have gone to the thresholds of political dialogues, stressful diplomatic conditions, and settlements through international arbitration and ICJ cases.⁷⁰

Disputes related to the quantity and quality of scarce freshwater resources can ignite competition among co-riparian states for larger shares of international freshwater resources.⁷¹ For instance, a very short time after South Africa helped tribal leaders in its upper co-riparian Lesotho in a military coup and in gaining power,⁷² it was able to sign an agreement with Lesotho to jointly construct a very large water project on shared rich waters.⁷³ This led to an agreement for more flow of water to South Africa.⁷⁴ In landlocked Lesotho, which is surrounded by South Africa, water is a central political issue.⁷⁵ Yet, with political and financial influence, South Africa was able to pull out a great deal, being a lower, but more powerful, riparian state.⁷⁶ Similarly, China, as an influential state in Asia, is constructing large-scale water-storage projects to control the flows of river waters as an upper riparian state to Nepal, Vietnam, Burma, and India.⁷⁷ If, in the future, such competition

67. Gabcikovo-Nagymaros Project (Hung./Slovk.), 1997 I.C.J. 7, 82–85 (1997).

68. Swain, *supra* note 3, at 772.

69. *Id.*

70. *E.g.* Gabcikovo-Nagymaros Project (Hung./Slovk.), 1997 I.C.J. 7, 82–85 (1997) (ICJ settlement between Hungary and Slovakia's water dispute); *see generally id.* at 772–76 (detailing the political tensions behind water agreements reached after transnational disputes to shared waters).

71. *See id.* at 46–48.

72. *See id.* at 47.

73. *Id.* at 47.

74. *Id.*

75. *See id.*

76. *Id.* at 47.

77. *See id.* at 46–47.

to acquire more control over international freshwater becomes intense among riparian states, it is likely that armed conflicts and even water wars will emerge.⁷⁸

II. The Proponents of the Water Wars Thesis in Scholastic Circles

The neo-Malthusian narrative includes pragmatic arguments supporting the water wars thesis.⁷⁹ This section of the paper will include a discussion of these arguments to answer the question of whether waters are imminent.

A. *The Neo-Malthusian Stance*

One view of water wars adopts a neo-Malthusian stance,⁸⁰ which indicates the future possibility of water wars.⁸¹ This position says that the growing population and stress on the scarce water will inevitably result in water wars.⁸² Here, it refers to the Arab–Israeli⁸³ water disputes of the past.⁸⁴ According to this narrative, since water sharing is crucial and precedential in nature, full-fledged armed conflicts and the use of military forces are perfectly imaginable for the future.⁸⁵ If not, then water scarcity and the sharing of transboundary freshwater resources will certainly be the chief factor in consolidating the possibility of armed conflicts in the near future.⁸⁶ For instance, in 1991, one scholar saw water pollution and water paucity as irrefutable evidence for the possibility of future water wars.⁸⁷ Similarly, in 1993 Bulloch and Darwish wrote a book on water conflicts, and, based on the intelligence reports of the CIA, they compiled a list of 10 possible places where water wars can emerge in the future.⁸⁸ Another research

78. *Id.*

79. See CHELLANEY, *supra* note 7, at 6–8.

80. See BROWN ET AL., *supra* note 3.

81. See CHELLANEY, *supra* note 7, at 6–8.

82. See *id.*

83. Murad Shaheen, *Questioning the Water-War Phenomenon in the Jordan Basin* 7(3) MIDDLE EAST POLICY 137–150 (2000). [Hereinafter: Shaheen]

84. See CHELLANEY, *supra* note 7, at 48.

85. See CHELLANEY, *supra* note 7, at 6–8.

86. Joyce R. Starr, *Water Wars* 82 FOREIGN POLICY 17–36 (1991).

87. *Id.*

88. See CHELLANEY, *supra* note 7, at 307 & 341. See also Jansson, *supra*

paper from Thomas Homer-Dixon in 1994 took a similar position that within 50 years the natural global resources, including water and agrarian land, will become scarce due to overpopulation and will subsequently become a catalyst for armed conflicts.⁸⁹ In 1999, Homer-Dixon continued his research and found that developing states are at a higher risk of depleting their natural resources or making them scarcer. This, he believes, will inevitably lead to ethnic clashes and civil violence.⁹⁰

Moreover, Ulrich Küffner in 1998 gave a somewhat bleaker view for the prospects regarding water wars.⁹¹ He noted that water stress has the potential to produce armed conflicts, because it has been seen in the past that farmers even have taken lives for water, and politicians have threatened to go to war if the construction of water projects that can decrease water flows is started; he then questions whether the world should be concerned about such threats.⁹² A separate 2002 work from Vandana Shiva, on the other hand, established that water wars are not something for the future; instead, water wars or water conflicts already exist.⁹³ Since water is the most important resource for human survival, Shiva believes that water conflicts exist but are disguised as ethnic or religious conflicts.⁹⁴ Thomas and Laura Meek argued in 2009 that the increasing polarization among rich and poor countries will increase the chances of international conflicts over resources, including water as a natural resource.⁹⁵ In response, in 2009, Zbigniew Kundzewicz and Piotr Kowalczyk said that with the ever-growing global population, water demand will increase and per capita water

note 15, at 28–31.

89. Thomas F. Homer-Dixon, *Environmental Scarcities and Violent Conflict: Evidence from Cases* 19(1) INT'L SECURITY 5–40 (1994) [hereinafter Homer-Dixon]; see also Jansson, *supra* note 15, at 28–31.

90. THOMAS F. HOMER-DIXON, ENVIRONMENT, SCARCITY, AND VIOLENCE 177–78 (1999); see also Jansson, *supra* note 15, at 31–32.

91. Ulrich Küffner, *Contested Waters. Dividing or Sharing?*, in WATER IN THE MIDDLE EAST: POTENTIAL FOR CONFLICTS AND PROSPECTS FOR COOPERATION 71, 71–83 (Waltina Scheumann & Manuel Schiffler eds., 1998).

92. *Id.* at 72; see also Jansson, *supra* note 15, at 31.

93. VANDANA SHIVA, WATER WARS: PRIVATIZATION, POLLUTION AND PROFIT 53–56 (2002) [hereinafter Shiva].

94. *Id.*; see also Jansson, *supra* note 15, at 32.

95. Thomas H. Meek & Laura A. Meek, Correspondence, *Increasing Inequality Is Already Making Shortages Worse*, 459 NATURE 31 (2009); see also Jansson, *supra* note 15, at 32.

availability will decrease, and will give rise to water conflicts.⁹⁶

The work of Mark Zeitoun and Nato Mirumachi in 2008 gave us a different perspective. They believed that the hypothesis of water wars in the future is well established and supported by scholars, the media, and secretaries-general of the UN, even though the thesis has been discredited by numerous works.⁹⁷ They refer to this thesis as the “unfounded hyperbole.”⁹⁸ Their work is an effort to locate the possibility of the coexistence of water conflicts with water cooperation. This means that it is also possible that in the future there will be both water wars and water cooperation in parallel.⁹⁹ It is not necessary to stick to one side when speculating about the future, because historical instances, present practices, rising population, and decreasing supply of freshwater suggest that both conflicting narratives in the literature are likely possibilities.¹⁰⁰ Hence, it is possible that in our future there will be both water wars and water cooperation.¹⁰¹ Thus, the occurrence of water wars does not necessarily imply that there will be no international water cooperation treaties and no diplomatic dialogues to amicably resolve water disputes.

An example of a historical water war that is routinely cited in the literature on water wars is the Six-Day War.¹⁰² In 1967, Israel fought the war with Jordan, Syria, and Egypt, and successfully increased its control over the freshwater resources of these states by the use of force, though it was not the main cause of the war.¹⁰³ Scholars repeatedly use this incident of water war to justify the possibility of water wars in the future, especially as water is becoming more stressed and scarcer amid the ongoing exponential surge in population.¹⁰⁴ Therefore, it is argued that it is inevitable¹⁰⁵ that in the future wars will be

96. Zbigniew W. Kundzewicz & Piotr Kowalczak, Correspondence, *The Potential for Water Conflict Is on the Increase* 459 NATURE 31 (2009); see also Jansson, *supra* note 15, at 32.

97. Mark Zeitoun & Nato Mirumachi, *Transboundary Water Interaction I: Reconsidering Conflict and Cooperation* 8 INT'L. ENVTL. AGREEMENTS: POL., LAW AND ECON. 297–316 (2008) [hereinafter: Zeitoun & Mirumachi].

98. *Id.* at 298.

99. *Id.*

100. *Id.*

101. *Id.*; see also Jansson, *supra* note 15.

102. See CHELLANEY, *supra* note 7, at 48.

103. See *id.*

104. See *id.* at 7.

105. *Id.*

fought for water, as today's wars are fought for oil.¹⁰⁶

B. The Emerging Political Significance of Freshwater

It is often foretold by scholars that the wars of the coming century will be fought for transboundary freshwater resources instead of oil resources.¹⁰⁷ This is mainly based on the fact that the water resources are becoming scarcer while the human population keeps increasing. In recent times, the world has seen a number of disputes over the sharing of international rivers; however, none became a war and all were amicably resolved with cooperation.¹⁰⁸

1. Water as a Resource

The international market is positioning water as a commodity asset for future trading, and envisioning it as the blue gold of tomorrow.¹⁰⁹ Given the rise in water demands for drinking and food-producing purposes and the rise in population and pollution of water, markets and investors have started to heavily invest in water resources.¹¹⁰ Therefore, one scholar has predicted that the water-rich West, Canada, the Nordic countries, and Russia are likely to rule this potential emerging market in the future by trading water with the East.¹¹¹ The Golan Heights, the Euphrates-Tigris river basin, Central Asia's Fergana Valley and Kashmir are all flashpoints of water-rich regions, infested with conflicts and non-state actors fighting for water resources.¹¹² Today, even without the use of traditional weapons, countries are waging silent wars against each other by constructing hydro projects on water sources, or by supporting non-state proxies in targeted states. Co-riparian states are already pursuing this direction by racing to build larger dams, barrages, and other water works on shared waters.¹¹³

106. Hongzhou Zhang, *Sino-Indian Water Disputes: The Coming Water Wars?* 3 WIRES WATER 155–66 (2016) [hereinafter: Zhang].

107. See Swain, *supra* note **Error! Bookmark not defined.**

108. See *id.*

109. See CHELLANEY, *supra* note 7, at 1.

110. See *id.*

111. *Id.*

112. *Id.* at 2.

113. *Id.* at 2–3.

2. Water as the New Oil

If water is the new oil, future wars of the coming century could be fought for water.¹¹⁴ The bottled water industry has exacerbated water stress, and increased the price of water, which once used to be free and highly subsidized by governments. It is predicted that countries that share transboundary rivers will be fought over this natural resource, just as they did for oil.¹¹⁵ A renowned geostrategist, Brahma Chellaney, believes that, unlike oil wars, water wars can be fought without having to fire a single bullet or single missile.¹¹⁶ He calls them silent wars, which can be fought against competing states by constructing huge water projects.¹¹⁷

Nevertheless, experts have noticed that the energy market, which relies heavily on oil, is now shifting toward newer and cleaner alternatives, which have consequently decreased oil use.¹¹⁸ For instance, even the automobile industry is trending toward hybrid and electric cars, which do not rely or rely very little on fossil fuels.¹¹⁹ Though oil is replaceable with other technologies, such as electric energy,¹²⁰ freshwater is generally considered to be irreplaceable. Considering this, the late former secretary-general of the UN Kofi Annan also warned, “[i]f we are not careful, future wars are going to be about water and not about oil.”¹²¹ This gives us a pessimistic view about our future, which may involve water wars, as several scholars have supported this view by arguing that water wars are inevitable.¹²²

III. The Antithesis to Water Wars Thesis

Is there any way to avoid future water wars? Kofi Annan’s comments highlight a condition: that states must be careful. If

114. *See id.* at 4.

115. *See Swain, supra* note 3, at 769–70.

116. CHELLANEY, *supra* note 7, at 6.

117. *Id.*

118. *See id.* at 5–6.

119. Leon Kaye, *Why Automakers Are the New Renewable Energy Investors*, THE GUARDIAN (Oct. 6, 2011), <https://www.theguardian.com/sustainable-business/automakers-new-renewable-energy-investors-sustainable-cars>.

120. *Id.*

121. *See CHELLANEY, supra* note 7, at 7.

122. *See id.* at 6–8.

humanity is careful, we can avoid future water wars.¹²³ Water wars can be effectively avoided by efficiently managing our water resources, and also by establishing cooperation among copriarian states. The opposite view of water wars gives more of a positive view of this world, arguing that cooperation will prevail over the possibility of water wars in the future,¹²⁴ because going to war over water is unrealistic when compared to the possibility of achieving international agreements for water cooperation, which is more precedential.¹²⁵

A. *The Opinions of Scholars Opposing the Water Wars Thesis*

Relying on the history of water cooperation, Mostafa Dolatyar and Tim Gray said in 2000 that:

The evidence does not support the view that water scarcity has caused wars in the Middle-East. Water scarcity may have been used as a pretext for wars on combatant sides (past of the political rhetoric); water installation may have been targeted by warring armies; water conflict may even have served as an occasion or flashpoint for war – but in none of these instances has water scarcity been the (fundamental) cause of war.¹²⁶

Dolatyar and Gray give us a more balanced view of the water war thesis. They establish that water may have been involved in past armed conflicts in the Middle East as a small factor among Israel and Arab countries, but it was not the fundamental cause for the instigation of war, or for the main contention for fighting.¹²⁷ Moreover, the present times and the history of warfare between Israel and Arab states suggest that the fundamental factors in these animosities involve religious, ethnic, and political reasons, and water is only a

123. *See id.* at 6–8.

124. *See* Rahaman, *supra* note 16; Jansson, *supra* note 15, at 32–33.

125. Petersen-Perlman, Jennifer C. Veilleux & Aaron T. Wolf, *International Water Conflict and Cooperation: Challenges and Opportunities*, 42 WATER INT'L 105, 107 (2017).

126. Mostafa Dolatyar & Tim S. Gray, *The Politics of Water Scarcity in the Middle East*, 9 ENVTL. POL. 65, 66 (2000).

127. *Id.*

nonfundamental aspect within these factors.¹²⁸

Furthermore, Shaheen examines the Arab–Israel water conflict of 1967 to see whether a future conflict is probable upon historical and past experience.¹²⁹ This perspective questions whether it is inevitable that, if one thing has happened in the past, it will necessarily repeat again. Shaheen¹³⁰—like Dolatyar and Gray¹³¹—tries to question whether in this conflict water was the main point of contention and not religion or ethnic differences. For example, even today there are armed conflicts between Israel and Arab countries. There is also conflict between Israel and Palestine on the basis of water supplies, though this is just one factor.¹³² For instance, Palestinian land is also a cause of conflict between Israel and Arab states: as reported by the United Nations Security Council, religious animosity and conflict regarding access to holy sites in Israel also is a significant issue.¹³³ Hence, we can argue that the chief and fundamental reason for these fights between Israel and Arab states is not water but religion or ethnic differences, even if water plays a role. On the other hand, if, for the sake of argument, the main cause of such conflicts were water, then is it definitive that history would repeat itself? Are we certain that, because Israel and Arab states fought for water once, the whole world will fight for water again? Is this narrative or thesis—which could be wrong—not speculative? Therefore, Shaheen concludes, “most of the evidence gathered to construct the water-war thesis is either speculative, based on intelligent calculations (hence the forecast of doomsday) or obsolete.”¹³⁴ Shaheen’s narrative contradicts the water wars thesis, that future wars will be fought for water. So, it is interesting to note that a single event like the 1967 Arab–Israeli conflict can be viewed through

128. *Id.*; Jansson, *supra* note 15, at 33.

129. Shaheen, *supra* note 83, at 137–50.

130. *Id.*

131. See Dolatyar & Gray, *supra* note 126.

132. See generally Shaheen, *supra* note 83, at 140–42 (discussing why water is not the fundamental factor to the 1967 war, which involves Palestine).

133. See Press Release, Security Council, Rising Tensions amid Crisis in Jerusalem Threaten Israel, Palestine with “Vortex of Violence,” Religious Conflict, Special Coordinator Warns Security Council, U.N. Press Release SC/12927 (July 25, 2017).

134. Shaheen, *supra* note 83, at 137–150.

two different lenses and can give different conclusions.^{135 136}

Like Shaheen,¹³⁷ Sandra Postel and Aaron Wolf¹³⁸ also support the second position, that water wars in the future are unlikely, and they deconstruct the water wars narrative.¹³⁹ They ask about the last time nations went on to war against each other over accessing freshwater resources and then answer it: “[r]emember the last time two nations went to war over water? Probably not, since it was 4,500 years ago.”¹⁴⁰ This shows the history of water wars, proving how unlikely full-fledged wars on water are.¹⁴¹ They argue that, in a 50-year period, more than 1,000 water conflicts were peacefully resolved by international water cooperation and treaty-making.¹⁴² Therefore, instead of resorting to armed conflict, it is more probable that water conflicts will be resolved by dialogues, meetings, and agreements. However, they admit that there is a high risk of conflicts in this sector, given the nature of growing populations and decreasing supplies.¹⁴³ Therefore, water disputes should be handled in an effective and timely manner.¹⁴⁴

Like Shaheen¹⁴⁵ and Postel and Wolf,¹⁴⁶ Undala Alam also attempts to deconstruct the water wars thesis, by arguing that, if it were a reality, a water war would already have broken out between India and Pakistan. It has not, however,¹⁴⁷ because all

135. See Dolatyar & Gray, *supra* note 126. See also Shaheen, *supra* note 83, at 137–150. See also Jansson, *supra* note 15.

136. See Jansson, *supra* note 15.

137. See generally Shaheen, *supra* note 83, at 137–150.

138. Sandra L. Postel & Aaron T. Wolf, *Dehydrating Conflict*, FOREIGN POL’Y (Nov. 18, 2009, 4:42 PM), <https://foreignpolicy.com/2009/11/18/dehydrating-conflict>.

139. See Jansson, *supra* note 15.

140. Postel & Wolf, *supra* note 138; see also Shira B. Yoffe & Aaron T. Wolf, *Water, Conflict and Cooperation: Geographical Perspectives*, 12 CAMBRIDGE REV. INT’L AFF’S 197 (1999); AARON T. WOLF, “WATER WARS” AND WATER REALITY: CONFLICT AND COOPERATION ALONG INTERNATIONAL WATERWAYS 251 (S.C. Lonergan ed., Kluwer Academic Publishers 1999).

141. See Postel & Wolf, *supra* note 138; see also Yoffe & Wolf, *supra* note 140; Wolf, *supra* note 140.

142. See Postel & Wolf, *supra* note 138; see also Yoffe & Wolf, *supra* note 140; Wolf, *supra* note 140.

143. See Postel & Wolf, *supra* note 138; see also Yoffe & Wolf, *supra* note 140; Wolf, *supra* note 140.

144. See Jansson, *supra* note 15.

145. See Shaheen, *supra* note 83, at 137–150.

146. See Jansson, *supra* note 15.

147. Undala Z. Alam, *Questioning the Water Wars Rationale: A Case Study of the Indus Waters Treaty*, 168 THE GEOGRAPHICAL J. 341, 341 (2002).

the preconditions for water wars have ended.¹⁴⁸ These countries have decades of history of armed conflicts, but have also not disputed numerous water projects by force, despite decreased water flow and increased water demands. Moreover, water cooperation and a water treaty between them have prevailed over resorting to armed conflict over distributing and using the water resources of the transboundary Indus Basin.¹⁴⁹ This, according to Alam, is the proof enough to dissipate the argument of the proponents of water wars.^{150 151}

Moreover, Giordano, Wolf, and Yoffe also conducted research in 2003 to identify indicators of the possibility of water wars in the future.¹⁵² They mentioned that water cooperation among conflicting actors and co-riparian states overwhelmingly outnumbered armed conflicts over water disputes in history.¹⁵³ So they disparaged the literature that supports the water wars thesis.¹⁵⁴ They concluded, “[e]xisting work often consists of case studies from the most volatile basins and excludes examination of cooperation.”¹⁵⁵ This means that proponents of water wars conveniently exclude history and examples of water cooperation, which have easily outnumbered armed conflicts.¹⁵⁶

Essentially, the conflicting narratives regarding the possibility of water wars have been going on for more than three decades now. The first position, which foretells water wars, has extensively relied on past instances. It has been backed by leading academics, the media, international organizations, prominent people, and policymakers alike. The second position, which counters and negates the first, relies on empirical data. However, it is pertinent to note that the nexus between scarce resources, growing population, and water conflicts has gained support in the international academic community.¹⁵⁷ Closas’

148. *Id.*

149. *Id.*

150. *Id.*

151. *See* Jansson, *supra* note 15.

152. *See* Shira Yoffe, Aaron T. Wolf, & Mark Giordano, *Conflict and Cooperation over International Freshwater Resources: Indicators of Basins at Risk*, 39 J. AM. WATER RES. ASS’N 1109 (2003); *see also* Yoffe & Wolf, *supra* note 138; Wolf, *supra* note 140, at 251–65.

153. *See* Yoffe et al., *supra* note 152.

154. *Id.* at 1124.

155. *Id.* at 1109.

156. *See id.* at 111-124; *see also*, Jansson, *supra* note 15.

157. *See* Homer-Dixon, *supra* note 89, at 5–40; *see also*, Jansson, *supra* note 15, at 28–3; HOMER-DIXON, *supra* note 90; Peter H. Gleick, Stephan

research of 2018 suggests that the debate between these narratives is still going on, so it is likely that this debate will soon be in the limelight again.¹⁵⁸ However, as of now, the ground realities that were present in the 1990s have drastically changed with regard to the availability of natural resources, climate, pollution of freshwater, and increased demand for water due to population growth.¹⁵⁹ Unfortunately, all these added characteristics make the debate around the water wars thesis more complex, more uncertain, and more polarized.¹⁶⁰

B. Water Cooperation

According to the World Bank, more than 245 international rivers have two or more co-riparian states.¹⁶¹ Many of them have agreements with other countries. The external nature of water supply, with or without agreements, makes it stressful for states to assure the availability of water supply to safeguard their national security and national interest.¹⁶² For instance, 97% of Egypt's freshwater supplies originate from outside of Egypt, in the transboundary Nile.¹⁶³ The situation is similar in Hungary, Mauritania, Botswana, Uzbekistan, Syria, Sudan, and the Gambia.¹⁶⁴ Though possible water wars have been predicted for more than two decades now, by comparison to oil wars,¹⁶⁵ no war over water has come to fruition yet. Therefore, Gleditsch and Tøset are of the view that, while water wars may be a possibility in the future, they are not inevitable.¹⁶⁶ By contrast, co-riparian

Lewandowsky, & Colin Kelley, Correspondence, *Climate and Conflict: Don't Oversimplify*, 555 NATURE 587 (2018); Jan Lundqvist & Peter Gleick, COMPREHENSIVE ASSESSMENT OF THE FRESHWATER RESOURCES OF THE WORLD: SUSTAINING OUR WATERS INTO THE 21ST CENTURY, STOCKHOLM ENVIRONMENT INSTITUTE (1997).

158. Ana Elisa Cascão et al., *Why Are Water Wars Back on the Agenda? And Why We Think It's a Bad Idea!* THE NORDIC AFRICAN INSTITUTE, (Mar. 22, 2018), <https://nai.uu.se/news-and-events/news/2018-03-22-why-are-water-wars-back-on-the-agenda-and-why-we-think-its-a-bad-idea.html> [hereinafter: Cascão et al.].

159. *Id.*

160. See Jansson, *supra* note 15.

161. See Swain, *supra* note **Error! Bookmark not defined.**, at 769.

162. *Id.*

163. *Id.* at 770.

164. *Id.*

165. *Id.*

166. Hans P. W. Tøset & Nils P. Gleditsch, Shared Rivers and Interstate Conflict, 19(8) POLITICAL GEOGRAPHY 971–996 (2000) [hereinafter Tøset et al.].

states are moving toward cooperation in sharing international waters, rather than going toward water wars.¹⁶⁷ Moreover, Yoffe and Wolf have noted that, as evidence of cooperation, more than 145 water cooperation treaties have been made in the twenty-first century.¹⁶⁸

In the past, water cooperation has also brought countries closer together.¹⁶⁹ For instance, the treaties signed between countries in Europe to share the waters of the Danube and Rhine laid the foundations of the European Union.¹⁷⁰ A need to control and manage water resources has, therefore, proven to be beneficial in bringing communities and diverse cultures together for cooperation, benefitting all equally.¹⁷¹

However, compared to the developed countries, developing countries are signing fewer water cooperation treaties.¹⁷² Of 300 international water cooperation treaties, more than 66 percent have been signed in Europe and North America.¹⁷³ For instance, in Europe, four main transboundary rivers are shared by four or more countries.¹⁷⁴ These four rivers account for 175 water cooperation and water management treaties.¹⁷⁵ By contrast, in Africa there are 12 transboundary rivers shared by four or more countries, and these 12 international rivers have only 34 signed treaties.¹⁷⁶ Similarly, Asia and the Middle East have five transboundary rivers with four or more co-riparian states, and these rivers have 31 treaties.¹⁷⁷ UN research has listed 48 joint commissions for water cooperation in Europe, 23 in America, 10 in Africa, and only 9 in Asia.¹⁷⁸ So, arguably, Europe is leading

167. See Swain, *supra* note **Error! Bookmark not defined.**, at 770.

168. See Yoffe & Wolf, *supra* note 140.

169. Asit K. Biswas, *Management of International Waters: Opportunities and Constraints* 15(4) WATER RESOURCES DEVELOPMENT 429–441 (1999) [hereinafter: Biswas]; See also Swain, *supra* note 3, at 770.

170. See Biswas, *supra* note 169, at 429–441. See also Swain, *supra* note 3, at 770.

171. See Biswas, *supra* note 169, at 429–441. See also Swain, *supra* note 3, at 770.

172. Peter Rogers, The Value of Cooperation in Resolving International River Basin Disputes 17(2) NATURAL RESOURCES FORUM 117–131 (1993).

173. *Id.* at 117–131.

174. See Swain, *supra* note 3, at 770–771.

175. See Swain, *supra* note 3, at 770–771.

176. See Swain, *supra* note 3, at 770–771.

177. Swain, *supra* note 3, at 770–771.

178. Swain, *supra* note 3, at 770–771.

this world in water cooperation,¹⁷⁹ and Asia is lagging behind.¹⁸⁰

1. An Example of the Emerging Threat of Future Water War between India and China

With the increasing rhetoric supporting the water wars thesis, it is argued that water wars will break out between India and China over the possible diversion of the Brahmaputra River. Since China is constructing large-scale water management and water storage on this river, which is a strong focus of international and Indian media attention.¹⁸¹ Moreover, numerous research papers, including strategic reports and scholars, are of the view that water wars between India and China are a zero-sum game.¹⁸² While India accuses China of planning to divert the Brahmaputra waters, China has officially assured India on many occasions that it has no such plans.¹⁸³ Would such a situation necessarily imply that a water war will break out between the two countries? Zhang, however, supports the opposite view.¹⁸⁴ He contends that the arguments and possibilities that support this narrative are overstated.¹⁸⁵ Further, for the sake of argument, if China were to divert all water from the Brahmaputra River (which China does not plan to), even then there will be little to no effect in the lower co-riparian states.¹⁸⁶ Contrary to popular claims of aggressive hegemony, Zhang argues that China is considering cooperation with its co-riparian states.¹⁸⁷

C. Sustainable Water Management

Proper regulation and management of supply and demand of water can resolve the issues of water scarcity and stress on states.¹⁸⁸ There is a need for effectively and efficiently managing

179. Swain, *supra* note 3, at 770–771.

180. Swain, *supra* note 3, at 770–771.

181. See Zhang, *supra* note 106.

182. Zhang, *supra* note 106.

183. Zhang, *supra* note 106.

184. Zhang, *supra* note 106.

185. Zhang, *supra* note 106.

186. Zhang, *supra* note 106, at 160–164 (stating that only a “fraction of the water in the Brahmaputra River” is being used).

187. Zhang, *supra* note 106, at 162.

188. Swain, *supra* note **Error! Bookmark not defined.**, at 778.

freshwater resources.¹⁸⁹ Therefore, the notion that water is free should be dispelled from the international narrative.¹⁹⁰ Instead, homes should include water meters to regulate the resource's use on a per-household basis, even for groundwater and consumer use. This would monitor and restrict the waste of water resources. It will also force consumers and households to use water efficiently, and it will create a sense of value for water as a resource.¹⁹¹ Introducing prices and quotas in water supplies will both increase the value of water as a resource and force consumers to use water efficiently.¹⁹²

It has been observed that the costs of water management projects, such as for building dams, barrages, and canals, are very high and the developing world cannot sustainably afford them.¹⁹³ For instance, Pakistan is facing problems financing the costs of its planned construction of dams to be able to manage Indus River waters.¹⁹⁴ Pakistan has even tried crowdfunding, forced public funding,¹⁹⁵ and appealing to the IMF for loans.¹⁹⁶ However, it has been unable to gather sufficient resources to finance its water storage projects. In addition to the high costs of constructing such projects, the cost of managing and maintaining them is also high.¹⁹⁷ Despite these burdens, developing states like Pakistan and India keep municipal water prices at a bare minimum and subsidized for their poor population, which makes it nearly impossible for the governments to sustain water management and large water-storage projects for their people.¹⁹⁸ The insufficiency of water supplies and the poor management of water distribution by the state can be illustrated by the fact that the Indian government spent more money on collecting water tax than the tax itself.¹⁹⁹

189. See Swain, *supra* note 3, at 778.

190. See Swain, *supra* note 3, at 778.

191. Swain, *supra* note 3, at 778.

192. Swain, *supra* note 3, at 778.

193. See Swain, *supra* note 3, at 778.

194. Asad Hashim, *In Pakistan, Government Attempts to Crowdfund \$12bn for Dams*, AL JAZEERA (Sept. 19, 2018), <https://www.aljazeera.com/indepth/features/pakistan-government-attempts-crowdfund-12bn-dams-180919120616015.html>.

195. *Id.*

196. Meher Ahmed, *Pakistan Tries a New Way to Pay for a Dam: Crowdsourcing* (NEW YORK, N.Y. TIMES (Oct. 25, 2018), <https://www.nytimes.com/2018/10/25/world/asia/pakistan-dam-fund.html>).

197. See Swain, *supra* note **Error! Bookmark not defined.**, at 778.

198. See Swain, *supra* note **Error! Bookmark not defined.**, at 778.

199. Swain, *supra* note **Error! Bookmark not defined.**, at 778.

This means that the costs of water-tax collection are higher than the amount of water-tax revenues.²⁰⁰ If this is the situation in developing countries, then how can water supply and demand ever be made sustainable?²⁰¹ It is only reasonable that water projects and water management costs are reflected in water usage prices. For this reason, water consumption — whether for industrial, agrarian, or household use, of river waters, canal waters, or ground or aquifer water — should be metered and licensed, just as electricity is. Only then will it be possible to efficiently sustain water management, which will also assure the water availability for future generations.²⁰² Holistic institutional change is required for policymaking, water-tax collection, planning and coordinating water pricing, water supplies, and water demands.²⁰³

However, there is a catch: Taxing water and setting quota limits per household or land for agricultural or domestic use could cut voter bases for policymakers. Farmers in the global south and poor people will be affected by the higher set costs of water, and the political party that chooses to levy such taxes will lose out.²⁰⁴ Therefore, the depoliticization of water issues and water availability should be the main focus of these reforms.²⁰⁵ The greater public should be made aware of the pressing concern of water scarcity and the need to use water efficiently because, of all the natural resources that are most crucial for human survival, water is the most taken for granted.²⁰⁶

In agrarian economies, though water is considered scarce or stressed, it is not, because most of the water is not used for domestic but for agricultural purposes.²⁰⁷ As discussed above, more than 80% of total water supplies are used for agricultural purposes, and less than 5% of all water is used for industrial purposes.²⁰⁸ Why, then, is water scarce or stressed in such

200. Swain, *supra* note **Error! Bookmark not defined.**, at 778.

201. See Swain, *supra* note **Error! Bookmark not defined.**, at 778–779.

202. See Swain, *supra* note **Error! Bookmark not defined.**, at 779–780.

203. See generally Ashok Swain, *Constructing Water Institutions: Appropriate Management of International River Water*, 12 CAMBRIDGE REV. OF INT'L AFF. 214 (1999) (advocating for a comprehensive framework for water resource management).

204. See Swain, *supra* note **Error! Bookmark not defined.**, at 778–779.

205. See Swain, *supra* note **Error! Bookmark not defined.**, at 778–779.

206. See Swain, *supra* note **Error! Bookmark not defined.**, at 778–779.

207. See Swain, *supra* note **Error! Bookmark not defined.**, at 771–772; See also CHELLANEY, *supra* note 7, at 7–9.

208. See Swain, *supra* note **Error! Bookmark not defined.**, at 771–772;

states? Water is stressed in agrarian developing countries like Pakistan because so much of the water is exported to other countries in the form of virtual water.²⁰⁹ Virtual water is the term used to describe products that need a lot of water to be created, such as meat and rice.²¹⁰ One kilogram of grain needs 1,000 liters (1 tonne) of water for its production, in the form of virtual water.²¹¹ Similarly, one kilogram of beef production requires 15,500 liters (15.5 metric tonnes) of water.²¹² So, if a state like Pakistan exports approximately 4.1 million metric tonnes of rice per year to other states,²¹³ this means that Pakistan exports much of its virtual water to other states in form of rice. Rice production globally depletes 17% of all groundwater and 40% of all irrigation water.²¹⁴

Virtual water exports of other grains, meat, cotton, and fruit also represent a significant drain on water resources.²¹⁵ The water scarcity of developing agrarian economies can be easily resolved by effectively managing waters and by devising new technologies for watering vegetation.²¹⁶ Installing new technology is expensive, but taxing water and setting water supply limitations can overcome such difficulties.²¹⁷ By contrast, developed dry regions should not use their waters to produce products that require high quantities of virtual water. For instance, Saudi Arabia uses its scant waters for the production of rice fields in deserts.²¹⁸ Israel uses its scarce water to grow oranges for export.²¹⁹ Instead, Saudi Arabia and Israel should use manage their water for domestic and consumption usages, and import virtual water from agricultural-based economies like India and Pakistan. It is understandable that, even in water

See also CHELLANEY, *supra* note 7, at 7–9.

209. See M. Arshed Rafiq, *Virtual Water Export Virtually Dries Pakistan*, DAILY TIMES (May 15, 2019), <https://dailytimes.com.pk/394828/virtual-water-export-virtually-dries-pakistan>.

210. Swain, *supra* note 3, at 779; See Andrew Biro, *Water Wars by Other Means: Virtual Water and Global Economic Restructuring*, 12 GLOBAL ENVTL. POL. 86, 86 (2012) [hereinafter Biro].

211. *Id.* at 88.

212. See *id.* at 97.

213. *Rice Exports Reach \$2.07bn Mark in FY19*, BUS. RECORDER (July 12, 2019), <https://fp.brecorder.com/2019/07/20190712496540>.

214. Rafiq, *supra* note 209.

215. See CHELLANEY, *supra* note 7, at 7, 114.

216. See CHELLANEY, *supra* note 7, at 174, 243, 280.

217. See Swain, *supra* note **Error! Bookmark not defined.**, at 778.

218. Swain, *supra* note **Error! Bookmark not defined.**, at 779.

219. Swain, *supra* note **Error! Bookmark not defined.**, at 779.

scarcity, states want to become food-sufficient and self-sustaining to provide for their own needs. A national agenda to remain self-sustainable with regard to national security is reasonable, and nothing is wrong with such a rationale. But the greater goal of the international community should not be to provide for individual needs without giving respect to the availability of freshwater resources; rather, it should be to provide for the global need and demand for food,²²⁰ and to prioritize domestic and future use of water. The very idea of international trade is to cater to each other's needs with specialized productions. Together, countries can foster the international food trade by focusing agrarian-based economies toward technological advancement to efficiently produce food. However, this is an ideal solution, and it would require immense global cooperation, which is not easy to attain. Andrew Biro agrees that the trade of virtual water may be a reason why water wars are not yet a reality.²²¹ He believes that trade in virtual water can alleviate water tensions more effectively than armed conflicts.²²² It is more sustainable and intelligent to import water-intensive products from far away than to invest scarce and expensive water resources in water-stressed countries.²²³

The production of food is made difficult by stress on water supply. This paper foretells that the focus of technological advancement will be on the efficient production of vegetables and fruit, which require less water than conventional methods.²²⁴ And if the technology for using scarce water will become expensive, and the production of food more difficult, it is inevitable that naturally grown fruits and vegetables in demand will become highly expensive.²²⁵ Therefore, it is in the utmost interest of the agrarian economy states not to waste water and rather utilize in an efficient way. If water is wasted by spilling it back to the sea, when more than 80% of water is used for agricultural purposes as virtual water,²²⁶ and if freshwater is

220. See Lundqvist & Gleick, *supra* note 157, at 207.

221. Biro, *supra* note 210, at 86, 88.

222. Biro, *supra* note 210, at 86.

223. Biro, *supra* note 210, at 86.

224. See David Zilberman et al., *Rising Energy Prices and the Economics of Water in Agriculture*, 10 WATER POL'Y 11, 19 (2008).

225. See Fred Pearce, *Water Scarcity: The Real Food Crisis*, YALE ENV'T 360 (June 2, 2008), https://e360.yale.edu/features/water_scarcity_the_real_food_crisis.

226. See Swain, *supra* note **Error! Bookmark not defined.**, at 771–772. See also CHELLANEY, *supra* note 7, at 7–9.

polluted by industrial use and the use of water streams as sewers, there is no freshwater left for domestic use or for drinking purposes.

D. *The Idea of Water Trade*

It is feared that, if we exhaust all our freshwater resources, there is no way humanity can survive.²²⁷ Therefore, as indicated by some experts, it is likely that the scarcity of freshwater resources will result in water wars.²²⁸ However, while Chellaney highlights the importance of the water trade, he maintains that, unlike other goods such as technology, it is very expensive to transport water.²²⁹ One country cannot transport its rich water resources to the other country, particularly if the latter is on a different continent.²³⁰ At first it seems that it is a logical argument, that indeed allocating water from rivers to one's own cities, especially in mountainous regions, is very expensive and cannot be afforded by the developing world. How can one country transport its river water to distant countries in other parts of the world on different continents? It would be very expensive, and almost impossible, to transport billions of liters of water from a water-rich country to a water-scarce country — such as the UAE — to water its fields. However, it is possible that water can be allocated for basic human needs instead of transferring it for irrigating fields. That is, for instance, the production of one kilogram of grain needs thousands of liters of water.²³¹ One kilogram of meat needs 15.5 metric tonnes (15,000 liters) of water.²³² Since transporting grains and meat is not expensive, water-scarce countries can easily import all their food needs from water-rich countries.²³³ Thus, rich, water-scarce countries can import grains and meat instead of importing water. As grains during the growing process have absorbed water, this trade of grains is also referred to as the trade of virtual waters in the form of grains and meat.²³⁴

As noted by experts, water needs for domestic purposes are

227. CHELLANEY, *supra* note 7, at 6.

228. See CHELLANEY, *supra* note 7, at 7.

229. See CHELLANEY, *supra* note 7, at 7.

230. See CHELLANEY, *supra* note 7, at 7.

231. Biro, *supra* note 210, at 88.

232. Biro, *supra* note 210, at 97.

233. See Swain, *supra* note **Error! Bookmark not defined.**, at 779.

234. See Swain, *supra* note **Error! Bookmark not defined.**, at 779.

very little, compared to the 80% of water allocated to agricultural purposes.²³⁵ For example, in the United States, 96% of freshwater use is indirect.²³⁶ Knowingly or unknowingly, agrarian countries such as India and Pakistan have been providing services of virtual water by exporting all their agricultural water in form of virtual waters to other countries, fulfilling the needs of a number of countries around the globe.²³⁷ Therefore, to resolve future water conflicts, resolve water scarcity, and efficiently manage the waters of the world, it is suggested here that the international community help agrarian countries like India and Pakistan in order to continue to aid in providing services of virtual waters.

E. Technology

It is possible in the future that efficient and inexpensive sustainable methods for converting seawater into freshwater could be introduced due to scientific innovations. For instance, Israel already has several water filtration plants that can turn salty seawater into freshwater.²³⁸ Recently, clean and solar-powered filtration projects have been installed in Africa, which have the ability to turn seawater into drinkable water.²³⁹ Likewise, at present, we have technology that can plant seed clouds to make artificial rain to help reduce a country's diminishing water supplies.²⁴⁰ This technique has been used in the deserts of the UAE for more than a decade now, but it is very expensive and not cost-effective.²⁴¹ Indeed, the technology to transform seawater into freshwater or the technology to seed

235. See Swain, *supra* note **Error! Bookmark not defined.**, at 771; CHELLANEY, *supra* note 7, at 7–9.

236. CHELLANEY, *supra* note 7, at 7.

237. See Waseem Ahmad Qureshi, *Political Dimension of Water Paucity in Pakistan*, 19 FLA. COASTAL L. REV. 1, 11–12 (2018).

238. Kirk D'Souza, *Desalination Nation: How Israel Is Helping the World Fight Water Shortage*, NO CAMELS (May 24, 2017) [hereinafter D'Souza], <https://nocamels.com/2017/05/desalination-israel-drought-water-shortage>.

239. Morgan McFall-Johnsen, *A Solar-Powered System Can Turn Salt Water into Fresh Drinking Water for 25,000 People Per Day. It Could Help Address the World's Looming Water Crisis*, BUS. INSIDER (Aug. 1, 2019), <https://www.businessinsider.com/solar-powered-device-turns-salt-water-into-fresh-drinking-water-2019-7>.

240. *Cloud Seeding: The Expensive Business of Rain in the Desert*, BBC NEWS (Feb. 15, 2014) [hereinafter BBC News], <https://www.bbc.com/news/av/business-26173279>.

241. *Id.*

clouds is very expensive at present.²⁴² If, through the invention of cheap technology, seawater could be transformed into freshwater, then the scarcity of freshwater may be mitigated effectively. Converted seawater will then be used for drinking, agriculture, and all sorts of possible uses.²⁴³

F. What for Now?

Immediately, before resorting to converting seawater into freshwater, and before disturbing natural hydrological cycles, humans should work toward effectively and efficiently controlling existing water resources, so that the ecosystem, wildlife, and natural cycles are not disturbed. To this end, this paper recommends that states should first make laws and enforce them to not pollute freshwater. Then, they should allocate resources to treat discarded waters from human settlements because, in addition to the pollution of freshwater by chemical discharges from industries,²⁴⁴ much of the pollution in river waters is caused by municipal excretions of untreated sewer water.²⁴⁵ Pertinently, the developing world lacks the funds to treat this sewer water properly. This brings us back to the downward spiral again, which points toward population, pollution, and poor management of water resources for all the problems with the availability of freshwater.

IV. Conclusion

As mentioned, it is often foretold by scholars that while the wars of the past have been fought for oil, the wars of the coming century will be fought for freshwater in international waters.²⁴⁶ This is mainly based on the fact that the resources are becoming scarcer while the human population keeps on increasing. As the human population is increasing exponentially, the demand for water is also increasing, and, in turn, the per capita availability is decreasing.²⁴⁷ Chellaney argues that water scarcity will lead to competition among co-riparian states to fight for international

242. See D'Souza, *supra* note 238; BBC News, *supra* note 240.

243. See D'Souza, *supra* note 238; BBC News, *supra* note 240.

244. See Swain, *supra* note **Error! Bookmark not defined.**, at 771.

245. See Swain, *supra* note **Error! Bookmark not defined.**, at 771.

246. Swain, *supra* note **Error! Bookmark not defined.**, at 769.

247. See BROWN ET AL., *supra* note **Error! Bookmark not defined.**, at 373.

freshwater.²⁴⁸ In recent times, the world has seen a number of disputes over the sharing of international rivers, but none of these have translated into a full-fledged war; rather, the majority have been resolved through cooperation among states.²⁴⁹ Therefore, Gleditsch and Toset are of the view that water wars may be a possibility in the future, but they are not inevitable.²⁵⁰ By contrast, co-riparian states are moving toward cooperation in sharing international waters rather than toward water wars.²⁵¹ Yoffe and Wolf have noted that, as evidence of cooperation, more than 145 water cooperation treaties have been made in the twenty-first century.²⁵² Likewise, proper regulation and management of supply and demand of freshwater can also resolve the issue of water scarcity and water stress on states.

In conclusion, the battle of narratives regarding the possibility of water wars has been going on for more than three decades. The position that predicts water wars has extensively relied on past instances. It has been backed by academics, media, international organizations, prominent people, and policymakers. In response, the position that counters and negates the possibility of water wars has relied on empirical data to disprove it. However, it is important to note that the nexus between scarce resources, growing population, and water conflicts has gained support in the international academic community.²⁵³ Closas' recent research suggests that the debate between these narratives is still going on, so it is likely that this debate will soon be in the limelight again.²⁵⁴ However, this time, the sustainability environment has changed. The ground realities that were present in the 1990s have drastically changed with regard to the availability of natural resources, climate change, the pollution of waters, and growing populations.²⁵⁵ All these added characteristics make this debate over water wars

248. See CHELLANEY, *supra* note 7, at 2.

249. See Swain, *supra* note 3 **Error! Bookmark not defined.**, at 703.

250. Toset et al., *supra* note 166, at 976.

251. See Swain, *supra* note **Error! Bookmark not defined.**, at 770.

252. See Yoffe & Wolf, *supra* note 140, at 209.

253. See Homer-Dixon, *supra* note 89; See also Jansson, *supra* note 15, at 28–32; HOMER-DIXON *supra* note 90; Peter H. Gleick, Stephan Lewandowsky & Colin Kelley, *Climate and Conflict: Don't Oversimplify*, 555 NATURE 587 (2018); Jan Lundqvist & Peter Gleick, *Comprehensive Assessment of the Freshwater Resources of the World: Sustaining Our Waters into the 21st Century* (1997).

254. See Cascão et al., *supra* note 158.

255. See Jansson, *supra* note 15, at 6.

more complex, more uncertain, and more polarized.²⁵⁶

It is not necessary to stick to one side when speculating about the future. Historical instances, present practices, the rising population, and the decreasing supply of freshwater suggest that both conflicting narratives are likely. Hence, it is possible that, in the future, there will be both water wars and water cooperation.²⁵⁷ Despite the presence of water wars, states can still cooperate on water issues, negotiate international water treaties, and act through diplomatic channels to amicably resolve water disputes. Nevertheless, if the defined prerequisites of water wars are met in the future, then water wars will likely take place on a larger scale, as water conflicts already exist.²⁵⁸ However, future water wars can be avoided by taking certain precautionary measures, and through cooperation.

The scarcity of water is making food production difficult. The focus of technological advancement will be on the efficient production of vegetables and fruit, which will require less water than conventional methods. Further, if the technology to use scarce water will become expensive, and the production of food more difficult, it is inevitable that naturally grown fruits and vegetables will be high in demand and highly expensive after 100 years. Therefore, it is in the utmost interest of the agrarian economy states: 1) to develop new technologies; 2) to grow food more efficiently; 3) to manage water more sustainably and effectively; 4) to meter water usage with installation of water meters on every connection; 5) to tax water for domestic, agricultural, and industrial usages; 6) to control and manage water supplies efficiently; 7) to decrease water waste at the hands of the general public and agriculture; 8) to invest in ways to employ rain waters; 9) to not let freshwater spill back to the sea (that is, to use all the freshwater in rivers efficiently); 10) to manage waters in a way that all floodwater is used effectively and not wasted; 11) to use all the stored floodwater during droughts; 12) to increase water storage; 13) to evaluate and ameliorate to environmental deterioration by water projects; 14) to work on calculations of virtual water to be able to cater to the

256. See Jansson, *supra* note 15, at 35.

257. See Zeitoun & Mirumachi, *supra* note 97, at 301–03; see Jansson, *supra* note 15, at 55–63.

258. See Swain, *supra* note **Error! Bookmark not defined.**, at 770 (“In this century, water scarcity has caused a few skirmishes, but no war has yet been fought.”).

needs and supply of water consumers; and 15) to first prioritize domestic use, then cater to demands for agricultural and industrial use. So long as water is wasted by spilling it back to the sea, more than 80% of water is used for agricultural purposes as virtual waters,²⁵⁹ and while freshwater is polluted by industrial use and by the use of water streams as sewers, there is not sufficient freshwater left for domestic use or for drinking purposes.

Moreover, there is a need to effectively and efficiently manage freshwater resources. The notion that “water is free” should be dispelled from the international narrative.²⁶⁰ Instead, pricing water with allowed limits on per household quota, and water meters for household use, even for groundwater and consumers’ use, should be introduced to monitor and restrict wastage and use of water. Introducing prices and quotas in water supplies will both increase the value of water as a resource and force consumers to use water efficiently.²⁶¹ Likewise, this paper recommends that states should first make and enforce laws to prevent the pollution of freshwater. Then, they should allocate resources to treat discarded waters from human settlements.

259. See Swain, *supra* note **Error! Bookmark not defined.**, at 771–72; cf. CHELLANEY, *supra* note 7, at .105 (“Virtual water, which is economically invisible, has been largely explored in relation to crop and livestock production and trade because agriculture accounts for more than two-thirds of global water withdrawals.”).

260. See Swain, *supra* note **Error! Bookmark not defined.**, at 778.

261. Swain, *supra* note **Error! Bookmark not defined.**, at 778.