LAW IN THE TIME OF CHOLERA

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ABSTRACT

Thousands die each day from infections related to water, as evidenced in the ongoing crises of cholera in Haiti, Zika in the Western Hemisphere, and Legionnaires' Disease in Flint, Michigan. Yet water law focuses primarily on two agendas. First, the "Blue Agenda" aims to provide an equitable allocation of water to individuals and communities while encouraging sustainable water management. Second, the "Green Agenda" aims to efficiently protect water in the natural environment from pollution. These two agendas often ignore, and can be inconsistent with, the "Red Agenda." The Red Agenda addresses prevention of waterborne infections, like cholera, and the habitat of water-related disease vectors, like mosquitoes transmitting malaria. Additionally, the Red Agenda focuses on access to water for sanitation and hygiene, with implications for epidemics like Ebola. In simplified terms, the Blue Agenda is about water quantity, the Green Agenda about water quality, and the Red Agenda about water diseases. Laws made in pursuit of the Blue Agenda, like building a dam or irrigation system, can interfere with the Red Agenda by bringing mosquito habitat closer to human communities. And laws made in the pursuit of the Green Agenda, like prohibiting discharges of pesticides into a river, can interfere with the Red Agenda by preventing a response to a malaria outbreak. This Article is the first to introduce the Blue, Green, and Red framework for water law, and explains why these agendas often conflict with each other and how to more effectively integrate these agendas into water law.

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INTRODUCTION

In an epic example of insight and courage, John Snow saved countless lives and forged a heroic legacy.[1] His triumph in the face of crisis represented a turning point in history, tipping the balance in the ongoing battle between mankind and one of mankind's greatest threats.[2] In 1848, one of a series of massive outbreaks of cholera in the nineteenth century swept through London.[3] Snow observed that the patterns of the outbreak were not consistent with the then-prominent miasma theory of disease transmission—the theory that "bad air" was the cause of epidemics like cholera and bubonic plague.[4] Snow theorized that the mode of transmission was water, and distributed a pamphlet advising hand-washing and boiling drinking water.[5]

In 1854, another cholera epidemic struck London.[6] Snow observed that competing distribution companies delivered water within the Soho neighborhood of London.[7] One of these companies, Vauxhall, derived its water supply downstream of major sewer discharges into the Thames River.[8] The other obtained its water supply upstream of the sewer discharges.[9] Snow, in what is called the "Grand Experiment," compared data on households consuming water supplied from these two companies.[10] Snow noted that the cholera rate was 8.5 times higher in households supplied by Vauxhall than its competitor.[11] He further noted that nearly a quarter of all cholera deaths in London occurred within a short distance of a hand pump on Broad Street, which was installed on top of a cesspit.[12] After speaking with families near the pump, most had lost multiple members of their households to cholera, and all had taken water from the pump.[13] Legend has it that Snow removed

1 No, not that Jon Snow. GEORGE R.R. MARTIN, A GAME OF THRONES (1996). *This* John Snow. PETER VINTEN-JOHANSEN ET AL., CHOLERA, CHLOROFORM, AND THE SCIENCE OF MEDICINE: A LIFE OF JOHN SNOW (2003).

2 *See generally* Rita R. Colwell, *Global Climate and Infectious Disease: The Cholera Paradigm*, 274 SCIENCE 2025, 2026 (1996) (discussing the impact of John Snow's work on subsequent scientific endeavors, including modelling of global climate change).

3 JOHN SNOW, ON THE MODE OF COMMUNICATION OF CHOLERA 3–5 (London, John Churchill 2d ed.1855).

4 *Id.*; *see also* Mervyn Susser & Ezra Susser, *Choosing a Future for Epidemiology: I. Eras and Paradigms*, 86 AM. J. PUB. HEALTH 668, 669 (1996).

5 SNOW, *supra* note 3, at 118; *see also* Nigel Paneth, *Assessing the Contributions of John Snow to Epidemiology: 150 Years After Removal of the Broad Street Pump Handle*, 15 EPIDEMIOLOGY 514, 515–16 (2004).

6 SNOW, *supra* note 3, at 76; *see also* SANDRA HEMPEL, THE STRANGE CASE OF THE BROAD STREET PUMP: JOHN SNOW AND THE MYSTERY OF CHOLERA 163 (2007).

7 SNOW, *supra* note 3, at 64.

8 *Id.*; *see also* Lewis C. Vollmar, Jr., *The Effect of Epidemics on the Development of English Law from the Black Death Through the Industrial Revolution*, 15 J. LEGAL MED. 385, 416–17 (1994).

9 SNOW, *supra* note 3, at 64.

10 *Id.* at 75–77; *see also* HEMPEL, *supra* note 6, at 174.

11 *See* HEMPEL, *supra* note 6, at 174.

12 *Id.* at 182.

13 *Id.* at 178–85.

the handle from the Broad Street pump, and saved the city.[14] In one of history's greatest examples of inductive reasoning and scientific acumen, Snow ushered in the germ theory of disease transmission and became the father of modern epidemiology.[15]

John Snow's work also began the integration of epidemiology with the development and implementation of law.[16] In March of 1855, Snow testified before Parliament regarding the development of laws to address sanitation.[17] At the time, a bill was proposed to regulate "offensive trades," including bone boiling and gas works, which many believed contributed to the miasma of bad air and thus to disease transmission.[18] Merchants within those trades called on Snow to testify as an expert witness.[19] Snow argued in favor of increased investment in public sanitation projects and protection of drinking water sources rather than regulation of offensive trades that impacted air quality.[20] In 1866, after opposition from political and professional opponents and following another devastating outbreak of cholera, Snow's proposals were finally enacted into law, resulting in regulation of sewage discharges and treatment requirements for drinking water.[21]

Greater integration of epidemiology and water law is still required, including in ex ante procedural rules for the prevention of epidemics, and improved ex post rules to ensure adequate care for infected persons and containment of outbreaks.[22] In Haiti, for example, an ongoing cholera epidemic has killed over 8500 people and sickened over 600,000.[23] In the wake of the catastrophic earthquake of 2010, UN relief workers from Nepal

14 *Id.* A handle-less water pump remains on Broadwick Street in Soho as a memorial to John Snow. Kari S. McLeod, *Our Sense of Snow: The Myth of John Snow in Medical Geography*, 50 Soc. Sci. & Med. 923, 932 (2000).

15 *See generally* Stephanie J. Snow, *John Snow: The Making of a Hero?*, 372 Lancet 22 (2008).

16 Charles D. Larson, *Historical Development of the National Primary Drinking Water Regulations*, *in* Safe Drinking Water Act: Amendments, Regulations and Standards 3, 4–5 (Edward J. Calabrese et al. eds., 1990).

17 Vinten-Johansen et al., *supra* note 1, at 7.

18 *Id.*

19 *Id.*

20 *Id.* at 10; *see also* James G. Derouin & David R. Nelson, *Developments in Toxic Tort Liability for the Quality of Groundwater Served*, 49 Ariz. L. Rev. 469, 471 (2007).

21 Vinten-Johansen et al., *supra* note 1, at 10; *see also* Stephanie True Peters, Cholera: Curse of the Nineteenth Century (Epidemic!) 46–50 (2005).

22 *See, e.g.*, Kim Shayo Buchanan, *When Is HIV a Crime? Sexuality, Gender and Consent*, 99 Minn. L. Rev. 1231 (2015) (discussing the role of epidemiology in evaluating the potential for criminal prosecution of persons intentionally spreading HIV); John Makdisi, *Proportional Liability: A Comprehensive Rule to Apportion Tort Damages Based on Probability*, 67 N.C. L. Rev. 1063 (1989) (noting the role of epidemiology in allocating liability for mass tort class action cases).

23 Enrico Bertuzzo et al., *On the Probability of Extinction of the Haiti Cholera Epidemic*, 30 Stochastic Envtl. Res. & Risk Assessment 2043, 2043 (2016).

brought a particularly virulent form of cholera into Haiti.[24] The disease was introduced into the Haitian population by poor waste management at the UN camp.[25] A U.S. district court judge recently dismissed a lawsuit against the UN, stating that the UN is immune from liability associated with the cholera outbreak in Haiti.[26] The UN came to restore and improve Haiti's water infrastructure and protect its water resources, and such immunity arguably facilitates the UN's efforts.[27] But because of a failure to integrate epidemiology into water planning, the UN introduced a fatal outbreak to an already reeling nation, an outbreak that has potentially shifted from an epidemic to an endemic crisis.[28]

The recent cholera outbreak in Haiti illustrates only one way in which law can fail to integrate epidemiology.[29] Water is both a major avenue through which pathogens infect people, either directly by ingestion or indirectly by vectors like mosquitoes, and a major factor in the prevention and treatment of infectious diseases, including through improved hygiene and sanitation.[30] Currently, 2.3 billion people live without access to adequate clean water supplies and approximately 6000 children under the age of five die every day from waterborne diseases.[31] Officials throughout the Western Hemisphere are currently struggling to contain the growing Zika virus outbreak, spreading by mosquitoes and resulting in serious birth defects and death.[32] The deadly and ongoing water crisis in Flint, Michigan, has

24 Guy R. Knudsen, *Cholera in Haiti: A Perfect Storm of Scientific and Legal Uncertainty*, 29 NAT. RES. & ENV'T 14, 15–16 (2014).

25 *Id.*; *see generally* ALEJANDRO CRAVIOTO ET AL., FINAL REP. OF THE INDEP. PANEL OF EXPERTS ON THE CHOLERA OUTBREAK IN HAITI (2011), http://www.un.org/News/dh/infocus/haiti/UN-cholera-report-final.pdf.

26 Patricia Hurtado, *UN Claims Immunity from Haiti Post-Quake Cholera Lawsuit*, BLOOMBERG (Oct. 23, 2014), http://www.bloomberg.com/news/articles/2014-10-23/un-claims-immunity-from-haiti-cholera-lawsuit.

27 *Id.*; *see also* Kristina Daugirdas & Julian Davis Mortenson, *United States Defends United Nations' Immunity in Haitian Cholera Case*, 108 AM. J. INT'L L. 819 (2014).

28 R.R. Frerichs et al., *Nepalese Origin of Cholera Epidemic in Haiti*, 18 CLINICAL MICROBIOLOGY & INFECTION E158 (2012). An infection is "endemic" when it has no need for external input to remain active in a given community.

29 *See generally* Brian Concannon Jr. & Beatrice Lindstrom, *Cheaper, Better, Longer-Lasting: A Rights-Based Approach to Disaster Response in Haiti*, 25 EMORY INT'L L. REV. 1145 (2011) (discussing greater integration of human health considerations in the law of disaster response, including improved water access).

30 Lawrence O. Gostin et al., *The Law and the Public's Health: A Study of Infectious Disease Law in the United States*, 99 COLUM. L. REV. 59, 64, 70 (1999). In epidemiology, a vector is any agent (including animal or microorganism) that carries and transmits an infectious pathogen (for example, a mosquito that transmits malaria).

31 Malgosia Fitzmaurice, *The Human Right to Water*, 18 FORDHAM ENVTL. L. REV. 537, 538 (2007). "Water stress" occurs where inadequate water quantity or quality prevents water supply from meeting demand during a period of time. *See Water Stress Versus Water Scarcity*, UN DEP'T ECON. & SOC. AFF., http://www.un.org/waterforlifedecade/scarcity.html (last updated Nov. 24, 2014).

32 Reed Johnson et al., *Spreading Virus Adds to Brazil's Woes*, WALL ST. J. (Dec. 22, 2015), http://www.wsj.com/articles/spreading-virus-adds-to-brazils-woes-1450830661; *see also*

included a spike in Legionnaires' Disease.[33] The serious threat to human health posed by such diseases is likely to be aggravated by global climate change.[34] As such, water law should have a heightened emphasis on the prevention and mitigation of disease epidemics.

Nevertheless, water law largely concentrates on two agendas that are not directly related to disease prevention or mitigation—what I call the "Blue Agenda" and the "Green Agenda." The Blue Agenda is concerned with water quantity and drought resiliency.[35] In particular, the Blue Agenda deals with the allocation of water rights, the development of water delivery infrastructure, the sustainable management of water consumption, and the apportionment of water resources between people and jurisdictions.[36] The Green Agenda is concerned with water quality.[37] In particular, the Green Agenda deals with the prevention of water pollution, the protection of aquatic ecosystems, and the effective treatment of toxic or carcinogenic chemicals in drinking water.[38] While both of these agendas have important implications for human health, they may at times be pursued in ways that interfere with the prevention of epidemics or that aggravate disease outbreaks.[39]

For example, the Green Agenda may prioritize pollution prevention in a way that interferes with the expeditious application of pesticides to kill mosquito larvae to mitigate a malaria or West Nile virus outbreak.[40] The Blue Agenda may prioritize bringing a reservoir or irrigation infrastructure into a community, but in doing so, may also bring mosquito habitat closer to that

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Shasta Darlington, *Brazil Warns Against Pregnancy Due to Spreading Virus*, CNN (Dec. 24, 2015), http://www.cnn.com/2015/12/23/health/brazil-zika-pregnancy-warning/.

33 Matt Ford, *A Legionnaires' Disease Outbreak in Flint*, ATLANTIC (Jan. 13, 2016), http://www.theatlantic.com/politics/archive/2016/01/flint-michigan-water-crisis/424062/.

34 *See generally* Lisa Heinzerling, *Climate Change, Human Health, and the Post-Cautionary Principle*, 96 GEO. L.J. 445 (2008) (discussing the human health implications of climate change); *see also* Erik B. Bluemel, *Unraveling the Global Warming Regime Complex: Competitive Entropy in the Regulation of the Global Public Good*, 155 U. PA. L. REV. 1981, 1990 n.27 (2007).

35 *See, e.g.*, Janet C. Neuman, *Drought Proofing Water Law*, 7 U. DENV. WATER L. REV. 92 (2003).

36 Rhett B. Larson, *Interstitial Federalism*, 62 UCLA L. REV. 908 (2015) [hereinafter Larson, *Interstitial Federalism*]; Rhett B. Larson, *The New Right in Water*, 70 WASH. & LEE L. REV. 2181 (2013) [hereinafter Larson, *The New Right in Water*].

37 *See, e.g.*, Anthony DeLaPaz, Note, *Leed Locally: How Local Governments Can Effectively Mandate Green Building Standards*, 2013 U. ILL. L. REV. 1211, 1212–13.

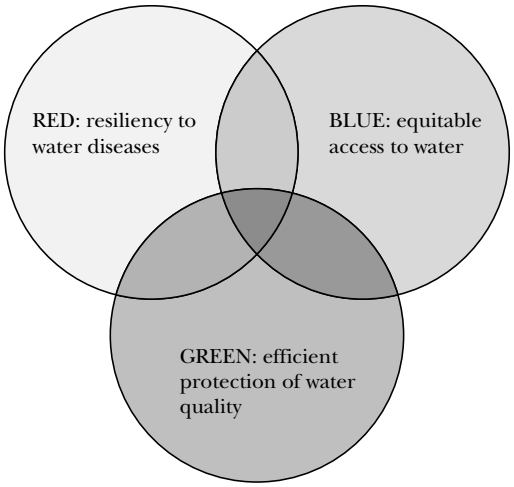
38 Rhett B. Larson, *Orphaned Pollution*, 45 ARIZ. ST. L.J. 991 (2013).

39 *See, e.g.*, Nat'l Cotton Council of Am. v. EPA, 553 F.3d 927 (6th Cir. 2009) (holding that pesticide applications require a Clean Water Act permit, which has implications for dispersal of pesticides to address insect-carried diseases); Larson, *The New Right in Water*, *supra* note 36, at 2234 (noting that regulation of disinfectant byproduct concentrations may discourage effective pathogen treatment in drinking water).

40 *See, e.g.*, John H. Minan & Tracy M. Frech, *Pesticides as "Pollutants" Under the Clean Water Act*, 47 SAN DIEGO L. REV. 109, 135–37 (2010) (discussing the regulation of pesticide applications in ways that delay response to water-related disease outbreaks).

community.[41] In such instances, the Green and Blue Agenda conflict with the aim to prevent and mitigate disease outbreaks, what I call the "Red Agenda." The Red Agenda deals with the control of habitats of disease vectors, like mosquitoes and snails, and the effective treatment of drinking water to address waterborne pathogens, like cholera or typhoid.[42] Additionally, the Red Agenda concentrates on the development of sanitation infrastructure to prevent diseases related to fecal contamination, like *Cryptosporidium* and *E. coli*, and improved access to water to prevent hygiene-related epidemics, like Ebola.[43] The three agendas overlap and are mutually reinforcing in important ways. However, water law practitioners and scholars, and water policymakers, tend to be focused on Green and Blue. The tri-colored framework seeks to make water law and policy more holistic and integrated by bringing more attention to the Red Agenda.

FIGURE 1: THE TRI-COLORED AGENDA FRAMEWORK



This Article is the first to introduce this tri-colored agenda framework of water law and policy, and argues for improved integration of the Red Agenda into water law in ways that are consistent with the Blue and Green Agendas. This Article proceeds in three Parts. Part I describes the Blue and Green

41 Erin K. MacDonald, Comment, *Playing by the Rules: The World Bank's Failure to Adhere to Policy in the Funding of Large-Scale Hydropower Projects*, 31 ENVTL. L. 1011, 1018 (2001).

42 For a brief overview of treatment and detection methods for waterborne pathogens, see Timothy M. Straub & Darrell P. Chandler, *Towards a Unified System for Detecting Waterborne Pathogens*, 53 J. MICROBIOLOGICAL METHODS 185 (2003). For an overview of the role of water supply development in impacting disease vector habitats, see David J. Bradley, *Water Supplies: The Consequences of Change*, *in* HUMAN RIGHTS IN HEALTH 81 (G.E.W. Wolstenholme & Katherine Elliott eds., 1974).

43 *See* Kaci Hickox, *Caught Between Civil Liberties and Public Safety Fears: Personal Reflections from a Healthcare Provider Treating Ebola*, 11 J. HEALTH & BIOMEDICAL L. 9, 17 (2015); *see also* Gostin et al., *supra* note 30, at 76 n.51.

Agendas in water law, and identifies the Red Agenda as another critical aim of water law. Part I also identifies epidemiological concepts, including Bradley Classifications of diseases, which form essential trans-disciplinary bridges between law and epidemiology.[44] Part II explains the ways in which laws that were developed in pursuit of the Blue and Green Agenda conflict with or frustrate the aims of the Red Agenda in the implementation of water policy.[45]

Part III discusses how "silo thinking" and "attenuated decision-making" explain why the Blue and Green Agenda are sometimes pursued in ways that interfere with the Red Agenda. Part III also proposes three reforms to more effectively integrate the Red Agenda into water law, including more nuanced water quality standards to prioritize disease prevention, greater assessment of disease vector considerations in the planning of water development projects, and a reinterpretation of the human right to water and a clean environment to account for water-related epidemics. The pursuit of the Red Agenda requires viewing infectious disease epidemics as inextricably tied to water resource management. The tri-color framework is thus a way to conceptualize water policy in a holistic way consistent with the "water, sanitation, and hygiene" (WASH) movement in international development and integrated water resource management (IWRM) in domestic water policy reform.[46]

In the same way law was driven by epidemiology in the wake of John Snow's removal of the Broad Street pump handle, epidemiology should be a driving consideration in the development and implementation of water law and policy. By removing the pump handle, Snow effectively and appropriately integrated Red with Blue—disease prevention and water access. By advocating for regulation of sewage discharges, Snow integrated the Red Agenda with the Green Agenda. Despite Snow's success, one of the greatest global threats to humans today remains microbial pathogens. That threat to human life is inevitably connected to water, one of the necessities of life. The manner in which water law was honed in the time of cholera provides a guide to how water law should be reformed today.

I. Water Law's Blue, Green, and Red Agendas

The bounds of what can be called "water law" are difficult to draw. Water is embedded in virtually all products, a concept called virtual water.[47]

44 Bradley, *supra* note 42; *see also* David J. Bradley, *The Epidemiology of Ricefield-Associated Diseases*, *in* Vector-Borne Disease Control in Humans Through Rice Agroecosystem Management 29 (W.H. Smith ed., 1988).

45 By "agendas," I do not mean special interest groups or approaches to public policy advocacy, but categories of goals pursued in law and policy generally.

46 Larson, *Interstitial Federalism*, *supra* note 36, at 942–43; Camille Pannu, *Drinking Water and Exclusion: A Case Study from California's Central Valley*, 100 Cal. L. Rev. 223, 244–45 (2012); *Global Water, Sanitation, & Hygiene (WASH)*, Ctrs. for Disease Control & Prevention (Mar. 8, 2016), http://www.cdc.gov/healthywater/global/index.html.

47 J.A. Allan, *Virtual Water—The Water, Food, and Trade Nexus: Useful Concept or Misleading Metaphor?*, 28 Water Int'l 106 (2003).

The concept of virtual water blurs the distinction between water law and laws governing food, energy, and trade.[48] Water is often understandably referred to as a human right, and is indeed incorporated as an express right in the constitutions of forty-one nations.[49] Water is also frequently viewed as a valuable property right, and thus central to land use and real estate law.[50] Water policy has obvious implications for public health law, housing law, public lands management, climate change adaptation and mitigation, and environmental law.[51] Water access is a major issue in gender and racial inequality.[52] International trade in virtual water, combined with the role of water in international human rights, terrorism, and armed conflict makes water a major issue in many aspects of international law.[53] Water law thus can quickly take on the "law of the horse" problem.[54]

For the purposes of this Article, however, water law means those laws that explicitly govern the ownership, transfer, use, consumption, diversion, pollution, treatment, or distribution of water and water-related infrastructure. Water law thus includes water rights, prevention and remediation of water pollution in the natural environment, and the treatment, distribution, and pricing of drinking water and wastewater. Water law also includes laws aimed at drought and flood resiliency, including infrastructure development and management for irrigation, reservoir storage, desalination, and flood control. Water law, thus defined, is largely focused on the Blue and Green agendas. This Part summarizes those two primary agendas of water law, and introduces the Red Agenda as an essential group of aims that should be incorporated more fully and explicitly into water law.

A. Water Law's Blue Agenda

Water law's Blue Agenda includes the aim to provide an equitable and sustainable allocation of water quantity to communities and individuals. This includes water rights and water resource development for domestic, indus-

48 *See, e.g.*, Rhett B. Larson, *Reconciling Energy and Food Security*, 48 U. RICH. L. REV. 929 (2014).

49 Larson, *The New Right in Water*, *supra* note 36, at 2184.

50 Sandra B. Zellmer & Jessica Harder, *Unbundling Property in Water*, 59 ALA. L. REV. 679 (2008).

51 Richard J. Lazarus, *Restoring What's Environmental About Environmental Law in the Supreme Court*, 47 UCLA L. REV. 703 (2000).

52 *See, e.g.*, Ben Crow & Farhana Sultana, *Gender, Class, and Access to Water: Three Cases in a Poor and Crowded Delta*, 15 SOC'Y & NAT. RESOURCES 709 (2002); Daria Roithmayr, *Lessons from* Mazibuko*: Persistent Inequality and the Commons*, 3 CONST. CT. REV. 317 (2010).

53 RHETT LARSON, CANADIAN GLOBAL AFF. INST., THE CASE OF CANADIAN BULK WATER EXPORTS (2015), http://www.cgai.ca/canadian_bulk_water_exports; *see also* Rhett B. Larson, *War and Water*, HUFFINGTON POST (Dec. 7, 2014, 11:54 AM), http://www.huffingtonpost.com/rhett-b-larson/war-and-water_b_5940892.html.

54 Frank H. Easterbrook, *Cyberspace and the Law of the Horse*, 1996 U. CHI. LEGAL F. 207 (arguing against the study of many areas of law impacting a certain industry, rather than general principles of law, because such an approach leads to a shallow understanding of essential principles of law).

trial, hydroelectric, and agricultural uses. At the international level, water law pursues the Blue Agenda in several ways. International transboundary water allocation regimes seek to equitably apportion international rivers, lakes, and aquifers between nations sharing those resources.[55] Such regimes include regional transboundary river treaties, like the 1944 Rivers Treaty that governs hydro-diplomatic relations between the United States and Mexico.[56] Other regimes include larger framework treaties, like the UN Convention on the Law of the Non-Navigational Uses of International Watercourses (the "Watercourses Convention"), that embody customary international law.[57] The allocation of international rivers and lakes is often made based on principles of reasonable and equitable utilization, the duty to avoid significant harm, and the obligation to cooperate with co-riparian states.[58] In determining the reasonableness and equity of allocating water between nations, international law considers several factors, including physical and climatic conditions, existing uses on the river, population and possible future uses, and the potential for conservation.[59] In making these international transboundary allocations, "special regard" is to be given to "vital human needs."[60]

There is a corollary to this approach to transboundary water allocation and the Blue Agenda in domestic U.S. water law. When states share transboundary water sources, domestic water law typically governs the allocation of those resources between states in two ways. The first is through the U.S. Supreme Court's original jurisdiction, in which case the Court allocates water

55 A. Dan Tarlock, *Four Challenges for International Water Law*, 23 TUL. ENVTL. L.J. 369, 397 (2009).

56 Treaty Respecting Utilization of Waters of the Colorado and Tijuana Rivers and of the Rio Grande, U.S.-Mex., Nov. 8, 1945, 59 Stat. 1219 (1944 Rivers Treaty). The 1944 Rivers Treaty is one of several treaties that departs significantly from the current approach to international transboundary water treaties and evolving customary international law, in that it apportions a specified quantity of raw water (i.e., 1.5 million acre-feet to Mexico), without consideration of equitable factors like those addressed in more recent international water treaties.

57 United Nations Convention on the Law of the Non-Navigational Uses of International Watercourses, 36 I.L.M. 703 (1997) [hereinafter Watercourses Convention]. For an overview of the development of the Watercourses Convention, see Gabriel E. Eckstein, *Development of International Water Law and the UN Watercourse Convention*, *in* HYDROPOLITICS IN THE DEVELOPING WORLD: A SOUTHERN AFRICAN PERSPECTIVE 81 (Anthony Turton & Roland Henwood eds., 2002). For an evaluation of the Watercourses Convention as customary international law, see Ryan B. Stoa, *The United Nations Watercourses Convention on the Dawn of Entry into Force*, 47 VAND. J. TRANSNAT'L L. 1321 (2014).

58 *See, e.g.*, Ziyi Huang, *Case Study on the Water Management of the Yaluzangbu/Brahmaputra River*, 27 GEO. INT'L ENVTL. L. REV. 229 (2015); Jian Ke & Qi Gao, *Only One Mekong: Developing Transboundary EIA Procedures of Mekong River Basin*, 30 PACE ENVTL. L. REV. 950 (2013); Anna Schulz, *Creating a Legal Framework for Good Transboundary Water Governance in the Zambezi and Incomati River Basins*, 19 GEO. INT'L ENVTL. L. REV. 117 (2007).

59 Watercourses Convention, *supra* note 57, art. 6. For a general overview of the factors considered in equitably apportioning interstate watercourses, see STEPHEN C. MCCAFFREY, THE LAW OF INTERNATIONAL WATERCOURSES 76–77 (2001).

60 Watercourses Convention, *supra* note 57, art. 10.

in dispute between states based on principles of equitable apportionment.[61] The factors considered under an analysis of equitable apportionment include physical and climatic conditions, existing uses on the river, population and anticipated future uses, rates of return flows, availability of storage, and wasteful water uses.[62] The second approach is for states to agree to water apportionment under a congressionally-authorized interstate compact.[63] Even in the case of interstate river compacts, however, the Supreme Court will apply principles of equitable apportionment in interpreting compact language and in allocating damages for violations of compact provisions.[64]

Equity, therefore, is a primary aim in the allocation of transboundary waters at both the international and U.S. domestic levels, and both levels of law consider factors that are strikingly similar when evaluating equitable allocation. Equitable allocation of transboundary resources is thus one of the primary aims of the Blue Agenda.[65] As for equitably apportioning water resources outside the context of transboundary waters, one approach is to treat water as a constitutional, or human, right.[66] Currently, forty-one nations have a constitutionally-recognized right to water.[67] There is a growing chorus of voices calling for recognition of an international human right to water.[68] In the United States, California has recently enacted its own "Human Right to Water Bill," and water shutoffs in Detroit have increased calls for recognition of the human right to water domestically.[69] The formu-

61 U.S. CONST. art. III, § 2. For a discussion of the principles of equitable apportionment, see Colorado v. New Mexico, 459 U.S. 176 (1982).

62 Nebraska v. Wyoming, 325 U.S. 589, 618 (1945).

63 U.S. CONST., art. I, § 10, cl. 3. For a general discussion of the strengths, weaknesses, and potential reforms associated with interstate river compacts, see Larson, *Interstitial Federalism*, *supra* note 36.

64 Kansas v. Nebraska, 135 S. Ct. 1042 (2015) (applying the equitable remedy of disgorgement in a dispute between Kansas and Nebraska over water rights to the shared Republic River, which is governed by an interstate compact).

65 *Colorado*, 459 U.S. at 183 ("Our aim is always to secure a just and equitable apportionment 'without quibbling over formulas.'" (quoting New Jersey v. New York, 283 U.S. 336, 343 (1931))).

66 *See generally* Fitzmaurice, *supra* note 31; Larson, *The New Right in Water*, *supra* note 36.

67 Larson, *The New Right in Water*, *supra* note 36, at 2184; *see also* Barton H. Thompson, Jr., *Water as a Public Commodity*, 95 MARQ. L. REV. 17, 32–33 (2011).

68 *See* G.A. Res. 64/292, ¶¶ 5, 8, The Human Right to Water and Sanitation, U.N. Doc. A/RES/64/292 (July 28, 2010) [hereinafter 2010 U.N. Resolution] (acknowledging that access to drinking water is an integral component of expanding human rights); *see also* Peter H. Gleick, *The Human Right to Water*, PAC. INST. 1 (2007); Stephen C. McCaffrey, *A Human Right to Water: Domestic and International Implications*, 5 GEO. INT'L ENVTL. L. REV. 1, 7 (1992); Anna F.S. Russell, *International Organizations and Human Rights: Realizing, Resisting or Repackaging the Right to Water?*, 9 J. HUMAN RIGHTS 1 (2010).

69 CAL. WATER CODE § 106.3(a) (West 2016). *See generally* INT'L HUMAN RIGHTS LAW CLINIC, U.C. BERKELEY, THE HUMAN RIGHT TO WATER BILL IN CALIFORNIA: AN IMPLEMENTATION FRAMEWORK FOR STATE AGENCIES (2013) [hereinafter HUMAN RIGHT TO WATER BILL IN CALIFORNIA], http://www.law.berkeley.edu/files/Water_Report_2013_Interactive_FINAL.pdf; *see also* Kate Galbraith, *Ireland Sets Water Fees, Angering Thousands*, N.Y. TIMES (Nov. 12,

lation of the human right to water, at the domestic and international levels, often leaves open for interpretation critical questions, including the amount, price, and proximity to the point of use necessary to satisfy such a right.[70] Nevertheless, the Blue Agenda aims to answer these questions and to achieve the equitable allocation of water between nations, communities, and individuals.

Water as an inalienable right to all is a principle embedded in one of the most influential global legal systems—Sharia law. Unsurprisingly, given its roots in the arid Arab peninsula, Sharia law addresses in significant depth the issue of water rights and water disputes.[71] There are two fundamental water rights precepts under Sharia law.[72] First, *shafa*, or the "right of thirst," establishes a universal right for all humans to quench their thirst and that of their animals.[73] Second, *shirb*, or the right of irrigation, provides a right for farmers to water their crops.[74] While the two principles of *shafa* and *shirb* are interpreted and implemented in dramatically different ways depending on geography and sect, there are certain generalizable principles, including a focus on equity in water distribution.[75] And while many Muslim-majority nations do not formally codify Sharia water law concepts like *shafa* and *shirb*, the concepts are nevertheless reflected in many water codes throughout the Middle East and North Africa given the influence of the Majalla, or Ottoman Code, on water resource management.[76] The Majalla creates a certain degree of uniformity within the region with respect to water, including the equity considerations inherent in *shafa* and *shirb*.[77]

In many Western nations, one way in which water law attempts to achieve equitable allocation of water is in the assignment of property rights in water. Because of its roots in English common law and Roman law and the colonial legacy of both of those legal systems, the allocation of property rights in water under a riparian regime is relatively common around the

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2014), http://www.nytimes.com/2014/11/13/business/international/Ireland-sets-water-fees-angering-thousands.html?_r=0; Alisa Priddle & Matt Helms, *Bankruptcy Judge Tells Detroit to Address Water Shutoffs*, USA TODAY (July 16, 2014) http://www.usatoday.com/story/news/nation/2014/07/16/detroit-bankruptcy-water/12734925/.

70 *See generally* Larson, *The New Right in Water*, *supra* note 36.

71 Indeed, the word "Sharia" itself is closely related to water, and can be interpreted to mean "the source of water." James Salzman, *Thirst: A Short History of Drinking Water*, 18 YALE J.L. & HUMAN. 94, 100 (2006).

72 Naser I. Faruqui, *Water, Human Rights, and Economic Instruments: The Islamic Perspective*, 9/10 WATER NEPAL 197, 201–03 (2001).

73 *See also* Chibli Mallat, *The Quest for Water Use Principles: Reflections on Shari'a and Custom in the Middle East*, *in* WATER IN THE MIDDLE EAST: LEGAL, POLITICAL AND COMMERCIAL IMPLICATIONS 127 (J.A. Allan & Chibli Mallat, eds., 1995).

74 Faruqui, *supra* note 72, at 201–03.

75 *Id.*; *see also* Mallat, *supra* note 73.

76 Ali Ahmad, *Islamic Water Law as a Comparative Model for Maintaining Water Quality*, 5 J. ISLAMIC L. & CULTURE 159 (2000).

77 *Id.*; *see also* Munther J. Haddadin, *Evolution of Water Administration and Legislation*, *in* WATER RESOURCES IN JORDAN: EVOLVING POLICIES FOR DEVELOPMENT, THE ENVIRONMENT, AND CONFLICT RESOLUTION 28, 28–52 (Munther J. Haddadin ed., 2006).

world.[78] Riparian regimes allocate water rights to those owning land abutting a waterbody.[79] Such owners have a right to make "reasonable" use of the water, with rights to "natural" uses being presumed reasonable and effectively unlimited, while rights to "artificial uses" are subject to the court's evaluation of the relative interests of co-riparian parties.[80] A natural use is one satisfying basic needs, including bathing, drinking, and household cleaning.[81] All other rights would be artificial, and subject to the reasonableness requirement.[82] Thus, riparian rights systems include an equity component reflective of that in transboundary water law and the human right to water, where basic human needs are prioritized and water users have an obligation to behave reasonably in their respective water uses.

In the western United States, rights to water are apportioned under the prior appropriation doctrine, which is a "first-in-time, first-in-rights" allocation regime.[83] Nevertheless, a right under prior appropriation is not perfected until put to beneficial use.[84] As is true generally of riparian rights regimes, in prior appropriation, water is owned by the state and held in trust for the benefit of all citizens.[85] One important way in which the state asserts its trust authority over water resources in prior appropriation jurisdictions is by retaining authority to reject applications for water rights, applications to transfer water rights, or to change diversion points on a river, if those actions would adversely impact public safety or are otherwise against the public welfare.[86] The beneficial use requirement of prior appropriation, applied and

78 *See generally* Joseph W. Dellapenna, *The Evolution of Riparianism in the United States*, 95 MARQ. L. REV. 53, 61 (2011); Roscoe Pound, *The Theory of Judicial Decision*, 36 HARV. L. REV. 641, 642 (1923).

79 JOSEPH L. SAX ET AL., LEGAL CONTROL OF WATER RESOURCES 154–57 (3d. ed. 2000); Marion Rice Kirkwood, *Appropriation of Percolating Water*, 1 STAN. L. REV. 1, 6 (1948).

80 Eric T. Freyfogle, *Water Justice*, 1986 U. ILL. L. REV. 481, 499–500. *See generally* Frank J. Trelease, *Coordination of Riparian and Appropriative Rights to the Use of Water*, 33 TEX. L. REV. 24 (1954).

81 Richard Ausness, *Water Rights, the Public Trust Doctrine, and the Protection of Instream Uses*, 1986 U. ILL. L. REV. 407, 416.

82 Arthur S. Haddaway, Note, *Water Rights—Is a Water Right an Easement?*, 7 TEX. L. REV. 453, 468 (1929).

83 Henry E. Smith, *Governing Water: The Semicommons of Fluid Property Rights*, 50 ARIZ. L. REV. 445, 467 (2008). Many western states rely on prior appropriation in allocating rights to groundwater, while others have bifurcated systems where surface water is governed by prior appropriation and groundwater is governed by a reasonable use regime similar to riparian rights. *See* ROBERT GLENNON, WATER FOLLIES: GROUNDWATER PUMPING AND THE FATE OF AMERICA'S FRESH WATER 29–32 (2002).

84 Reed D. Benson, *Alive but Irrelevant: The Prior Appropriation Doctrine in Today's Western Water Law*, 83 U. COLO. L. REV. 675, 676 (2012); Christine A. Klein, *The Constitutional Mythology of Western Water Law*, 14 VA. ENVTL. L.J. 343, 349 (1995).

85 Robin Kundis Craig, *Climate Change, Regulatory Fragmentation, and Water Triage*, 79 U. COLO. L. REV. 825, 836 (2008); *see also* Melissa K. Scanlan, *Implementing the Public Trust Doctrine: A Lakeside View into the Trustees' World*, 39 ECOLOGY L.Q. 123, 136 (2012).

86 *See, e.g.*, ARIZ. REV. STAT. ANN. §§ 45–153 (2016); Consuelo Bokum, *Implementing the Public Welfare Requirement in New Mexico's Water Code*, 36 NAT. RESOURCES J. 681, 683–85 (1996).

enforced through the public trust doctrine, is essentially a question of equity in the allocation of water rights.[87]

Another layer of U.S. water law further supports the pursuit of equitable allocation of water rights. For reservations of federal land, including reservations created for Native American tribes, the minimum amount of water is implicitly reserved to meet the primary purpose of the reservation.[88] Such reserved rights—often referred to as "*Winters* rights"—support national forests, wildlife refuges, and the homelands of indigenous peoples.[89] These rights for tribes are quantified with an eye toward establishing a permanent homeland. While typically quantified based on the reservation's practicably irrigable acreage, water rights settlement agreements and some state courts have taken a more nuanced, reservation-specific approach aimed at achieving an equitable allocation to the tribe.[90] As such, the tribal water rights regime, consistent with other approaches to water rights in the United States, primarily seeks an equitable allocation of water rights.[91]

Federally-reserved *Winters* rights, the beneficial use requirement in prior appropriation law, and the role of the public trust doctrine, arguably act as proxies for the reasonable use requirement in riparianism, and as a corollary to the equity considerations that are paramount in transboundary water law and the human right to water. Equitable allocation of water resources, broadly defined, is the touchstone and primary aim of the Blue Agenda.

One of the ways in which this aim is advanced both domestically and internationally is through the financing and development of water infrastructure, including in particular reservoirs, drinking water treatment plants and distribution, wastewater collection and treatment, and irrigation systems.[92] The World Bank plays a major role at the international level in financing

87 A. Dan Tarlock, *The Future of Prior Appropriation in the New West*, 41 NAT. RESOURCES J. 769 (2001); John G. Tisdell, *Equity and Social Justice in Water Doctrines*, 4 SOC. JUST. RES. 401 (2003).

88 Winters v. United States, 207 U.S. 564 (1908); *see also* United States v. New Mexico, 438 U.S. 696, 718 (1978); Cappaert v. United States, 426 U.S. 128, 141 (1976).

89 *Winters*, 207 U.S. at 564; A. Dan Tarlock, *Tribal Justice and Property Rights: The Evolution of* Winters v. United States, 50 NAT. RESOURCES J. 471 (2010).

90 Arizona v. California, 373 U.S. 546, 595–601 (1963); *see also In re* Gen. Adjudication of All Rights to Use Water in the Gila River Sys. & Source, 35 P.3d 68, 78–80 (Ariz. 2001); Robert T. Anderson, *Indian Water Rights: Litigation and Settlements*, 42 TULSA L. REV. 23, 30–31 (2006).

91 Tarlock, *supra* note 89, at 493; *see also* Jeremy N. Jungreis, *"Permit" Me Another Drink: A Proposal for Safeguarding the Water Rights of Federal Lands in the Regulated Riparian East*, 29 HARV. ENVTL. L. REV. 378, n.75 (2005); Andrew C. Mergen & Sylvia F. Liu, *A Misplaced Sensitivity: The Draft Opinions in* Wyoming v. United States, 68 U. COLO. L. REV. 683, 711–12 (1997).

92 Elizabeth C. Black, *Climate Change Adaptation: Local Solutions for a Global Problem*, 22 GEO. INT'L ENVTL. L. REV. 359 (2010); Thomas M. Kerr, *Supplying Water Infrastructure to Developing Countries via Private Sector Project Financing*, 8 GEO. INT'L ENVTL. L. REV. 91 (1995).

major water infrastructure projects.[93] The World Bank Inspection Panel provides a forum in which to arbitrate disputes associated with the application of international and domestic law to water infrastructure development.[94] Additionally, the World Bank utilizes an impact assessment process to evaluate the environmental impacts of its projects.[95] Under international law, including the Espoo Convention, similar requirements for conducting environmental impact assessments apply to water resource development projects, like infrastructure for water treatment, distribution, and storage.[96]

Similarly, in the United States, federal water development projects, including dams and reservoirs built, maintained, and operated by federal agencies like the Bureau of Reclamation, U.S. Army Corps of Engineers, and Tennessee Valley Authority, are subject to political and judicial oversight and ex ante environmental assessment requirements under the National Environmental Protection Act (NEPA).[97] Privately-financed water infrastructure developments must typically obtain federal permits that likewise are subject to NEPA requirements and judicial oversight.[98] The promotion and regulation, including public financing, of water infrastructure development projects represents one of the key means through which water law pursues the Blue Agenda.

Equity is the express and implied aim of the Blue Agenda; however, that aim is not always reflected in the implementation and interpretation of laws and policy enacted in pursuit of the Blue Agenda.[99] The Blue Agenda pursues equitable allocation through rights allocation, conservation incentives, subsidies for water development, and water markets and water pricing. Because water law ostensibly aims for both inter-generational and intra-generational equitable allocation of water, it is not always implemented in a

93 *See supra* note 92; *see also* Adam McBeth, *A Right by Any Other Name: The Evasive Engagement of International Financial Institutions with Human Rights*, 40 GEO. WASH. INT'L L. REV. 1101, 1130 (2009).

94 Yaser Khalaileh, *Prospects for Cooperation and Dispute over Water in the Middle East*, 5 BERKELEY J. MIDDLE E. & ISLAMIC L. 73 (2012); John E. Thorson et al., *Dividing Western Waters: A Century of Adjudicating Rivers and Streams*, 8 U. DENV. WATER L. REV. 355 (2005).

95 Martin V. Totaro, *Legal Positivism, Constructivism, and International Human Rights Law: The Case of Participatory Development*, 48 VA. J. INT'L L. 719, 758–59 (2008).

96 United Nations Convention on Environmental Impact Assessment in a Transboundary Context, 30 I.L.M. 800 (Feb. 25, 1991) [hereinafter Espoo Convention]; *see also* Ke & Gao, *supra* note 58, at 978–79; Aaron Schwabach, *Diverting the Danube: The Gabcikovo-Nagymaros Dispute and International Freshwater Law*, 14 BERKELEY J. INT'L L. 290, 322–23 (1996).

97 Leonard B. Dworsky et al., *Water Resources Planning and Management in the United States Federal System: Long Term Assessment and Intergovernmental Issues*, 31 NAT. RESOURCES J. 475, 518 (1991).

98 *Id.*; *see also* Kenneth S. Weiner, *NEPA and State NEPAs: Learning from the Past, Foresight for the Future*, 39 ENVTL. L. REP. 10675, 10676–77 (2009).

99 *See, e.g.*, Hope M. Babcock, *Reserved Indian Water Rights in Riparian Jurisdictions: Water, Water Everywhere, Perhaps Some Drops for Us*, 91 CORNELL L. REV. 1203 (2006); Barton H. Thompson, Jr., *Institutional Perspectives on Water Policy and Markets*, 81 CAL. L. REV. 671 (1993).

way that is likely to effectively achieve those aims.[100] This is not a question of whether the Blue Agenda exists, but whether the Blue Agenda is failing. That is a question that lies outside the scope of this Article.

B. Water Law's Green Agenda

Water law's Green Agenda includes the aim to prevent or remediate pollution of aquatic ecosystems and to establish and enforce healthy drinking water quality standards for toxic or carcinogenic chemicals.[101] The Green Agenda also seeks to ensure adequate water supplies to support aquatic, wetland, and riparian ecosystems.[102] In many ways, the Blue Agenda reinforces the Green Agenda. For example, the environmental impact assessments associated with federal projects in the United States, the Espoo Convention, and World Bank-financed projects aim to mitigate or avoid environmental impacts from water development projects intended to improve water access.[103] Furthermore, many water rights regimes provide for water to be allocated to environmental in-stream flows for habitat preservation and protection.[104]

Pursuit of the Green Agenda at the international level has many parallels with the international pursuit of the Blue Agenda as well. As with the Blue Agenda, treaty law governs certain aspects of the protection of water resources at the international level.[105] Customary international law also creates obligations on states to avoid extraterritorial environmental harms,

100 *See* David H. Getches, *Colorado River Governance: Sharing Federal Authority as an Incentive to Create a New Institution*, 68 U. COLO. L. REV. 573, 576–77 (1997); *see also* Ardi Imseis, *On the Fourth Geneva Convention and the Occupied Palestinian Territory*, 44 HARV. INT'L L.J. 65, 105–06 (2003).

101 *See, e.g.*, Eric Biber & J.B. Ruhl, *The Permit Power Revisited: The Theory and Practice of Regulatory Permits in the Administrative State*, 64 DUKE L.J. 133, 215–16 (2014) (evaluating the role of permitting and standards regimes in environmental protection); Lisa Heinzerling, *Discounting Our Future*, 34 LAND & WATER L. REV. 39, 57–64 (1999) (discussing the role of cost-benefit analysis and discount rates in regulating water quality); James Salzman, *Creating Markets for Ecosystem Services: Notes from the Field*, 80 N.Y.U. L. REV. 870, 877–88 (2005) (evaluating the role of market mechanisms for protecting the environment).

102 Freyfogle, *supra* note 80, at 486; Benjamin A. Kahn, *The Legal Framework Surrounding Maori Claims to Water Resources in New Zealand: In Contrast to the American Indian Experience*, 35 STAN. J. INT'L L. 49, 56 (1999); Christine A. Klein, *Water Bankruptcy*, 97 MINN. L. REV. 560, 568 (2012); Luis Inaraja Vera, *Instream Flows in California and Spain: The Thorny Issue of Compensation*, 27 GEO. INT'L ENVTL. L. REV. 199 (2015).

103 *See generally* Bradley C. Karkkainen, *Toward a Smarter NEPA: Monitoring and Managing Government's Environmental Performance*, 102 COLUM. L. REV. 903 (2002).

104 *See, e.g.*, Marc Becker, *Correa, Indigenous Movements, and the Writing of a New Constitution in Ecuador*, 38 LATIN AM. PERSP. 47, 47 (2010); Janet C. Neuman & Michael C. Blumm, *Water for National Forests: The Bypass Flow Report and the Great Divide in Western Water Law*, 18 STAN. ENVTL. L.J. 3, 8 (1999).

105 *See, e.g.*, Final Act of the International Conference on the Conservation of Wetlands and Waterfowl, 11 I.L.M. 963 (1972) (Ramsar Convention); *see also* Meredith A. Giordano, *Managing the Quality of International Rivers: Global Principles and Basin Practice*, 43 NAT. RESOURCES J. 111, 113–18 (2003).

including the contamination of transboundary water bodies.[106] Advocates for the protection and remediation of water resources have also relied on international human rights arguments, including the right to a clean environment.[107] International law has begun a possible shift toward the development and implementation of regulatory regimes whereby water quality standards are established and enforced, and discharges to water bodies are regulated by permits.[108]

This recent development in international law has its roots in domestic law's pursuit of the Green Agenda, where water quality is protected by establishing water quality standards and issuing permits for discharges to water bodies. In England, prior to the nineteenth-century cholera outbreaks, water pollution was largely addressed through suits under common law, under theories of tort or nuisance.[109] John Snow's testimony before Parliament led to reforms in water quality protection in the United Kingdom, beginning with criminal sanctions for water pollution and evolving to a licensing system for discharges to rivers.[110] Other countries have taken a similar approach with respect to water quality standards and water discharge permits, including China, South Africa, Australia, and Brazil.[111]

106 Rhett B. Larson, *Innovation and International Commons: The Case of Desalination Under International Law*, 2012 UTAH L. REV. 759, 779–82; Thomas W. Merrill, *Golden Rules for Transboundary Pollution*, 46 DUKE L.J. 931, 955 (1997).

107 *See, e.g.*, Elizabeth Burleson, *Cooperative Federalism and Hydraulic Fracturing: A Human Right to a Clean Environment*, 22 CORNELL J.L. & PUB. POL'Y 289 (2012); Stephen C. McCaffrey & Kate J. Neville, *Small Capacity and Big Responsibilities: Financial and Legal Implications of a Human Right to Water for Developing Countries*, 21 GEO. INT'L ENVTL. L. REV. 679, 697–98 (2009).

108 *See generally* Pál Belényesi, *Regulation of Water Services in the EU*, 2014 EUR. NETWORKS L. & REG. Q. 17. For an overview of water quality permitting approaches and international water quality protection law, see ROBERT L. GLICKSMAN ET AL., ENVIRONMENTAL PROTECTION: LAW AND POLICY 554–80 (2015).

109 *See* Jason J. Czarnezki & Mark L. Thomsen, *Advancing the Rebirth of Environmental Common Law*, 34 B.C. ENVTL. AFF. L. REV. 1 (2007) (summarizing the history of common law suits related to environmental contamination and arguing that common law approaches will fill in regulatory gaps where federal law has failed to adequately prevent or mitigate pollution); *see also* Alexandra B. Klass, *Common Law and Federalism in the Age of the Regulatory State*, 92 IOWA L. REV. 545 (2007) (arguing for the integration of state common law approaches to environmental protection and federal regulation).

110 William Howarth, *Water Quality and Land Use Regulation Under the Water Framework Directive*, 23 PACE ENVTL. L. REV. 351 (2006); Larson, *supra* note 16, at 3, 6.

111 *See, e.g.*, Chris Calfee, *Some, for All, for Ever: Defending the Constitutionality of South Africa's National Water Act of 1998*, 7 U.C. DAVIS J. INT'L L. & POL'Y 57 (2001); David N. Cassuto & Rômulo S.R. Sampaio, *Water Law in the United States and Brazil—Climate Change & Two Approaches to Emerging Water Poverty*, 35 WM. & MARY ENVTL. L. & POL'Y REV. 371 (2011); Rosemary Lyster, *Common but Differentiated? Australia's Response to Global Climate Change*, 16 GEO. INT'L ENVTL. L. REV. 561 (2004); Wang Mingyuan, *China's Pollutant Discharge Permit System Evolves Behind Its Economic Expansion*, 19 VILL. ENVTL. L.J. 95 (2008).

The United States takes a similar approach in pursuing the Green Agenda under the Clean Water Act (CWA).[112] Under the CWA, the U.S. Environmental Protection Agency (EPA), in partnership with state governments granted primacy to implement the CWA, regulates water quality throughout the United States in surface waters deemed "waters of the United States."[113] The meaning of "waters of the United States," and thus the scope of the CWA's jurisdiction, has been the source of ongoing legal battles and efforts at legislative and regulatory reforms. In general, the jurisdiction is defined broadly to include any surface water with a "significant nexus" to a traditional navigable watercourse.[114] For such waters, state governments establish surface water quality standards (SWQS) within their states under CWA jurisdiction and with EPA oversight and approval.[115] Surface water quality standards are established at both acute and chronic levels of listed contaminants, and each of those standards is intended to protect different designated uses of the water body, including wildlife habitat, fishing, bathing, and drinking.[116]

States regularly assesses each watercourse for compliance with the applicable SWQS.[117] Surface watercourses that fail to meet SWQS are deemed "impaired" for the constituents exceeding standards.[118] The state then establishes for each impaired watercourse a "total maximum daily load" (TMDL).[119] Under section 303(d) of the CWA, a TMDL is a calculation of the maximum amount of a pollutant a watercourse can receive and still meet

112 33 U.S.C. § 1362(7) (2012). For an overview of federal and state partnerships in the implementation of the Clean Water Act, see ROBIN KUNDIS CRAIG, THE CLEAN WATER ACT AND THE CONSTITUTION: LEGAL STRUCTURE AND THE PUBLIC'S RIGHT TO A CLEAN AND HEALTHY ENVIRONMENT 9–10 (2d ed. 2009).

113 Clean Water Act, 33 U.S.C. § 1251. For an overview of the CWA and its implementing regulations, see JAMES SALZMAN & BARTON H. THOMPSON, JR., ENVIRONMENTAL LAW & POLICY 123–46 (2003).

114 In 2006, in *Rapanos v. United States*, the United States Supreme Court held in a plurality decision (meaning a decision in which no single holding garnered the support of a majority of the Court) that a watercourse falls within CWA jurisdiction under certain circumstances. 547 U.S. 715 (2006). The plurality opinion, written by Justice Antonin Scalia, held that CWA jurisdiction adheres only to traditional navigable waters, relatively permanent tributaries to traditional navigable waters, and wetlands directly abutting traditional navigable waters. *Id.* at 733–34. The concurring opinion authored by Justice Anthony Kennedy held that CWA jurisdiction adheres so long as a water body has a "significant nexus" to a traditional navigable water. *Id.* at 759 (Kennedy, J., concurring).

115 33 U.S.C. § 1251; *see also* Larson, *supra* note 38, at 1000–02. For a discussion of multi-level governance in environmental law, see Hari M. Osofsky, *Diagonal Federalism and Climate Change Implications for the Obama Administration*, 62 ALA. L. REV. 237 (2011).

116 Larson, *supra* note 38, at 1000–02; *see also* SALZMAN & THOMPSON, *supra* note 113, at 145–55.

117 Larson, *supra* note 38, at 1000–02; *see also* Philip Weinberg, *Federal-State Relationships*, *in* ENVIRONMENTAL LAW AND PRACTICE GUIDE: STATE AND FEDERAL LAW § 41.01 (Michael B. Gerrard ed., 1992).

118 33 U.S.C. §§ 1311, 1313(c)–(d); 40 C.F.R. § 130.2(j) (2001).

119 *Supra* note 118; *see also* SALZMAN & THOMPSON, *supra* note 113, at 150–66.

SWQS.[120] The TMDL is then used to establish effluent limitations for discharge permits into the impaired watercourse.[121] These permits, issued under the National Pollutant Discharge Elimination System (NPDES) of section 302 of the CWA, authorize point source discharges of pollutants to CWA-jurisdictional waters.[122] The U.S. Army Corps of Engineers oversees and implements a separate permitting system under section 404 of the CWA for dredge and fill projects, which are typically required for dam construction and diversion projects, and as such, another example of the intersection of the Blue and Green Agendas.[123]

Groundwater quality protection at the local and national level has taken a similar standards/permit approach to command and control regulation of water pollution.[124] Such permits are often implemented under state law in the United States, but the federal government permits groundwater discharges in the Underground Injection Control (UIC) program of the Safe Drinking Water Act (SDWA).[125] Frequently, the standards applied in groundwater quality permitting are similar, if not identical, to the standards applied to protect drinking water sources or for treated drinking water.[126]

In the United States and internationally, quality standards for drinking water—meaning water treated for purposes of human consumption and delivered to the point of use—are aimed primarily at the protection of human health.[127] In the United States, drinking water quality standards or

120 33 U.S.C. § 1313(d); *see also* Victor B. Flatt, *Spare the Rod and Spoil the Law: Why the Clean Water Act Has Never Grown Up*, 55 ALA. L. REV. 595, 599 (2004) (noting the failure of the TMDL program to effectively address water quality due to a lack of enforceable timetables absent court orders).

121 *See supra* note 118; *see also* Larson, *supra* note 38.

122 *See supra* note 118; *see also* Lisa Heinzerling, *Selling Pollution, Forcing Democracy*, 14 STAN. ENVTL. L.J. 300, 302 (1995) (discussing how command and control regimes, like the CWA, dictate technology implementation without necessarily making precise decisions on permissible levels of pollution).

123 33 U.S.C. § 1344; *see also* Gregory J. Hobbs, Jr., *Priority: The Most Misunderstood Stick in the Bundle*, 32 ENVTL. L. 37, 54 (2002).

124 *See generally* Debbie Sivas, *Groundwater Pollution from Agricultural Activities: Policies for Protection*, 7 STAN. ENVTL. L.J. 117 (1988); Mary Christina Wood, *Regulating Discharges into Groundwater: The Crucial Link in Pollution Control Under the Clean Water Act*, 12 HARV. ENVTL. L. REV. 569 (1988).

125 *See, e.g.*; 42 U.S.C. § 300h(b)(1)(A) (2012); ARIZ. REV. STAT. ANN. § 49-241 (2016); New Mexico's Discharge Permit Program, 8 N.M. Reg. 676 (Aug. 15, 2002) (noting the applicable sections at § 20.6.2.5101). For an overview of the UIC program and the recently enacted exceptions to UIC for hydraulic fracturing, see Hannah Wiseman, *Untested Waters: The Rise of Hydraulic Fracturing in Oil and Gas Production and the Need to Revisit Regulation*, 20 FORDHAM ENVTL. L. REV. 115 (2009).

126 *Id.*; *see also* Charles B. Anderson, *Damage to Natural Resources and the Cost of Restoration*, 72 TUL. L. REV. 417, 449 (1997); Janet S. Herman et al., *Groundwater Ecosystems and the Service of Water Purification*, 20 STAN. ENVTL. L.J. 479, 482–83 (2001).

127 Safe Drinking Water Act, 42 U.S.C. § 300g-1(b)(4) (providing maximum contaminant levels to protect human health). For a discussion of the challenges and uncertainty associated with the science behind establishing drinking water quality standards, see Wendy E. Wagner, *Congress, Science, and Environmental Policy*, 1999 U. ILL. L. REV. 181,

"maximum contaminant levels" (MCLs), are set at a level as close as feasible to a level at which there are no known or anticipated health impacts.[128] The concept of feasibility, in the case of MCLs, takes into consideration treatment costs.[129] Internationally, many domestic drinking water-quality standards are based on the World Health Organization's (WHO) drinking water quality standards, which are also the standards relied upon by the World Bank in financing drinking water treatment and distribution systems.[130] As with MCLs, the WHO drinking water quality standards are explicitly based on a cost/benefit analysis and technical feasibility considerations.[131]

The combination of standards and permitting applied to discharge permits and water quality protection is similarly oriented toward feasibility and efficiency.[132] The objective of this standards/permit approach applied to water quality protection is to balance concerns for environmental integrity and human health against interests in economic development and the economic and technical feasibility of preventive or remedial actions aimed at water pollution.[133] This balancing of interests and pragmatic consideration of costs can be broadly defined as efficiency.[134] Water law's Green Agenda is vulnerable to arguments that it fails to acceptably achieve efficient outcomes.[135] Additionally, the Green Agenda arguably inappropriately priori-

209–11. For a discussion of the human health-oriented approach to the establishment of drinking water quality standards, see James Salzman, *Is It Safe to Drink the Water?*, 19 DUKE ENVTL. L. & POL'Y F. 1 (2008).

128 42 U.S.C. § 300g-1(b)(4)(A)–g-1(d).

129 *Id.*; *see also* Arden Rowell, *Allocating Pollution*, 79 U. CHI. L. REV. 985, 999–1000 (2012).

130 Aaron Ezroj, *How the European Union's WEEE & ROHS Directives Can Help the United States Develop a Successful National E-Waste Strategy*, 28 VA. ENVTL. L.J. 45, 71–72 (2010); Diane M. Kohn, Note, *Setting a Standard: Environmental Impact Assessment Policies of Multilateral Development Banks and Export Credit Agencies*, 9 ENVTL. LAW. 281, 286 (2002).

131 Salzman, *supra* note 127, at 39; *see also* Hugo Tremblay, *A Clash of Paradigms in the Water Sector? Tensions and Synergies Between Integrated Water Resources Management and the Human Rights-Based Approach to Development*, 51 NAT. RESOURCES J. 307, 351–52 (2011).

132 *See, e.g.*, BRUCE A. ACKERMAN ET AL., THE UNCERTAIN SEARCH FOR ENVIRONMENTAL QUALITY 270–73 (1974) (discussing the efficiency considerations associated with permit systems for water pollution control); Heinzerling, *supra* note 122, at 300 (evaluating the impacts of pollution permit systems and their orientation toward efficiency and cost/benefit analysis); Louis J. Kotzé & Rebecca Bates, *Similar but Different: Comparative Perspectives on Access to Water in Australia and South Africa*, 15 U. DENV. WATER L. REV. 221, 257 (2012) (comparing the role of efficiency and cost-benefit analysis in the water quality permitting regimes of Australia and South Africa).

133 *See, e.g.*, Robert W. Adler, *The Decline and (Possible) Renewal of the Aspiration in the Clean Water Act*, 88 WASH. L. REV. 759, 795–96 (2013); Cass R. Sunstein, *The Arithmetic of Arsenic*, 90 GEO. L.J. 2255, 2259 (2002).

134 *See* DOUGLASS C. NORTH, INSTITUTIONS, INSTITUTIONAL CHANGE AND ECONOMIC PERFORMANCE 112 (James Alt & Douglass North eds., 2004) (1990).

135 *See, e.g.*, Mark A. Latham, *(Un)Restoring the Chemical, Physical, and Biological Integrity of Our Nation's Waters: The Emerging Clean Water Act Jurisprudence of the Roberts Court*, 28 VA. ENVTL. L.J. 411 (2010); Jonathan S. Masur & Eric A. Posner, *Against Feasibility Analysis*, 77 U. CHI. L. REV. 657 (2010) (providing a critique of feasibility analyses like those applied to

tizes efficient protection over maximum protection or some other goal for the protection of human health and the environment.[136] Nevertheless, the express language of water quality statutes and regulation and the implied intent in their implementation evince that efficiency is a major, if not the primary, goal of such regulatory regimes.[137] As such, the combined primary aims of the Blue and Green Agendas of water law are equity in water distribution and efficiency in the promotion and protection of water quality.[138] Despite the breadth and importance of these aims, water law nevertheless remains incomplete in the scope and significance of its aspirations and influence.

C. Water Law's Red Agenda

Water law and policy should more highly prioritize, and more effectively integrate, the Red Agenda. The Red Agenda aims domestic and international water law toward preventing and mitigating the outbreak of communicable diseases.[139] The Red Agenda focuses on managing the interaction between human communities and the aquatic habitats of disease vectors in the development of water delivery infrastructure, and prioritizes prevention, treatment, and mitigation of waterborne pathogens in the development of drinking water systems.[140] While the Green Agenda focuses on protecting human health from contaminants, the Red Agenda focuses on protection from pathogens.

To the extent the Red Agenda is already part of water law and policy, it is only in two small ways. First, the Red Agenda is arguably a minor appendage to the Green Agenda's general protection of human health and its pursuit of "clean water" by, for example, establishing drinking water standards for fecal coliforms or discharge permits for wastewater treatment plants.[141] Second,

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the EPA's water quality protection programs); J.B. Ruhl, *Farms, Their Environmental Harms, and Environmental Law*, 27 ECOLOGY L.Q. 263 (2001) (analyzing the failure of environmental law to curb environmental harms caused by farms).

136 *See, e.g.*, John Bronsteen et al., *Well-Being Analysis vs. Cost-Benefit Analysis*, 62 DUKE L.J. 1603, 1633–36 (2013); Howard Latin, *Ideal Versus Real Regulatory Efficiency: Implementation of Uniform Standards and 'Fine-Tuning' Regulatory Reforms*, 37 STAN. L. REV. 1267 (1985). *See generally* FRANK ACKERMAN & LISA HEINZERLING, PRICELESS: ON KNOWING THE PRICE OF EVERYTHING AND THE VALUE OF NOTHING 35 (2004).

137 John C. Dernbach, *The Unfocused Regulation of Toxic and Hazardous Pollutants*, 21 HARV. ENVTL. L. REV. 1 (1997); Jonathan Baert Wiener, *Global Environmental Regulation: Instrument Choice in Legal Context*, 108 YALE L.J. 677 (1999).

138 *See* Richard O. Zerbe Jr., *An Integration of Equity and Efficiency*, 73 WASH. L. REV. 349 (1998) (discussing the difficulties of aligning equity and efficiency in achieving public policy results).

139 *See, e.g.*, Julia A. Jones, Comment, *International Control of Cholera: An Environmental Perspective to Infectious Disease Control*, 74 IND. L.J. 1035 (1999).

140 *See, e.g.*, Elizabeth Cooper, *Social Risk and the Transformation of Public Health Law: Lessons from the Plague Years*, 86 IOWA L. REV. 869 (2001).

141 Mary Jane Angelo & Jon Morris, *Maintaining a Healthy Water Supply While Growing a Healthy Food Supply: Legal Tools for Cleaning up Agricultural Water Pollution*, 62 U. KAN. L. REV.

the Red Agenda is incidentally pursued along with the Blue Agenda's goal of sufficient water quantity, in which case human health is improved through access to water for hygiene and sanitation.[142] Nevertheless, as argued below, these minor nods toward the Red Agenda are not only inadequate to address the massive global problem of communicable disease epidemics, but frequently, the pursuit of the Blue and Green Agendas interferes with the Red Agenda.

Advancing the Red Agenda and more effectively integrating it within water law and policy requires understanding the inexorable link between communicable disease and water management.[143] One of the most important ways in which this connection between water and communicable diseases has been framed is in the functional classification of diseases by route of transmission, commonly referred to as Bradley Classifications in epidemiology.[144] The Bradley Classifications divide communicable diseases into four classes depending on the type of agent and transmission route, all of which are associated with water.[145] What is striking about the Bradley Classification system is how many major communicable diseases fit into one of these four water-related classes.

The first class includes waterborne infections.[146] Waterborne infections are those that occur by directly ingesting the microbial pathogen.[147] Waterborne infections include cholera, typhoid, *Cryptosporidium*, giardia, *E. coli*,

1003, 1033 (2014) (noting the ostensible goal of water pollution law as the protection of human health). *But see* Hannah Wiseman, *Fracturing Regulation Applied*, 22 DUKE ENVTL. L. & POL'Y F. 361, 368–69 (2012) (noting the commentators who have argued that water quality protection laws have failed to adequately protect human health).

142 *See, e.g.*, Amy Hardberger, *Life, Liberty, and the Pursuit of Water: Evaluating Water as a Human Right and the Duties and Obligations It Creates*, 4 NW. U. J. INT'L HUM. RTS. 331 (2005) (discussing the role of the human right to access water in improving human health); Sharmila L. Murthy, *The Human Right(s) to Water and Sanitation: History, Meaning, and the Controversy Over-Privatization*, 31 BERKELEY J. INT'L L. 89, 99–100 (2013) (discussing the impacts for human health associated with an effective human right to sanitation). *But see* Larson, *Interstitial Federalism*, *supra* note 36, at 924 (discussing the limits of the human right to water in protecting human health).

143 *See, e.g.*, Robin Kundis Craig, *Removing the "Cloak of a Standing Inquiry": Pollution Regulation, Public Health, and Private Risk in the Injury-in-Fact Analysis*, 29 CARDOZO L. REV. 149, 164 (2007); *see also* STEVEN JOHNSON, THE GHOST MAP: THE STORY OF LONDON'S MOST TERRIFYING EPIDEMIC—AND HOW IT CHANGED SCIENCE, CITIES, AND THE MODERN WORLD 30–44, 103–05 (2006) (describing the relationship between the management of water and sanitation and cholera epidemics in nineteenth-century London).

144 GILBERT F. WHITE ET AL., DRAWERS OF WATER: DOMESTIC WATER USE IN EAST AFRICA (1972); *see also* J. Bartram & R. Carr, *An Introduction to Emerging Waterborne Zoonoses and General Control Principles, in* WATERBORNE ZOONOSES: IDENTIFICATION, CAUSES, AND CONTROL 17, 18 (J.A. Cotruvo et al. eds., 2004) [hereinafter WATERBORNE ZOONOSES].

145 WHITE ET AL., *supra* note 144; *see also* D.D. Mara & R.G.A. Feachem, *Water- and Excreta-Related Diseases: Unitary Environmental Classification*, 125 J. ENVTL. ENGINEERING 334 (1999).

146 WHITE ET AL., *supra* note 144.

147 *Id.*; *see also* C.L. Moe, *What Are the Criteria for Determining Whether a Disease Is Zoonotic and Water Related?*, *in* WATERBORNE ZOONOSES, *supra* note 144, at 27.

and other pathogens that can survive in water and can be transmitted through ingestion.[148] Typically, these pathogens are enteric microorganisms introduced to the aquatic environment by fecal contamination.[149] Symptoms of such diseases include abdominal pain, diarrhea, dehydration, and fever.[150] Transmission and ultimate infection depend on the degree of contamination, the survival of the pathogen in the aquatic environment, infectivity of the pathogen, and the degree of individual exposure to the contaminated water.[151] Preventative measures include improved sanitation infrastructure to prevent fecal contamination and improved treatment of drinking water (including disinfection by chlorine or chlorine dioxide).[152] Because of generally poor sanitation and inadequate treatment, waterborne disease outbreaks are particular deadly in the developing world.[153] At least 1.8 million people die annually from waterborne diseases like cholera, with children under the age of five constituting ninety percent of those deaths.[154] Waterborne diseases constitute eighty percent of all illnesses in the developing world.[155]

Outbreaks of *Cryptosporidium*, however, are relatively common even in developed countries.[156] One outbreak in Wisconsin in 1993 infected over 400,000 people and resulted in over 100 deaths.[157] Unlike bacterial pathogens like cholera and typhoid, *Cryptosporidium* is a protozoon that, during the oocyst stage of its lifecycle, is remarkably resilient to traditional means of

148 Moe, *supra* note 147, at 31–32.

149 *Id.*

150 Christine L. Moe, *Waterborne Transmission of Infectious Agents*, *in* MANUAL OF ENVIRONMENTAL MICROBIOLOGY 222, 222–48 (Christon J. Hurst et al. eds., 3d ed. 2007).

151 *Id.*

152 *See, e.g.*, Thomas Clasen et al., *Microbiological Effectiveness and Cost of Disinfecting Water by Boiling in Semi-Urban India*, 79 AM. J. TROPICAL MED. HYGIENE 407 (2008); J.V. Pinfold, *Faecal Contamination of Water and Fingertip-Rinses as a Method for Evaluating the Effect of Low-Cost Water Supply and Sanitation Activities on Faeco-Oral Disease Transmission II: A Hygiene Intervention Study in Rural North-East Thailand*, 105 EPIDEMIOLOGY & INFECTION 377 (1990); Mark A. Shannon et al., *Science and Technology for Water Purification in the Coming Decades*, 452 NATURE 301 (2008).

153 *See generally* José Martines et al., *Diarrheal Diseases*, *in* DISEASE CONTROL PRIORITIES IN DEVELOPING COUNTRIES 91, 91–99 (Dean T. Jamison et al. eds., 1993); *see also* Itzchak Kornfeld, *A Global Water Apartheid: From Revelation to Resolution*, 43 VAND. J. TRANSNAT'L L. 701, 708–09 (2010).

154 Kornfeld, *supra* note 153, at 708. The 1.6 million children who die annually from waterborne diseases is five times the number of deaths annually from HIV/AIDS. *Id.*

155 William L. Andreen, *Environmental Law and International Assistance: The Challenge of Strengthening Environmental Law in the Developing World*, 25 COLUM. J. ENVTL. L. 17, 18–19 (2000).

156 Ida Ngueng Feze et al., *The Regulation of Novel Water Quality Assessment Biotechnologies: Is Canada Ready to Ride the Next Wave?*, 26 J. ENVTL. L. & PRAC. 201, 206–07 (2014).

157 *Id.*; *see also* Jeffrey P. Davis, *The Massive Waterborne Outbreak of* Cryptosporidium *Infections, Milwaukee, Wisconsin, 1993*, *in* OUTBREAK INVESTIGATIONS AROUND THE WORLD: CASE STUDIES IN INFECTIOUS DISEASE FIELD EPIDEMIOLOGY 197, 219, 223 (Mark S. Dworkin ed., 2010).

disinfection, including by chlorine.[158] Addressing *Cryptosporidium* outbreaks has required innovative approaches to drinking water treatment, including increased and improved reliance on membrane filtration and implementation of ultraviolet radiation treatment.[159]

The second class includes water-washed infections.[160] Such infections arise due to inadequate water for personal and domestic hygiene.[161] Water-washed infections include shigella, trachoma, and scabies.[162] Shigella is a bacterium closely related to salmonella, and one of the leading causes of dysentery in the world.[163] Trachoma is caused by chlamydia bacteria in the eye, and is an extreme form of conjunctivitis that can result in blindness.[164] Scabies is a skin infestation of mites, and infects over 100 million people worldwide.[165] In each case, infection results in part from the lack of available water resources to promote adequate hygiene. One of the seminal longitudinal studies associated with water-washed diseases is called *Drawers of Water*.[166] That study demonstrated marked improvement in the health of communities in Uganda, including significant decline in the prevalence of water-washed infections, when water gathering containers changed from small peanut oil cans to larger plastic jugs.[167]

One of the implications of *Drawers of Water* is the prioritization of access to clean water for hygiene purposes in public health policy.[168] The importance of water access for hygiene can be seen in the 2014 Ebola outbreak.[169] One of the most significant aggravating factors of the Ebola outbreak in West Africa was the lack of water for hygiene, and one of the reasons Ebola was effectively contained within developed countries was the ready availability of

158 *See supra* note 157; *see also* Panagiotis Karanis et al., *Waterborne Transmission of Protozoan Parasites: A Worldwide Review of Outbreaks and Lessons Learnt*, 5 J. WATER & HEALTH 1, 2 (2007).

159 STEVE E. HRUDEY & ELIZABETH J. HRUDEY, ENSURING SAFE DRINKING WATER: LEARNING FROM FRONTLINE EXPERIENCE WITH CONTAMINATION 11–21 (2014).

160 WHITE ET AL., *supra* note 144; *see also* Mara & Feachem, *supra* note 145, at 334.

161 Mara & Feachem, *supra* note 145, at 334; *see also* Moe, *supra* note 147, at 31–32.

162 Moe, *supra* note 150, at 226.

163 Minnie M. Mathan & V.I. Mathan, *Ultrastructural Pathology of the Rectal Mucosa in* Shigella *Dysentery*, 123 AM. J. PATHOLOGY 25 (1986). Dysentery is the inflammation of the intestine resulting in diarrhea with blood, and is a symptom of both bacterial infections (like shigella) and amoebic infections (like that of *Entamoeba histolytica*). *Id.* at 37.

164 Thomas M. Lietman et al., *Clinically Active Trachoma Versus Actual Chlamydial Infection*, 172 MED. J. AUSTL. 93 (2000).

165 Larry G. Arlian et al., *Resistance and Immune Response in Scabies-Infested Hosts Immunized with* Dermatophagoides *Mites*, 52 AM. J. TROPICAL MED. & HYGIENE 539 (1995).

166 WHITE ET AL., *supra* note 144; *see* JOHN THOMPSON ET AL., INT'L INST. FOR ECON. DEV., DRAWERS OF WATER II: 30 YEARS OF CHANGE IN DOMESTIC WATER USE & ENVIRONMENTAL HEALTH IN EAST AFRICA (2002), http://pubs.iied.org/pdfs/9049IIED.pdf.

167 *Id.* at 38.

168 *Id.* at 75; *see also* Peter H. Gleick, *Basic Water Requirements for Human Activities: Meeting Basic Needs*, 21 WATER INT'L 83 (1996).

169 *See generally* James G. Hodge, Jr. et al., *Global Emergency Legal Responses to the 2014 Ebola Outbreak*, 42 J.L. MED. & ETHICS 595, 597 (2014).

clean water and flushing toilets.[170] The lawsuit against the UN seeking damages associated with the Haitian cholera outbreak blamed the UN for failing to screen workers for infectious diseases.[171] But just as important a factor in the ultimate severity of the epidemic was the lack of adequate sanitation infrastructure and clean water in Haiti.[172] Had there been flushing toilets and plenty of water for washing hands and food, cholera would likely have flared and burned out quickly in Haiti, as it does whenever it emerges in developed countries.[173] Instead, cholera is likely now an endemic disease in Haiti, and costs much more in terms of loss of life than the cost of adequate sanitation.[174]

The third class includes water-based infections.[175] Water-based infections are those in which the pathogen spends part of its life inside vectors whose primary habitat is aquatic, like a snail or a water flea (a small crustacean).[176] This aquatic vector is the primary transmission pathway into human populations.[177] Water-based infections include guinea worm and schistosomiasis.[178] A person is infected by guinea worm diseases, also called dracunculiasis, by ingesting water containing water fleas, which carry the guinea worm larvae.[179] Schistosomiasis is a disease caused by flat worms that are released from freshwater snails and burrow through human skin.[180] Once in the human body, the lifecycle of the worm proceeds, with the worm traveling to the lungs, liver, kidneys, bladder, and even the brain.[181] Symptoms can include abdominal pain, diarrhea, and blood in the stool and urine, and infection can lead to liver damage, kidney failure, infertility, cancer, learning disabilities, and death.[182] Humans are generally infected by swimming or wading in freshwater infested with infected snails. Schistosomiasis affects nearly 210 million people worldwide, with as many as 200,000

170 Hickox, *supra* note 43, at 17.

171 Ed Pilkington, *Haitians Launch New Lawsuit Against UN over Thousands of Cholera Deaths*, GUARDIAN (Mar. 11, 2014), https://www.theguardian.com/world/2014/mar/11/haiti-cholera-un-deaths-lawsuit.

172 David A. Walton & Louise C. Ivers, *Responding to Cholera in Post-Earthquake Haiti*, 364 N. ENGL. J. MED. 3, 4 (2011).

173 Concannon Jr. & Lindstrom, *supra* note 29, at 1167–68.

174 Kashmira A. Date et al., *Considerations for Oral Cholera Vaccine Use During Outbreak After Earthquake in Haiti, 2010–2011*, 17 EMERGING INFECTIOUS DISEASES 2105 (2011).

175 WHITE ET AL., *supra* note 144; *see also* Mara & Feachem, *supra* note 145, at 334–35.

176 *See supra* note 175.

177 *See supra* note 175.

178 *See supra* note 175.

179 Chris Greenaway, *Dracunculiasis (Guinea Worm Disease)*, 170 CAN. MED. ASS'N J. 495 (2004).

180 Edward J. Pearce & Andrew S. MacDonald, *The Immunobiology of Schistosomiasis*, 2 NATURE REVS. IMMUNOLOGY 499 (2002).

181 Allen W. Cheever, *Schistosomiasis: Infection Versus Disease and Hypersensitivity Versus Immunity*, 142 AM. J. PATHOLOGY 699 (1993).

182 *Id.*

deaths annually.[183] Like guinea worm, it is considered by the WHO to be a neglected tropical disease in terms of invested research in treatment and prevention.[184]

The fourth class includes water-related infections.[185] Water-related infections are those in which the pathogen spends part of its life in a vector who breeds in aquatic environments, like mosquitoes or flies.[186] Water-related infections include malaria, West Nile virus, dengue fever, yellow fever, chikungunya, sleeping sickness, and filariasis.[187] The pathogen in each case is carried by the vector and transmitted to humans by the vector's bite.[188] These vectors breed and have their larval stage in aquatic environments.[189] The health effects of the different water-related infections vary. Malaria is the infection of a protozoan carried by mosquitoes and results in fever, fatigue, aches, vomiting, and in severe cases, seizures, coma, and death.[190] The West Nile, Zika, dengue, yellow fever, and chikungunya viral infections have malaria-like symptoms.[191]

These water-related infections have varying levels of effective treatments.[192] However, they represent collectively one of the greatest threats to human life.[193] Malaria alone kills between 600,000 and 900,000 people each year.[194] While the majority of water-related infections occur in developing countries, small West Nile outbreaks are increasingly common in the developed world.[195] For each of these water-related infections, and regardless of

183 *Id.*; *see also* Bruno Gryseels et al., *Human Schistosomiasis*, 368 LANCET 1106, 1113 (2006).

184 John O. Gyapong et al., *Integration of Control of Neglected Tropical Diseases into Health-Care Systems: Challenges and Opportunities*, 375 LANCET 160 (2010).

185 WHITE ET AL., *supra* note 144; *see also* Mara & Feachem, *supra* note 145, at 334.

186 *Supra* note 185.

187 *Supra* note 185; *see also* Stuart Batterman et al., *Sustainable Control of Water-Related Infectious Diseases: A Review and Proposal for Interdisciplinary Health-Based Systems Research*, 117 ENVTL. HEALTH PERSP. 1023 (2009).

188 *Supra* note 187.

189 *Supra* note 187; *see also* Gerry F. Killeen et al., *Habitat Targeting for Controlling Aquatic Stages of Malaria Vectors in Africa*, 74 AM. J. TROPICAL MED. HYGIENE 517 (2006).

190 William R. Brieger, *Pile Sorts as a Means of Improving the Quality of Survey Data: Malaria Illness Symptoms*, 9 HEALTH EDUC. RES. 257 (1994).

191 Dirk M. Elston, *Life-Threatening Stings, Bites, Infestations, and Parasitic Diseases*, 23 CLINICS IN DERMATOLOGY 164, 167–68 (2005).

192 *See, e.g.*, Davidson H. Hamer et al., *Improved Diagnostic Testing and Malaria Treatment Practices in Zambia*, 297 J. AM. MED. ASSOC. 2227 (2007); Zvi Shimoni et al., *Treatment of West Nile Virus Encephalitis with Intravenous Immunoglobulin*, 7 EMERGING INFECTIOUS DISEASES 759 (2001).

193 Duane J. Gubler, *Resurgent Vector-Borne Diseases as a Global Health Problem*, 4 EMERGING INFECTIOUS DISEASES 442 (1998); Atul A. Khasnis & Mary D. Nettleman, *Global Warming and Infectious Disease*, 36 ARCHIVES MED. RES. 689 (2005).

194 WORLD HEALTH ORG., WORLD MALARIA REPORT 2014, at 32 (2014).

195 Edward B. Hayes & Duane J. Gubler, *West Nile Virus: Epidemiology and Clinical Features of an Emerging Epidemic in the United States*, 57 ANN. REV. MED. 181 (2006); Sean B. Hecht, *Climate Change and the Transformation of Risk: Insurance Matters*, 55 UCLA L. REV. 1559, 1575–76 (2008).

location, vector control remains a critical measure for the prevention of epidemics.[196]

A review of the Bradley Classifications emphasizes the importance of the Red Agenda and orients its aims. First, the Red Agenda promotes improved drinking water treatment, and prioritizes microbial pathogen disinfection in the treatment and distribution of drinking water and in the establishment of drinking water standards. The Red Agenda also emphasizes the role of water law in making water available for hygiene and sanitation, and encourages investment in sanitation infrastructure. Additionally, the Red Agenda focuses on disease prevention, and in particular, the role of law in influencing land use, pesticide applications, and water resource development to prevent or mitigate increased intersection of disease vector habitat and human communities. These aims of the Red Agenda can be broadly defined as resiliency to Bradley Classification infections within human communities. Resiliency, like equity and efficiency, is an expansive term with malleable connotations. Nevertheless, it roughly captures the primary goal of the Red Agenda, which is to save human lives and avoid or mitigate human suffering.

There are few instances in water law where the Red Agenda takes prominence. For example, the SDWA's MCLs and the WHO's drinking water standards set limits on fecal coliforms, and impose disinfectant requirements to ensure adequate treatment for pathogens.[197] Discharge permits for treated wastewater are generally designed to establish effluent limits for fecal coliforms, and surface water quality standards typically address bacteria.[198] These, however, are only a few narrow instances in which water law explicitly and directly advances the Red Agenda, and even then, it does so as part of the broader standards and permitting scheme of the Green Agenda and only in the context of waterborne pathogens.

The litigation relating to the UN's role in the Haitian cholera epidemic is illustrative of one possible approach to advancing the Red Agenda in international water law in the context of waterborne outbreaks.[199] International law could require the screening of aid workers and establish minimum sanitation practices to avoid the introduction of pathogens into an environment in ways that would risk outbreaks.[200] While the immunity claimed by the UN

196 David P. Fidler, *Return of the Fourth Horseman: Emerging Infectious Diseases and International Law*, 81 MINN. L. REV. 771, 802–03 (1997); Douglas E. Norris, *Mosquito-Borne Diseases as a Consequence of Land Use Change*, 1 ECOHEALTH 19 (2004).

197 William E. Cox, *Evolution of the Safe Drinking Water Act: A Search for Effective Quality Assurance Strategies and Workable Concepts of Federalism*, 21 WM. & MARY ENVTL. L. & POL'Y REV. 69, 111–12 (1997); Judith Kimerling, *International Standards in Ecuador's Amazon Oil Fields: The Privatization of Environmental Law*, 26 COLUM. J. ENVTL. L. 289, 371 n.229 (2001).

198 *See, e.g.*, Paul W. Morenberg, Comment, *Environmental Fraud by Government Contractors: A New Application of the False Claims Act*, 22 B.C. ENVTL. AFF. L. REV. 623, 666 n.381 (1995); *see also* Lee R. Okster, *Smithfield Foods: A Case for Federal Action*, 23 WM. & MARY ENVTL. L. & POL'Y REV. 381 (1999).

199 Knudsen, *supra* note 24, at 15–16.

200 *Id.*; *see also* Rosa Freedman, *UN Immunity or Impunity? A Human Rights Based Challenge*, 25 EUR. J. INT'L L. 239, 240 (2014).

from liability associated with the outbreak would encourage investment by the international community in humanitarian response, the UN could establish a trust fund comparable to the compensation regimes used in black lung cases in the United States to compensate victims of epidemics that originate from international humanitarian projects.[201] Countries investing in humanitarian aid could be required to invest a minimum percentage in a trust fund or insurance policy aimed at compensating potential victims of disease epidemics, and toward disease treatment, containment, and prevention.

The ongoing Zika virus outbreak spreading rapidly throughout the Western Hemisphere also provides helpful context for understanding the role of the Red Agenda in domestic water law in the context of water-related outbreaks.[202] Zika is a mosquito-borne virus similar to the dengue, West Nile, and yellow fever viruses.[203] The virus was likely brought into Brazil during the 2014 World Cup.[204] Since then, there have been over 2400 cases (compared to 147 cases the previous year), and as many as 40 deaths.[205] More alarming, however, have been the first documented cases connecting Zika infection with microcephaly in infants.[206] Microcephaly is a birth defect resulting in an undersized head and underdeveloped brain, leading to development issues and premature death.[207] The current Zika outbreak is the largest recorded, and the first to suggest a connection between Zika infection and microcephaly.[208]

The response from the Brazilian government has ranged from advising citizens against becoming pregnant to establishing a task force to eliminate stagnant water bodies where mosquitoes might breed.[209] Management of surface water resources to limit mosquito breeding during Brazil's wet season becomes the nation's best option, as there are no vaccines or cures for Zika. The Zika outbreak has the potential to become an international issue as well, as was evidenced with news coverage of Zika during the 2016 Summer Olympics in Rio. The Zika epidemic appears to be following the same epidemiological path as recent outbreaks of a similar mosquito-borne virus, chikungunya.[210] That virus has extended throughout much of Latin

201 Freedman, *supra* note 200, at 39–41; *see also* Allen R. Prunty & Mark E. Solomons, *The Federal Black Lung Program: Its Evolution and Current Issues*, 91 W. VA. L. REV. 665, 683–84 (1989).

202 Johnson et al., *supra* note 32; *see also* Darlington, *supra* note 32.

203 Edward B. Hayes, *Zika Virus Outside Africa*, 15 EMERGING INFECTIOUS DISEASE 1347, 1347 (2009).

204 Darlington, *supra* note 32.

205 *Id.*; Johnson et al., *supra* note 32.

206 Darlington, *supra* note 32; Johnson et al., *supra* note 32.

207 Darlington, *supra* note 32; Johnson et al., *supra* note 32; *see also* Madeline A. Lancaster et al., *Cerebral Organoids Model Human Brain Development and Microcephaly*, 501 NATURE 373, 373 (2013).

208 Johnson et al., *supra* note 32.

209 *Id.*

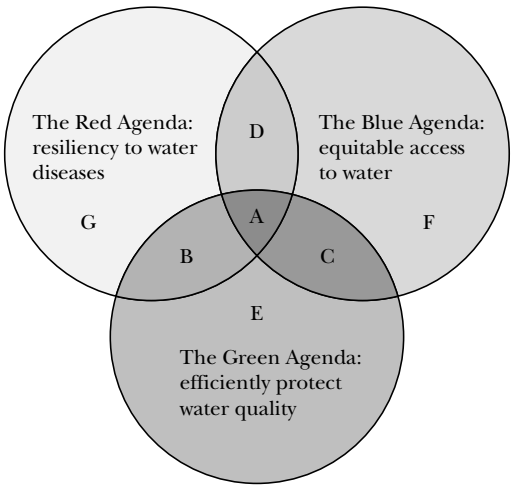
210 *Id.*

America[211] and the southwestern United States.[212] Water law may ultimately play the most significant role in containing the disease by facilitating pesticide applications to breeding habitats, limiting development projects that result in standing water, and regulating the development of irrigation, wetland, sewage, and storage infrastructure. Water law, in pursuing the Red Agenda, seeks to make communities resilient to these kinds of epidemics, while still meeting its goals of equitable water apportionment and efficient water quality protection.

D. How the Three Agendas of Water Law Interact

The Red, Green, and Blue Agendas of water law interact in a myriad of ways. The Venn diagram below provides an illustration upon which a discussion of these interactions can be based:

FIGURE 2: VENN DIAGRAM OF THE THREE WATER LAW AGENDAS



As illustrated in this diagram, the three agendas of water law interact in important ways. For example, in Area A of the diagram, all three agendas are integrated. An example of a water law that integrates all three agendas might be legal incentives for water efficiency, like irrigation duties or minimum water efficiencies for appliances. In that case, more water is available for the environment to protect aquatic habitat and to dilute pollution, thus advancing the Green Agenda. More water is available for domestic, industrial, and agricultural uses, and for water banking, thus advancing the Blue Agenda.

211 CDC, *Chikungunya Virus: Geographic Distribution* (May 12, 2016), https://www.cdc.gov/chikungunya/geo/.

212 CDC, *Chikungunya Virus: 2016 Provisional Data for the United States* (Nov. 22, 2016), https://www.cdc.gov/chikungunya/geo/united-states-2016.html.

And more water is available for hygiene and sanitation, thus preventing water-washed and waterborne diseases and advancing the Red Agenda.

Area B of the diagram would include ways in which the Red and Green Agendas reinforce one another. For example, prohibitions against untreated discharges from wastewater treatment plants to rivers would protect rivers from nutrient pollution and also limit exposure to diseases resulting from fecal contamination, thus advancing both the Green and Red Agendas. Area C is the intersection of the Blue and Green Agendas, which could refer to improved irrigation techniques that would enhance water available for agriculture under the Blue Agenda while limiting pollution from irrigation runoff under the Green Agenda. Area D is the intersection of the Red and Blue Agendas, which would include investments in water infrastructure to deliver treated drinking water to households. This diagram illustrates many ways in which water law's three agendas are mutually reinforcing.

Nevertheless, there are areas in which water law's three agendas may ignore the aims of the other agendas, or even be implemented in ways that conflict with those aims. In Area G, for example, the dumping of enormous concentrations of disinfectants and pesticides into rivers and lakes in the name of preventing waterborne or water-related diseases might inappropriately prioritize the Red Agenda over the Green. A large rice irrigation project might advance the Blue Agenda in Area F, but bring disease vectors closer to humans and result in fertilizer and pesticide contamination, thus frustrating the aims of the Green and Red Agendas.

The ongoing water crisis in Flint, Michigan, can be better understood through this framework. To address resource restraints associated with water service, the city of Flint ceased purchasing water from Detroit and instead shifted its primary water source to the nearby Flint River.[213] Lowering water costs and shifting to a closer source is an example of Blue Agenda thinking. However, the shift has resulted in a major public health crisis, including a spike in Legionnaires' Disease, a waterborne bacterial infection, in Flint.[214] Had water planners integrated the Red Agenda into planning, they may have been more likely to consider the status of the new water source in terms of the potential for waterborne pathogen outbreaks. Additionally, the Blue Agenda approach that led to reliance on the Flint River as a drinking water source arguably failed to adequately integrate the Green Agenda by not considering the corrosive nature of the Flint River water caused by chloride contamination.[215]

213 Hannah Rappleye et al., *Bad Decisions, Broken Promises: A Timeline of the Flint Water Crisis*, NBC NEWS (Jan. 19, 2016), http://www.nbcnews.com/news/us-news/bad-decisions-broken-promises-timeline-flint-water-crisis-n499641.

214 Suzannah Gonzales, *Legionnaires' Spike in Michigan County Dealing with Water Crisis*, REUTERS (Jan. 13, 2016), http://www.reuters.com/article/us-michigan-water-idUSKCN0UR23120160113.

215 Stephen Rodrick, *Who Poisoned Flint, Michigan?*, ROLLING STONE (Jan. 22, 2016), http://www.rollingstone.com/politics/news/who-poisoned-flint-michigan-20160122.

The crisis in Flint is arguably an example of pure Blue thinking, lodged in Area F of Figure 2 and failing to adequately integrate the other agendas. The fundamental importance of the three-agendas framework is to encourage an integrated approach to the development and implementation of water law and policy, and avoid or mitigate conflicts between these agendas, like that in Flint. This integrated approach should result in a water policy that efficiently protects water quality (Green), equitably apportions water quantity (Blue), and enhances resilience to water diseases (Red).

II. Conflicting Agendas in Water Law

The tripartite aims of water law and policy are thus equity in water distribution and access (the Blue Agenda), efficiency in water quality protection and remediation (the Green Agenda), and resiliency to diseases classified under the Bradley Classifications (the Red Agenda). The inherent breadth and ambiguity of these terms are a double-edged sword, making it both simple and complicated to reconcile these aims depending on how one defines them. There is nothing inevitably irreconcilable about the aims to promote equity, efficiency, and resiliency in the development and application of law.

The advancement of the Red Agenda in water law, however, is often incidental to the promotion of the other agendas. Furthermore, the Green and Blue Agendas are sometimes pursued in water law in ways that ignore, or even conflict with, the Red Agenda. This Part discusses three ways in which water law pursues the Green Agenda and the Blue Agenda to the detriment of the Red Agenda: (A) in the establishment of drinking water quality standards; (B) in the development of water infrastructure; and (C) in the interpretation of the right to water and a clean environment.

A. Drinking Water Quality Standards Conflicting with the Red Agenda

Drinking water quality standards would appear to be one part of water law that explicitly advances the Red Agenda. After all, the express purpose of the SDWA and its primary drinking water standards is the protection of public health.[216] As noted above, drinking water standards often directly address issues such as disinfection, minimum treatment techniques, and maximum levels of total coliforms.[217] Nevertheless, even in the area of water law most obviously and directly connected to disease prevention, the Red Agenda can be stifled by the Green Agenda.

For example, drinking water quality standards may establish maximum levels for disinfectant byproducts (DBPs).[218] DBPs are compounds produced from the reaction of disinfectants (like chlorine or chlorine dioxide) with

216 42 U.S.C. § 300f(1)(A) (2012); H.R. Rep. No. 93-1185 1 (1974); 1 World Health Org., Guidelines for Drinking-Water Quality 1 (3d ed. 2004).

217 *See* World Health Org., *supra* note 216, at 5; Keith S. Porter, *Fixing Our Drinking Water: From Field and Forest to Faucet*, 23 Pace Envtl. L. Rev. 389, 403 (2006).

218 *See* Larson, *The New Right in Water*, *supra* note 36, at 2234.

organic compounds in water.[219] For example, a reservoir may have elevated organic compounds like leaves and bark, resulting from storm runoff after a wildfire or bark beetle infestation in the surrounding forest. When that reservoir water is treated with chlorine to kill harmful bacteria, the chlorine will react with the organic compounds, producing DBPs like trihalomethane or haloacetic acid.[220] Chronic ingestion of elevated levels of DBPs in drinking water has been demonstrated to increase risk of cancer and neurological disorders.[221]

Where maximum chronic DBP standards are applied to drinking water in developing countries, the result is often prioritization of concerns for chronic DBP toxicity at the expense of effective treatment of pathogens.[222] Countries tend to focus on compliance with DBP standards by reducing treatment with disinfectants.[223] This may be a rational tradeoff in some developed countries where the risk of cholera or typhoid is minimal, effective treatment options are available, and improved sanitation and hygiene practices would limit any outbreak.[224] However, the threat posed by microbial pathogens in developing countries is far greater than the health effects of chronic elevated DBP concentrations.[225] In the case of DBP standards, the aims of the Green Agenda to efficiently protect water quality at reasonable costs interfere with improving community resilience to waterborne pathogens like cholera, and thus conflict with the Red Agenda.

Drinking water quality standards fail to integrate the Red Agenda in other ways as well, and in ways that impact communities in both developed and developing nations. There is growing pressure on regulators to improve drinking water quality by addressing possible chemical threats to human

219 Guanghui Hua & David A. Reckhow, *Comparison of Disinfection Byproduct Formation from Chlorine and Alternative Disinfectants*, 41 WATER RES. 1667, 1667 (2007).

220 *Id.*

221 *See* NAT'L RES. COUNCIL, WATERSHED MANAGEMENT FOR POTABLE WATER SUPPLY: ASSESSING THE NEW YORK CITY STRATEGY 23 (2000); Gary A. Boorman et al., *Drinking Water Disinfection Byproducts: Review and Approach to Toxicity Evaluation*, 107 ENVTL. HEALTH PERSP. 207 (1999); Barton H. Thompson, Jr., *Markets for Nature*, 25 WM. & MARY ENVTL. L. & POL'Y REV. 261, 296 n.132 (2000).

222 Nicholas John Ashbolt, *Risk Analysis of Drinking Water Microbial Contamination Versus Disinfection By-Products (DBPs)*, 198 TOXICOLOGY 255 (2004); *see also* Larson, *The New Right in Water*, *supra* note 36, at 2234.

223 Larson, *The New Right in Water*, *supra* note 36, at 2234.

224 *Id.*

225 *Id.* The World Health Organization has cautioned against universal, one-size-fits-all quality standards, noting that "[i]t must be emphasized that the guideline values recommended [by the WHO] are not mandatory limits. In order to define such limits, it is necessary to consider the guideline values in the context of local or national environmental, social, economic, and cultural conditions." Ashok Gadgil, *Drinking Water in Developing Countries*, 23 ANN. REV. ENERGY & ENV'T 253, 255 (1998) (internal quotation marks omitted) (quoting 2 WORLD HEALTH ORG., GUIDELINES FOR DRINKING-WATER QUALITY § 1.1 (2d ed. 1996)). To the extent a positive human right to water is framed as a requirement for water of "equal" quality across the globe, such a requirement could pose risks to public health.

health, such as pharmaceuticals or pesticides.[226] This pressure for more stringent drinking water standards, particularly in developed countries, results in increased costs to public water systems.[227] In some instances, however, more stringent drinking water standards may result in greater risks to human health. Small drinking water systems cannot achieve economies of scale, and often have limited bonding capacity, less access to credit and capital, and a smaller customer base.[228] Such systems may not be able to afford more stringent standards aimed at constituent chemicals that are difficult to detect, much less effectively treat.[229]

These systems may be forced to allocate scarce resources that could go toward treatment of microbial pathogens or toward monitoring for chemical constituents that are expensive to detect and treat. Under the SDWA, small public water systems that rely on surface water or groundwater under the direct influence of surface water must only monitor for *Cryptosporidium* if *E. coli* concentrations exceed a certain level.[230] For these systems, more stringent standards for chemical constituents may divert resources away from filtration or ultraviolet treatment needed to address *Cryptosporidium*.[231] As noted above, *Cryptosporidium* outbreaks are relatively common in the developing world and notoriously difficult and expensive to treat.[232] There are unquestionably health concerns associated with the presence of pharmaceuticals and pesticides in drinking water.[233] But the question is whether the risk associated with monitoring and treating these contaminants is as imminent

226 *See, e.g.*, Gabriel Eckstein, *Drugs on Tap: Managing Pharmaceuticals in Our Nation's Waters*, 23 N.Y.U. ENVTL. L.J. 37 (2015); Noah Sachs, *Blocked Pathways: Potential Legal Responses to Endocrine Disrupting Chemicals*, 24 COLUM. J. ENVTL. L. 289, 309 (1999).

227 Adam Babich, *Too Much Science in Environmental Law*, 28 COLUM. J. ENVTL. L. 119, 167 (2003); Michael Carney, *European Drinking Water Standards*, 83 J. AM. WATER WORKS ASS'N 48 (1991); David L. Markell, *The Role of Local Governments in Environmental Regulation: Shoring up Our Federal System*, 44 SYRACUSE L. REV. 885, 891 n.14 (1993) (citing ENVTL. PROT. AGENCY, EPA 230-R-93-007, LOCAL GOVERNMENT IMPLEMENTATION OF ENVIRONMENTAL MANDATES: FIVE CASE STUDIES, FINAL REPORT 11–14 (1993)).

228 Cox, *supra* note 197, at 154; *see also* Rena I. Steinzor, *Unfunded Environmental Mandates and the "New (New) Federalism": Devolution, Revolution, or Reform?*, 81 MINN. L. REV. 97, 208–09 (1996).

229 Cox, *supra* note 197, at 153; *see also* Paul Westerhoff et al., *Fate of Endocrine-Disruptor, Pharmaceutical, and Personal Care Product Chemicals During Simulated Drinking Water Treatment Processes*, 39 ENVTL. SCI. & TECH. 6649 (2005).

230 Long Term 2 Enhanced Surface Water Treatment Rule, 68 Fed. Reg. 47,640, 47,665 (proposed Aug. 11, 2003) (to be codified at 40 C.F.R. pt. 141, 142); AM. WATER WORKS ASS'N, DISTRIBUTION SYSTEM REGULATION 17 (2013), http://www.awwa.org/Portals/0/files/publications/documents/samples/20428-4e_excerpt.pdf (noting that the new rule permits small systems to perform initial *E. coli* monitoring to determine if *Cryptosporidium* monitoring is necessary).

231 J. Alan Roberson, *From Common Cup to Cryptosporidium: A Regulatory Evolution*, 98 AM. WATER WORKS ASS'N 198, 204 (2006).

232 Michael F. Craun et al., *Waterborne Outbreaks Reported in the United States*, 4 J. WATER & HEALTH 19 (2006).

233 *See* Eckstein, *supra* note 226; *see also* Sachs, *supra* note 226.

and serious to a given community as the threat of a waterborne disease outbreak like *Cryptosporidium*, and how systems evaluating these risks should allocate costs to mitigate them.

Similar issues arise in another aspect of the Green Agenda, though this applies to intentional criminal contamination of drinking water supplies rather than the more typical conception of pollution. Increased costs have been imposed on small systems in the wake of the terrorist attacks of September 11, 2001.[234] In an effort to protect drinking water systems from terrorist attacks, the SDWA was amended to require all community water systems (i.e., those systems serving at least fifteen service connections or twenty-five people year-round)[235] to conduct vulnerability assessments to chemical or biological attacks and prepare emergency response plans.[236] The costs associated with these assessments and emergency plans can be significant, particularly for smaller systems with already limited resources.

Increased regulatory compliance costs cannot be easily addressed by increasing rates, either, because these systems are typically regulated public utilities with a state agency setting their rates.[237] As such, small drinking water systems may be forced to expend limited resources on the prevention of, and response to, terrorist attacks rather than improved monitoring, filtration, and ultraviolet treatment for *Cryptosporidium*. A terrorist attack on any community's drinking water system would be catastrophic, and systems are well-advised to invest in the prevention of, and response to, such attacks. However, appropriate consideration of the Red Agenda would facilitate better assessment of the risks terrorism poses to a system as compared to *Cryptosporidium*.

However, integration of the Red Agenda alongside the Green Agenda would require an evaluation of the resiliency of the community to pathogens of concern, regardless of system size, in addition to the cost-benefit analysis associated with the application of more stringent standards for potentially toxic chemicals like biological or chemical weapons or pharmaceuticals or pesticides. Under the current approach, many small public water systems are forced to prioritize addressing toxic chemical constituents without knowing for certain whether microbial pathogens pose a greater threat to their consumers. Proper consideration of the Red Agenda would compel an evaluation of the relative risks posed to a given community and how best to allocate scarce resources to address these risks.

234 42 U.S.C. § 300i-2(a)(1) (2012). *See generally* Steven D. Shermer, *The Drinking Water Security and Safety Amendments of 2002: Is America's Drinking Water Infrastructure Safer Four Years Later?*, 24 UCLA J. ENVTL. L. & POL'Y 355 (2006).

235 42 U.S.C. § 300f(15).

236 42 U.S.C. § 300i-2(a)(1); *see also* AM. WATER WORKS ASS'N, PROTECTING OUR WATER: DRINKING WATER SECURITY IN AMERICA AFTER 9/11 (2003), http://www.awwa.org/publications/journal-awwa/abstract/articleid/14839.aspx.

237 Larson, *The New Right in Water*, *supra* note 36, at 2221–22.

B. Water Infrastructure Development Conflicting with the Red Agenda

Despite these conflicts between the Green and Red Agendas, there are ways—like fecal coliform standards—in which these two agendas reinforce each other. The Blue Agenda—the pursuit of equitable allocation of, and access to, water resources—can also reinforce the Red Agenda. The essential lesson from *Drawers of Water* is that simply providing adequate water quantity for hygiene purposes can have dramatic effects for the prevention of water-washed diseases, like scabies or trachoma.[238] Nevertheless, some efforts to improve access to water and equitably allocate water resources can aggravate public health issues related to microbial pathogens.[239] As with the Green Agenda and its emphasis on DBPs, the Blue Agenda can at times conflict with the Red Agenda.

The construction of reservoirs, man-made wetlands, irrigation systems, rice fields, and other infrastructure or built habitats could advance access to water and promote the Blue Agenda.[240] Indeed, there is pressing need throughout the world for increased investment in water infrastructure.[241] The need for increased investment in water infrastructure has led to increasing funds available from international development banks, non-governmental organizations, international development agencies, and incentives for private lenders and investors to support water projects like dams, water treatment plants, and irrigation systems.[242]

But these water projects could also frustrate the Red Agenda by bringing disease vector habitats closer to human communities.[243] This conflict results from a combination of factors that would be better addressed with improved integration of the Red Agenda in water law. These factors include deforestation and replacement of forest with irrigated agriculture or with cattle graz-

238 WHITE ET AL., *supra* note 144; *see also* Mara & Feachem, *supra* note 145, at 334.

239 David Bradley, *Institutional Capacity to Monitor the Interactions of Agricultural and Health Change*, *in* AGRICULTURE, ENVIRONMENT, AND HEALTH: SUSTAINABLE DEVELOPMENT IN THE 21ST CENTURY 308, 327 (Vernon W. Ruttan ed., 1994).

240 *See, e.g.*, Michael C. Blumm, *Public Choice Theory and the Public Lands: Why "Multiple Use" Failed*, 18 HARV. ENVTL. L. REV. 405, 410 n.37 (1994); Margaret J. Vick, *The Senegal River Basin: A Retrospective and Prospective Look at the Legal Régime*, 46 NAT. RESOURCES J. 211, 223 (2006).

241 David Grey & Claudia W. Sadoff, *Sink or Swim? Water Security for Growth and Development*, 9 WATER POL'Y 545 (2007).

242 *See, e.g.*, Richard Briffault, *The Most Popular Tool: Tax Increment Financing and the Political Economy of Local Government*, 77 U. CHI. L. REV. 65, 68 (2010); Craig, *supra* note 85, at 910–11; Thomas M. Kerr, *Supplying Water Infrastructure to Developing Countries Via Private Sector Project Financing*, 8 GEO. INT'L ENVTL. L. REV. 91, 92–95 (1995).

243 *See generally* Jonathan A. Patz et al., *Unhealthy Landscapes: Policy Recommendations on Land Use Change and Infectious Disease Emergence*, 112 ENVTL. HEALTH PERSP. 1092, 1092 (2004) (prescribing certain reforms in land use planning to prevent infectious disease outbreaks associated with agricultural development, deforestation, and population increases and shifts); *see also* Itzchak E. Kornfeld, *Adiós to Paradise: The Yacyretá Dam and the Destruction of Environmental and Human Rights*, 7 FLA. A&M U. L. REV. 181, 206–07 (2012).

ing requiring stock ponds for watering.[244] When replacement of forests with agriculture is combined with rising temperatures associated with global climate change, the conditions necessary for tropical disease vectors, like mosquitoes, to thrive and expand intersect with human communities.[245]

The example of the development of the Diama Dam is illustrative of the potential conflict between the Blue and Red Agendas in water law and policy.[246] In 1987, the first of a series of dams was completed on a tributary of the Senegal River in Mali, and the total project created a reservoir storage capacity of 11.3 billion cubic meters of water for irrigation, hydroelectric power, flood control, and human domestic and industrial uses.[247] The $150-million project, partially financed by the African Development Bank, was motivated in part by objectives to develop irrigated farming by controlling water resources and to regulate the navigability of rivers between Mali and Senegal.[248]

The dam allowed expansion of irrigation infrastructure, including in particular flood rice irrigation.[249] Although one of the stated objectives was to make the river navigable year-round,[250] implementation came at the cost of downstream farming[251] that had existed for centuries in the region. Within a year after the dam's completion, communities living near new irrigation projects in Senegal suffered a significant increase in waterborne, water-related, and water-based infections.[252] These included cholera epidemics and increased incidence of malaria.[253] Most significant, however, was a dramatic increase in schistosomiasis. Studies in 1988 and 1989 showed

244 William Jobin, Dams and Disease: Ecological Design and Health Impacts of Large Dams, Canals and Irrigation Systems 21 (1999); *see also* Patricia L. Farnese, *Searching for Wildlife: A Critique of Canada's Regulatory Response to Emerging Zoonotic Diseases*, 39 Queen's L.J. 471, 477–78 (2014).

245 Farnese, *supra* note 244, at 477–78.

246 Vick, *supra* note 240, at 215–18.

247 *Id.* at 216; *see also* S. Sow et al., *Water-Related Disease Patterns Before and After the Construction of the Diama Dam in Northern Senegal*, 96 Annals of Tropical Med. & Parasitology 575 (2002).

248 African Dev. Bank Grp., Senegal/Mali/Mauritania Diama Dam Project: Project Performance Evaluation Report (PPER) 1–8 (1988), http://www.afdb.org/fileadmin/uploads/afdb/Documents/Evaluation-Reports-_Shared-With-OPEV_/06004235-EN-MULTINATIONAL-DIAMA-DAM-PROJECT.pdf; David G. LeMarquand, *International Development of the Senegal River*, 15 Water Int'l 223, 225 (1990).

249 *See* Jennifer Keiser et al., *Effect of Irrigation and Large Dams on the Burden of Malaria on a Global and Regional Scale*, 72 Am. J. Tropical Med. & Hygiene 392, 394 (2005).

250 Andre DeGeorges & B.K. Reilly, Dams and Large Scale Irrigation on the Senegal River: Impacts on Man and the Environment 4 (2006), http://hdr.undp.org/sites/default/files/degeorges_andre.pdf.

251 *Id.* at 10.

252 *Id.* at 18; Keiser et al., *supra* note 249, at 401; V.R. Southgate, *Schistosomiasis in the Senegal River Basin: Before and After the Construction of the Dams at Diama, Senegal and Manantali, Mali and Future Prospects*, 71 J. Helminthology 125, 128 (1997). *But see* Sow et al., *supra* note 247, at 579–83.

253 *See* Keiser et al., *supra* note 249, at 398.

that sixty percent of the people living within the vicinity of the Diama Dam had intestinal schistosomiasis.[254]

In the case of the Diama Dam, legal rights to water for irrigation, international legal obligations to maintain navigability on an international river, and incentives created by international development bank loan programs facilitated the development of a large dam and irrigation project that ultimately advanced the Blue Agenda (greater access to water). However, in the case of the Diama Dam, the Blue Agenda significantly conflicted with the aims of the Red Agenda by expanding disease vector habitat in rice fields, increasing human interaction with disease vectors by making wading possible year-round, and bringing drinking water sources closer to human habitation without corresponding improvements in sanitation, increasing the likelihood of fecal contamination. Integration of the Red Agenda in water project financing, water rights, international navigation treaties, and water treatment requirements could have harmonized the two aims of the two agendas.

The conflict between the Blue and Red Agendas is not unique to the Diama Dam case or to developing countries in general. The increased incidence of West Nile virus in the United States has been linked to the development of large dam projects, and particularly, the connection between large dams and irrigation in warm-weather environments.[255] In the arid western United States, large dams and irrigation systems, often funded and managed by federal agencies, are critical to satisfying prior appropriation water rights and managing the equitable apportionment of interstate rivers.[256]

Dams and irrigation infrastructure, furthermore, are not the only water projects that implicate a conflict between the Blue and Red Agendas. In Arizona, for example, regulations encourage, and in some cases effectively require, artificial groundwater recharge in order to avoid unsustainable groundwater pumping, called overdraft.[257] Artificial groundwater recharge typically involves large, standing surface water impoundments, sometimes of river water and sometimes of treated sewage effluent, which then percolate into the underlying aquifer.[258] It is possible that the development of artificial groundwater recharge facilities, aimed at advancing the Blue Agenda, could frustrate the Red Agenda in ways similar to that of large irrigation projects or dams. Dams, irrigation systems, groundwater recharge, and water distribution projects promote inter-generational and intra-generational equi-

254 *See* M. Picquet et al., *The Epidemiology of Human Schistosomiasis in the Senegal River Basin*, 90 TRANSACTIONS ROYAL SOC'Y TROPICAL MED. & HYGIENE 340, 340–41 (1996).

255 William Reisen et al., *West Nile Virus in California*, 10 EMERGING INFECTIOUS DISEASES 1369, 1369 (2004).

256 Reed D. Benson, *Deflating the Deference Myth: National Interests vs. State Authority Under Federal Laws Affecting Water Use*, 2006 UTAH L. REV. 241, 251.

257 Paula K. Smith, *Coercion and Groundwater Management: Three Case Studies and a "Market" Approach*, 16 ENVTL. L. 797, 862–69 (1986).

258 Chris Avery et al., *Good Intentions, Unintended Consequences: The Central Arizona Groundwater Replenishment District*, 49 ARIZ. L. REV. 339, 347–48 (2007).

table water allocation under the Blue Agenda, but may erode or limit resiliency to water-related epidemics under the Red Agenda.

C. Human Right to Water Conflicting with the Red Agenda

One way in which water law seeks to advance both the Blue and Green Agendas is through human rights. As noted above, there are increasing calls for the recognition of a human right to water, including in a recent UN Human Rights Commission Comment and in the codification of such rights in national constitutions.[259] The human right to water can be interpreted as requiring a country to provide a minimum amount of water at a minimum quality, at a maximum price and maximum distance from the point of use.[260] However, guaranteeing water access within a reasonable proximity of the point of use could require bringing water sources closer to human habitation. As such, complying with the human right to water could result in greater intersection of human communities and disease vector habitats, and increased interaction between human waste and drinking water sources. The Blue Agenda component of the human right to water thus could interfere with the Red Agenda in much the same way as the incentives for water infrastructure developing discussed above.

The Green Agenda component of human rights may similarly interfere with the Red Agenda. As with growing calls for the recognition of a human right to water, there are also increasing calls for recognizing a human right to a clean environment.[261] Such a human right would place an affirmative obligation on states to protect the environment from contamination at a certain level and require remediation of pollution exceeding that level.[262] Preventing water pollution and facilitating remediation of water contamination have potential benefits to human health as well as to environmental protection. Toxic chemicals and elevated heavy metals in drinking water have serious detrimental effects on humans.[263] Pollution of aquatic ecosystems results in destruction of habitat, loss of biodiversity, and contamination of water

259 *See, e.g.*, Keith H. Hirokawa, *Property as Capture and Care*, 74 ALB. L. REV. 175, 230 (2010); Larson, *The New Right in Water*, *supra* note 36, at 2187.

260 Erik B. Bluemel, *The Implications of Formulating a Human Right to Water*, 31 ECOLOGY L.Q. 957, 983–85 (2004); Ramin Pejan, Note, *The Right to Water: The Road to Justiciability*, 36 GEO. WASH. INT'L L. REV. 1181, 1188 (2004).

261 *See* Michael Burger, *Bi-Polar and Polycentric Approaches to Human Rights and the Environment*, 28 COLUM. J. ENVTL. L. 371, 381 (2003); Hari M. Osofsky, *Learning from Environmental Justice: A New Model for International Environmental Rights*, 24 STAN. ENVTL. L.J. 71, 129–30 (2005).

262 *See* Sumudu Atapattu, *The Right to a Healthy Life or the Right to Die Polluted?: The Emergence of a Human Right to a Healthy Environment Under International Law*, 16 TUL. ENVTL. L.J. 65, 90–91 (2002); Linda A. Malone & Scott Pasternack, *Exercising Environmental Human Rights and Remedies in the United Nations System*, 27 WM. & MARY ENVTL. L. & POL'Y REV. 365 (2003).

263 *See, e.g.*, Troyen A. Brennan, *Environmental Torts*, 46 VAND. L. REV. 1, 6 n.16 (1993); Wendy E. Wagner, *Commons Ignorance: The Failure of Environmental Law to Produce Needed Information on Health and the Environment*, 53 DUKE L.J. 1619, 1742 n.439 (2004).

resources with inherent aesthetic, recreational, cultural, and ecosystem service values.[264] Laws aimed at preventing these harms, including the standards and permit schemes associated with the Green Agenda, play an important role in protecting and promoting healthy ecosystems and human communities.[265]

Nevertheless, as with the example of the regulation of DBP concentrations, pollution prevention regulation can be implemented in a way that interferes with equally important human health considerations. In *National Cotton Council v. EPA*, the Sixth Circuit Court of Appeals struck down a federal rule that exempted pesticide application to surface waters from CWA permitting requirements.[266] The EPA had promulgated a rule in 2006 to exempt pesticide applications from CWA permitting requirements when such application was conducted in accordance with the Federal Insecticide, Fungicide, and Rodenticide Act (FIFRA).[267] The rule was an outgrowth of previous cases that held that CWA permitting requirements applied to pesticide discharges to jurisdictional waters.[268] In the wake of these earlier decisions, many states moved to establish general permits for pesticide discharges, in part to prevent individual permitting requirements from delaying response to outbreaks of West Nile virus.[269] General permits are issued pursuant to notice-and-comment rulemaking requirements and apply to a broad category of discharges, with individual discharges filing a "Notice of Intent" (NOI) to discharge pursuant to those permits, and thus avoid the costs and delays associated with individual permits.[270] The EPA declined to pursue a general permit approach, and instead promulgated the rule exempting such discharges from CWA permitting requirements, under the theory that these discharges were not "pollutants" as defined under the CWA because they were chemical "products" and not chemical "wastes."[271]

The Sixth Circuit rejected the EPA's rationale and struck down the rule as inconsistent with the CWA.[272] The court held that residual pesticides in

264 Avi Brisman, *Double Whammy: Collateral Consequences of Conviction and Imprisonment for Sustainable Communities and the Environment*, 28 WM. & MARY ENVTL. L. & POL'Y REV. 423, 450 (2004) (quoting BETH E. LACHMAN, LINKING SUSTAINABLE COMMUNITY ACTIVITIES TO POLLUTION PREVENTION: A SOURCEBOOK 6–7 (1997)); James Gathii & Keith H. Hirokawa, *Curtailing Ecosystem Exportation: Ecosystem Services as a Basis to Reconsider Export-Driven Agriculture in Economies Highly Dependent on Agricultural Exports*, 30 VA. ENVTL. L.J. 1, 16–17 (2012).

265 Patricia Ross McCubbin, *The Risk in Technology-Based Standards*, 16 DUKE ENVTL. L. & POL'Y F. 1, 4–5 (2005); Lynn A. Stout, *Strict Scrutiny and Social Choice: An Economic Inquiry into Fundamental Rights and Suspect Classifications*, 80 GEO. L.J. 1787, 1797 (1992).

266 Nat'l Cotton Council v. EPA, 553 F.3d 927 (6th Cir. 2009).

267 *Id.* at 929.

268 *Id.* at 930–31; *see also* League of Wilderness Defs./Blue Mountains Biodiversity Project v. Forsgren, 309 F.3d 1181 (9th Cir. 2002); Headwaters, Inc. v. Talent Irrigation Dist., 243 F.3d 526 (9th Cir. 2001).

269 Kevin J. Beaton, *Clean Water Act Permitting Requirements for Pesticide Applications in Idaho*, 52 ADVOCATE 15, 16 (2009).

270 *See Nat'l Cotton Council*, 553 F.3d at 930.

271 *Id.* at 934–35; *see also* 40 C.F.R. § 122.3(h) (2009).

272 *Nat'l Cotton Council*, 553 F.3d at 940.

the water constituted a "waste" for purposes of the definition of a CWA pollutant, and that other pesticides that relied on bacteria, fungi, or viruses were clearly "biological materials" and thus pollutants under the CWA.[273] In response to the Sixth Circuit's decision, the EPA ultimately pursued the same course that state permitting agencies had taken in response to previous court decisions, and issued a Pesticide General Permit to regulate discharges of pesticides to jurisdictional waters.[274] Nevertheless, despite the cost savings as compared to an individual permit process, general permits still require the submittal of an NOI and other related compliance costs, potentially including the preparation of a pollution prevention plan, internal compliance audits, and employee training.[275]

The compliance costs associated with permitting pesticide discharges to prevent water pollution are a prime example of the conflict between the Green and Red Agendas in the context of human rights. In an effort to protect the environment from water pollution, water law imposes costs that could interfere with an expeditious response to water-related disease outbreak. The human right to a clean environment may ultimately protect human communities from toxins or carcinogens, but at the expense of protecting the same community from pathogens and vectors. Achieving efficient protection of the environment under the Green Agenda with a relatively inexpensive general permit may nevertheless prevent adequate resiliency to epidemics under the Red Agenda.

The apparent conflict between these two legitimate aims is reminiscent of the controversy surrounding dichlorodiphenyltrichloroethane, or DDT.[276] DDT is particularly effective in preventing water-related disease outbreaks, as it is one of the best chemicals for controlling mosquito populations.[277] However, the dangerous side effects of DDT use on human health were cataloged in Rachel Carson's seminal book *Silent Spring*.[278] This led to a ban on the use of DDT in many countries, and ultimately an international ban on the use of DDT under the Stockholm Convention on Persistent Organic Pollutants.[279]

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273 *See id.* at 937–38.

274 Final National Pollutant Discharge Elimination System (NPDES) Pesticide General Permit for Point Source Discharges from the Application of Pesticides, 76 Fed. Reg. 68,750 (Nov. 7, 2011).

275 *See generally* Steven G. Davison, *General Permits Under Section 404 of the Clean Water Act*, 26 Pace Envtl. L. Rev. 35 (2009).

276 *See generally* D.R. Roberts et al., *A Probability Model of Vector Behavior: Effects of DDT Repellency, Irritancy, and Toxicity in Malaria Control*, 25 J. Vector Ecology 48 (2000).

277 *See* Amir Attaran & Rajendra Maharaj, *DDT for Malaria Control Should Not Be Banned*, 321 British Med. J. 1403, 1403 (2000); Andrew P. Morriss & Roger E. Meiners, *Property Rights, Pesticides, & Public Health: Explaining the Paradox of Modern Pesticide Policy*, 14 Fordham Envtl. L.J. 1, 28–32 (2002).

278 *See generally* Rachel Carson, Silent Spring (1962).

279 Stockholm Convention on Persistent Organic Pollutants (POPs), May 22, 2001, 40 I.L.M. 1531; *see also* Julie B. Truelsen, Comment, *Developments in Toxics in 2004: The Ratification of the Stockholm Convention and the Rotterdam Convention*, 16 Colo. J. Int'l Envtl. L. & Pol'y 217, 218–19 (2005).

Yet the ban on DDT has resulted in a dramatic increase in the incidence of malaria worldwide.[280] In 1952, the WHO estimated the global number of people infected by malaria to be around 350 million people.[281] By 1969, that number had fallen by ninety-seven percent, largely as a result of DDT.[282] The risk of malaria doubled in Colombia and Peru when DDT application ceased in the 1990s.[283] In Sri Lanka, malaria infections fell from 2.8 million per year to seventeen after application of DDT.[284] When DDT application ceased in Sri Lanka, malaria infections rose to 500,000 per year by 1969.[285]

This is not to say that the damage potentially caused by DDT does not outweigh the harms of the malaria it prevents, nor does this mean that there are not options for malaria control that are equal to or better than DDT, but with fewer costs and risks.[286] But it illustrates the role of the precautionary principle in environmental law and policy and its place within the human rights approach under the Green Agenda. The precautionary principle has growing influence in international and domestic environmental law and policy, and states that governments should not wait for scientific certainty before intervening to prevent any harm that could be serious or irreversible.[287] The precautionary principle has been invoked as part of the human right to a clean environment.[288] But this principle, in cases involving pesticide application, can simply be begging the question—cautious of what? Taking precautions to prevent environmental and human health impacts from DDT applications involved risks associated with increasing incidence of malaria and, in some cases, the rise of drug-resistant strains of malaria as nations shifted from vector control using DDT to treatment with anti-malarial drugs.[289] The Green Agenda's application of the precautionary principle was certainly cautious within the context of environmental toxins, but it perhaps failed to integrate the risks associated with the Red Agenda.

The examples of pesticide and DBP regulation illustrate why distinguishing between the Green and Red Agendas is helpful. At first, these two agendas can appear identical, if not largely overlapping. After all, protecting the

280 *See* Morriss & Meiners, *supra* note 277, at 28–32.

281 *Id.* at 30.

282 *Id.*

283 *Id.* at 31.

284 *Id.*; *see* D.R. Roberts et al., *DDT House Spraying and Re-Emerging Malaria*, 356 LANCET 330, 331 (2000).

285 Morriss & Meiners, *supra* note 277, at 31; *see* Roberts et al., *supra* note 284, at 331.

286 Morriss & Meiners, *supra* note 277, at 33–37.

287 *See* CASS R. SUNSTEIN, LAWS OF FEAR: BEYOND THE PRECAUTIONARY PRINCIPLE 18 (2005); Noah M. Sachs, *Rescuing the Strong Precautionary Principle from Its Critics*, 2011 U. ILL. L. REV. 1285, 1288.

288 *See* Menno T. Kamminga, *The Precautionary Approach in International Human Rights Law: How It Can Benefit the Environment*, *in* THE PRECAUTIONARY PRINCIPLE AND INTERNATIONAL LAW: THE CHALLENGE OF IMPLEMENTATION 171–86 (David Freestone & Ellen Hey eds., 1996); Stephen G. Wood et al., *Whither the Precautionary Principle? An American Assessment from an Administrative Law Perspective*, 54 AM. J. COMP. L. 581, 582 (2006).

289 *See* Morriss & Meiners, *supra* note 277, at 28–40.

environment from water pollution and preventing harmful chemicals in drinking water seems completely consistent with protecting human health. And these agendas certainly may be pursued in ways that are consistent in their approach and mutually reinforcing. However, the cases of DBP regulation and pesticide permitting suggest that focusing excessively on pollution and chemicals (the heart of the Green Agenda) can sometimes exclude effective consideration of pathogens and vectors (the heart of the Red Agenda).

III. Integrating the Red Agenda into Water Law

While the examples provided above note the myriad ways in which the predominant Blue and Green Agendas of water law conflict with the Red Agenda, such conflicts are not inevitable or ubiquitous. Indeed, as already noted, there are important ways in which these agendas already function in harmony and are mutually reinforcing, such as the Blue Agenda's focus on water provision facilitating improved hygiene, and the Green Agenda's drinking water standards relating to fecal coliforms. Indeed, one lesson from the *Drawers of Water* study is the importance of water access—even to less-than-clean water—in promoting improved hygiene and sanitation. While conflicts between agendas occur, water law is not necessarily characterized generally by such conflicts and these agendas overlap in important ways. Even the conflicts discussed above between these agendas can be avoided or mitigated by making reforms to water law.

This Part proposes three broad categories of legal reforms to avoid or mitigate conflicts between the Green and Blue Agendas and the Red Agenda: (A) increase the role of local stakeholders in the development of drinking water standards; (B) integrate pathogen and disease vector habitat considerations into environmental assessments conducted by governments and development banks; and (C) reinterpret the human rights to water and a clean environment to account for disease prevention, including an adaptive approach that allows for emergency response to epidemics associated with water resources.

A. Why the Colors Conflict

The examples discussed above provide some evidence that the pursuit of the Blue and Green Agendas in water law and policy can interfere in varying degrees with the pursuit of the Red Agenda. But these examples leave open the question of the cause of such conflicts. As already noted above, such conflicts are not inevitable and each of these agendas can be, and often are, pursued in ways that are mutually reinforcing. What then causes these agendas to sometimes clash? Silo thinking and attenuated decisionmaking are two possible explanations.

The silo effect afflicts large departments or divisions of larger organizations, where the individual department develops its own "bureaucratic imperatives" that create obstacles to effective information sharing and

cooperation.[290] For example, the Department of Homeland Security was created in the aftermath of the attacks of September 11, 2001, as a response to silo thinking in intelligence agencies that arguably precluded information sharing related to the terrorist threat between the National Security Agency (NSA), the Central Intelligence Agency (CIA), and the Federal Bureau of Investigation (FBI).[291] The NSA focuses on signals intelligence, the CIA on foreign human espionage, and the FBI on domestic criminal intelligence. Arguably, these separate silos and distinct imperatives prevented effective coordination in counter-terrorism.[292]

A large organization—like a national government or the World Bank—may broadly desire to protect the environment and human health while equitably allocating water resources. But individual agencies or departments within those organizations tasked with distinct agendas pursue those agendas within their individual silos. Effectively, the silo effect "reflects the divergence of interests and incentives between a large organization (the principal) and a particular department or division within it (the agent)."[293] Furthermore, the distinct competencies and bureaucracies of each agent create transaction costs in integrating process, jargon, and disciplinary expertise that may frustrate efforts at coordination.[294]

So the U.S. government may desire to simultaneously pursue all three water policy agendas, but the EPA focuses on the prevention of pollution and the treatment of drinking water, while the U.S. Army Corps of Engineers or Bureau of Reclamation focuses on water infrastructure development and management, and the Centers for Disease Control and Prevention (CDC) concentrates on the prevention of, and response to, disease outbreaks. Each has distinct processes for the development and implementation of policy, and each has different competencies, such that communication and coordination requires overcoming differences in expertise and operation. Additionally, each has different incentives, as one agency primarily responsible for advancing one agenda would receive little reward for advancing other agendas, particularly at the expense of its own. This silo thinking impedes interagency coordination for purposes of water policy in the same way it did for the intelligence community.

In addition to silo thinking, attenuated decisionmaking also partially explains the reason water law agendas sometimes clash. Attenuated decisionmaking occurs when policy is made at a jurisdictional level remote from the

290 Richard E. Levy & Robert L. Glicksman, *Agency-Specific Precedents*, 89 TEX. L. REV. 499, 511 (2011).

291 Joshua A.T. Fairfield & Erik Luna, *Digital Innocence*, 99 CORNELL L. REV. 981, 1016 n.224 (2014); Levy & Glicksman, *supra* note 290, at 511.

292 *See* Francesca Bignami, *European Versus American Liberty: A Comparative Privacy Analysis of Antiterrorism Data Mining*, 48 B.C. L. REV. 609, 622–23 (2007); Fairfield & Luna, *supra* note 291, at 1016 n.224.

293 Levy & Glicksman, *supra* note 290, at 512.

294 *Id.* at 513.

implementation level.[295] Organizations like the EPA, WHO, or World Bank may be attenuated from the geographic, sociocultural, or economic reality of the areas where their water policy is ultimately implemented. Thus, the concerns of the developed world with respect to water—carcinogens, pesticides, pharmaceuticals, recreation—reflected in some agency decisionmaking may take precedence over the greater concerns associated with the Red Agenda in the communities where water policy is implemented.

B. Localized Water Governance

Water policy as advanced under any of the three agendas is frequently a question of devolving regulatory authority to a more localized level. In other words, integrating the three agendas requires reform that overcomes attenuated decisionmaking and promotes familiarity amongst water policymakers of the epidemiological realities of the regions where policy is implemented. For purposes of advancing water policy's agendas, the world is like a golf ball—a sphere pocked with divots.[296] Each divot is a catchment or river basin into which all water drains, and the boundaries between divots are called watersheds.[297] Under what is called the "*internalization prescription for government jurisdiction*," authority to govern natural resources like water that spill over jurisdictional boundaries should be assigned "*to the smallest unit of government that internalizes the effects of its exercise.*"[298] This prescription prevents jurisdictions from externalizing costs associated with such spillover goods, like damming or polluting a river and thereby adversely impacting a downstream neighbor.[299] In the case of water, jurisdictional boundaries should correspond to water's geographic contours—i.e., its watershed and sub-basins.[300]

To satisfy the internalization prescription, "*[w]hen the effects of a public good or bad spill over jurisdictions, a special district should provide the good or control the bad.*"[301] Such localized districts facilitate greater familiarity with the unique sociocultural, hydrological, climatological, economic, and epidemiological conditions of the resource.[302]

The WHO drinking water standards and the EPA's MCLs can fail to properly account for local conditions, because standard-setting agencies have an attenuated relationship with the water and its unique local and regional

295 *See, e.g.*, Francesca Bignami, *Transgovernmental Networks vs. Democracy: The Case of the European Information Privacy Network*, 26 MICH. J. INT'L L. 807, 812 (2005).

296 Larson, *Interstitial Federalism*, *supra* note 36, at 911.

297 *Id.*

298 ROBERT D. COOTER, THE STRATEGIC CONSTITUTION 107 (2000).

299 *Id.* at 105–07.

300 Larson, *Interstitial Federalism*, *supra* note 36, at 912.

301 COOTER, *supra* note 298, at 106.

302 Larson, *Interstitial Federalism*, *supra* note 36, at 911–12; *see also* J.B. Ruhl & Harold J. Ruhl, Jr., *The Arrow of the Law in Modern Administrative States: Using Complexity Theory to Reveal the Diminishing Returns and Increasing Risks the Burgeoning of Law Poses to Society*, 30 U.C. DAVIS L. REV. 405, 471–72 (1997) (discussing the effects of decentralization on complex social structures, not unlike the localized districts and their relation to water law).

conditions, including organic material in source water and the relative risks posed to a population from DBP concentrations or microbial pathogens. The SDWA has a structure that facilitates some degree of localized control over drinking water standards.[303] The EPA can grant primacy to state agencies under the SDWA to establish standards, with the EPA retaining oversight authority.[304] Furthermore, public water systems can petition agencies implementing the SDWA for a variance from applicable MCLs if localized conditions make MCL compliance infeasible.[305]

Nevertheless, states with SDWA primacy typically adopt the EPA's MCLs.[306] Even oversight from a state agency may fail to appropriately comply with the internalization prescription, because the jurisdictional boundary is still often broader than the applicable watershed boundaries, or else the watershed cross-state jurisdictional boundaries.[307] WHO standards, MCLs, or other "one size fits all" drinking water quality requirements may focus on addressing chronic DBP standards while risking inadequate disinfection for pathogens.[308] To more fully integrate the Red Agenda into water law, drinking water standards could be developed through a negotiated rulemaking process involving input from local stakeholders at the sub-basin level.

For drinking water treatment projects in developing countries, standards could prioritize disinfection at early stages, with a focus on treatment for heavy metals and toxins, phased in over a period of years as waterborne infections are reduced. Such stakeholder groups will require support from technical experts, which should be factored into budgets associated with loans from development banks. Localized participation in the development and implementation of drinking water standards does not require less technical or scientific competency, but is intended to ensure that scientists, technicians, financiers, developers, and policymakers are sensitive to the concerns and priorities of the communities where water projects are implemented. With exceptions to unlawful or otherwise negligent operation of treatment systems, water project financing, construction, and operation in the developing world could be shielded from liability associated with the presence of harmful chemicals in drinking water where that presence is attributable to the prioritization of disinfection over treatment of potentially harmful chemicals like DBPs, pesticides, or pharmaceuticals. Such a liability shield may avoid disincentives to investment in the control of waterborne infections and appropriately focus initial resources on disinfection of drinking water.

In the United States, a similar negotiated rulemaking process could apply to the development and implementation of MCLs. This process could

303 *See generally* James W. Moeller, *Legal Issues Associated with Safe Drinking Water in Washington, D.C.*, 31 WM. & MARY ENVTL. L. & POL'Y REV. 661 (2007).

304 42 U.S.C. § 300g-2(a) (2012).

305 *See, e.g.*, *id.* § 300g-4(e); 40 C.F.R. § 142.10 (2015).

306 Inessa Abayev, Note, *Hydraulic Fracturing Wastewater: Making the Case for Treating the Environmentally Condemned*, 24 FORDHAM ENVTL. L. REV. 275, 297 (2013).

307 Larson, *Interstitial Federalism*, *supra* note 36, at 911.

308 Larson, *The New Right in Water*, *supra* note 36, at 2243.

be overseen by state agencies with SDWA primacy. Local stakeholder groups could also establish drinking water standards for non-public water systems that do not fall within the jurisdiction of the SDWA. As a part of their application for Certificates of Convenience and Necessity (effectively, the granting of a monopoly over a certain area to a public utility by the state),[309] public water systems could pay into a trust administered by the state agency with SDWA primacy. The amount paid into the trust would be determined by the size of the customer base of the public water system, and would create funds to support smaller drinking water systems to conduct source water assessments for *Cryptosporidium* and invest in filtration or ultra-violet treatment where necessary. Local stakeholder groups, adequately supported by resources from state and federal funds, should receive deference from EPA oversight and courts when reasonably prioritizing disinfection over investments in treatment for pharmaceuticals or other potentially harmful chemicals. This localized approach to the development of drinking water quality standards and treatment requirements would ideally integrate the Green Agenda's concern with the efficient prevention and mitigation of water contamination with the Red Agenda's concern for community resilience to infection.

C. Pathogen and Vector Assessments in Water Development

A more localized approach to water governance may help overcome attenuated decisionmaking and thereby integrate the Red Agenda more effectively into water policy. However, additional reforms are necessary to overcome silo thinking. For example, ex ante water project assessments should require coordination between agencies tasked with promoting each agenda. In environmental impact assessments made under the Espoo Treaty, NEPA, and similar programs, state-funded or state-conducted water projects should be required to consider disease vector habitat issues as part of project assessment. Currently, while disease vector issues may be considered in these assessments, no such consideration is explicitly required in either Espoo or NEPA.[310] Such treaties and statutes could be amended to explicitly require the impact statement to address disease vectors, including the evaluation of project alternatives to mitigate possible intersection between expanded or enhanced disease vector habitat and human communities. There is growing scholarship and increasing movement in policy implementation of Health

309 *See, e.g.*, Henry J. Friendly, Book Review, 49 HARV. L. REV. 163, 165 (1935) (reviewing I.L. SHARFMAN, THE INTERSTATE COMMERCE COMMISSION (1935)); *see also* Emily Rogers & Jasmine Grant, *Water Utilities*, 45 TEX. ENVTL. L.J. 419, 419–21 (2015).

310 *See* National Environmental Policy Act, 42 U.S.C. § 4321 (2012) (note there is no explicit requirement to address disease vectors under NEPA); Espoo Convention, *supra* note 96 (note there is no explicit requirement to address disease vectors in environmental impact assessments conducted under the Espoo Treaty); Alice M. Noble-Allgire, *Transfrontier Environmental Damage*, 84 AM. SOC'Y INT'L L. PROC. 12, 25 (1990) (reporting the remarks of Ken Murphy and Nicholas A. Robinson, noting that disease vector issues may be considered in environmental impact assessments).

Impact Assessments (HIAs) as a companion to environmental impact assessments to ensure adequate consideration of public health.[311]

Environment impact assessment requirements, like those of NEPA, have been criticized as toothless procedural hoops with little to no impact on substantive outcomes and improved environmental protection.[312] Nevertheless, these largely procedural statutes can improve project planning by at least requiring consideration of certain concerns and by imposing a transparency requirement on such consideration through a public release of the assessment report.[313] Furthermore, these statutes can have substantive components in the sense that agencies and companies may agree to enforceable obligations under memoranda of understanding incorporated into the record of decision as part of the assessment process.[314] An explicit requirement to consider microbial pathogens may have at least alerted the UN to the possible need to screen aid workers for cholera without having to impose liability on humanitarian efforts. The focus in water law on the Green and Blue Agendas may result in water projects moving forward without sufficient consideration being given to diseases under the Bradley Classification. An improved environmental impact statement process would impose an obligation to at least evaluate the potential for water projects to impede advancing the Red Agenda. An express requirement in NEPA for the coordinated efforts of the EPA, CDC, and water resource development agencies would mitigate the impacts of silo thinking in water policy development and implementation.

One of the ways in which environmental impact assessments could evaluate the concerns of the Red Agenda is by addressing how water projects might result in the loss of disability-adjusted life years (DALYs). DALY is a measure of the burden of a disease, expressed in terms of the number of years of life lost due to poor health, disability, or premature death.[315] The WHO relies on DALYs to make decisions on the allocation of resources for

311 *See, e.g.*, EUROPEAN CTR. FOR HEALTH POLICY, HEALTH IMPACT ASSESSMENT: MAIN CONCEPTS AND SUGGESTED APPROACH, GOTHENBURG CONSENSUS PAPER (1999), http://www.apho.org.uk/resource/item.aspx?RID=44163; Andrew L. Dannenberg et al., *Growing the Field of Health Impact Assessment in the United States: An Agenda for Research and Practice*, 96 AM. J. PUB. HEALTH 262 (2006).

312 *See* Bradley C. Karkkainen, *Whither NEPA?*, 12 N.Y.U. ENVTL. L.J. 333, 339–43 (2004); Veronika Tomoszkova, *Implementation of the EU Directive on Environmental Impact Assessment in the Czech Republic: How Long Can the Wolf Be Tricked?*, 6 WASH. & LEE J. ENERGY, CLIMATE & ENV'T 451, 495 (2015).

313 *See, e.g.*, Michael LeVine et al., *What About BOEM? The Need to Reform the Regulations Governing Offshore Oil and Gas Planning and Leasing*, 31 ALASKA L. REV. 231, 245 n.74 (2014).

314 Jody Freeman & Jim Rossi, *Agency Coordination in Shared Regulatory Space*, 125 HARV. L. REV. 1131, 1164 n.155 (2012); Mason Baker, Note, *What Does It Mean to Comply with NEPA?: An Investigation into Whether NEPA Should Have Procedural or Substantive Force*, 31 UTAH ENVTL. L. REV. 241, 246–47 (2011).

315 *See generally* Sudhir Anand & Kara Hanson, *Disability-Adjusted Life Years: A Critical Review*, 16 J. HEALTH ECON. 685 (1997).

disease prevention.[316] Risk assessments made for water projects could be required to evaluate the potential health impacts from diseases under Bradley Classifications in terms of DALYs, and subject those evaluations to public scrutiny in a public notice-and-comment process. While DALY has its limits as a measurement of disease impact, an explicit requirement to model, measure, and evaluate health impacts in a widely accepted and relatively holistic metric would promote improved evaluation of issues central to the Red Agenda in environmental impact assessments.[317]

Environmental impact statements are not the only way in which water law could be reformed to require government agencies to more fully consider issues under the Red Agenda. For example, under prior appropriation regimes, applications for changes in diversion points on a stream, new appropriative rights, or to transfer water rights typically require approval from a state agency.[318] State agencies may decline such applications for a number of reasons, including when such changes or transfers would be against the public welfare or a menace to public safety.[319] State agencies in such instances could use their authority to deny applications wherever changes in diversion points, new appropriative rights, or transfers of water rights might significantly enhance disease vector habitat, or substantially increase the likely intersection between disease vector habitat and human communities, or else human waste and drinking water sources. Such an approach would integrate the concerns of the Red Agenda with the Blue Agenda's focus on the equitable apportionment of water resources between individuals, communities, and generations. State water rights agencies should have an explicit requirement to coordinate with state health agencies with relevant expertise in waterborne and water-related diseases to ensure that water rights transfers and changes in diversion points do not increase the risk of disease outbreaks.

An additional possible reform would be to create the water policy version of the Department of Homeland Security at the national level, and establish a system that integrates different water policy silos so that each water policy agenda is adequately considered. Water policy agents in the EPA, Bureau of Reclamation, U.S. Army Corps of Engineers, and Centers for Disease Control could have formalized inter-agency communication and collaboration in water resource assessments. This integrated approach could be mirrored at the local level, with health, natural resource, and environmental agencies collaborating in water project assessments under a rigorous, participatory, and integrated HIA process.

316 I. Glenn Cohen, *Rationing Legal Services*, 5 J. Legal Analysis 221, 287 (2013).

317 *See* Anand & Hanson, *supra* note 315, at 699.

318 *See, e.g.*, Ariz. Rev. Stat. Ann. § 45-153 (2016); Norman K. Johnson & Charles T. DuMars, *A Survey of the Evolution of Western Water Law in Response to Changing Economic and Public Interest Demands*, 29 Nat. Resources J. 347, 357–58 (1989); Jesse Reiblich & Christine A. Klein, *Climate Change and Water Transfers*, 41 Pepp. L. Rev. 439, 458 nn.139–40 (2014).

319 Johnson & DuMars, *supra* note 318, at 358.

D. Reinterpreting Rights to Account for the Red Agenda

Both silo thinking and attenuated decisionmaking are symptomatic of the reliance on human rights to advance water policy. Advocates pursuing both the Blue and Green Agendas have relied on human rights to advance equitable water apportionment and efficient water protection.[320] Although an international human right to water currently is of questionable efficacy and enforceability, the rhetoric of human rights raises the "lexical priority" of water issues at the international level.[321] Furthermore, domestic constitutional law has made advances in recent years in integrating express rights to water within an enforceable human rights framework.[322] Yet, as noted above, the human rights approach to the Blue and Green Agendas can be implemented in ways that interfere with the Red Agenda, including by preventing expeditious response to outbreaks through anti-vector pesticide application. These conflicts may arise in part when human rights organizations suffer from silo effects without proper coordination with health organizations, and when human rights advocates unfamiliar with local health concerns thereby improperly prioritize water access over disease prevention. These conflicts between water law agendas in the human rights sphere can be mitigated or reconciled by reinterpreting the human right to water and a clean environment in several ways.

First, advocating and formulating human rights to water and a clean environment, at both the national and international level, should tie such rights more directly to the right to life.[323] By so doing, these rights are placed within the context where protection of human life (perhaps measured by limiting loss of DALYs) is the primary goal of the right to water. Within that context, policymakers and courts may be more likely to interpret such human rights in terms that maximize human resilience to microbial diseases and water-related epidemics. Such an interpretation should encourage variances from water quality standards and emergency waivers of permitting obligations to facilitate expeditious response to disease outbreaks, with such exceptions to the norm seen as consistent with the promotion and protection

320 *See, e.g.*, Fitzmaurice, *supra* note 31; McCaffrey, *supra* note 68, Neil A.F. Popovic, *In Pursuit of Environmental Human Rights: Commentary on the Draft Declaration of Principles on Human Rights and the Environment*, 27 COLUM. HUM. RTS. L. REV. 487 (1996).

321 Larson, *The New Right in Water*, *supra* note 36, at 2209; *see also* Daniel Bodansky, *Introduction: Climate Change and Human Rights: Unpacking the Issues*, 38 GA. J. INT'L & COMP. L. 511, 514 (2010); Larson, *The New Right in Water*, *supra* note 36, at 2209–13.

322 *See, e.g.*, Larson, *The New Right in Water*, *supra* note 36, at 2205 n.127; *see also* Barton H. Thompson, Jr., *Water as a Public Commodity*, 95 MARQ. L. REV. 17, 33 (2011).

323 Such a relationship between a human right to water and the right to life has been made in some instances, including in General Comment 15 to the UN Convention on Economic, Social and Cultural Rights, which stated that the right to water is a "prerequisite for the realization of other human rights" and "falls within the category of guarantees essential for securing an adequate standard of living." U.N. Econ. & Soc. Council, Comm. on Econ., Soc. & Cultural Rights, Substantive Issues Arising in the Implementation of the International Covenant on Economic, Social and Cultural Rights: General Comment No. 15, The Right to Water, U.N. Doc. E/C.12/2002/11 (Jan. 20, 2003).

of human rights. When rights to water and a clean environment conflict with the right to life, such rights should be interpreted in favor of measures that minimize the loss of DALYs.

Second, the human right to water and a clean environment should consistently be tied to a human right to sanitation.[324] Fecal contamination of drinking water sources is one of the primary causes of waterborne infections, including cholera and *Cryptosporidium*.[325] Despite the importance of sanitation, progress in that area lags far behind improvements in access to water for drinking and domestic purposes. The UN's Millennium Development Goals (MDGs) aimed to halve, by 2015, the proportion of the world's population without sustainable access to safe drinking water and basic sanitation.[326] Nevertheless, progress in the sanitation sector has lagged far behind progress in drinking water since the MDGs were announced.[327] There are many possible explanations for this phenomenon. It could possibly be because NGOs, development banks, and nations can more easily and attractively publicize progress in drinking water than sanitation (glossy photographs of clean tap water, wells, and water treatment plants tend to be more aesthetically pleasing as marketing and propaganda tools than photos of latrines). But part of the explanation may be a simple preference for investment in drinking water rather than sanitation, because sanitation is something people are less comfortable talking about than drinking water. Greater emphasis on sanitation within the human rights conversation, and interpretation of the right to water as including a right to sanitation, would facilitate this essential public conversation.

Third, a human rights approach to water provision and quality should be interpreted to include certain procedural rights associated with the development of water policy. A human right to water can be viewed as compromising two rights—a provision right and a participation right.[328] A provision right imposes an affirmative obligation on the state to sustainably provide water of adequate quantity and quality.[329] Such a provision right is problem-

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324 The connection between water and sanitation in the human rights context had been made elsewhere. *See, e.g.*, 2010 U.N. Resolution, *supra* note 68; Lori Beail-Farkas, *The Human Right to Water and Sanitation: Context, Contours, and Enforcement Prospects*, 30 WIS. INT'L L.J. 761 (2013); Gonzalo Aguilar Cavallo, *The Human Right to Water and Sanitation: From Political Commitments to Customary Rule?*, 3 PACE INT'L L. REV. ONLINE COMPANION 136 (2012); Murthy, *supra* note 142.

325 *See, e.g.*, Nicholas John Ashbolt, *Microbial Contamination of Drinking Water and Disease Outcomes in Developing Regions*, 198 TOXICOLOGY 229, 233–35 (2004).

326 G.A. Res. 55/2, ¶ 19, United Nations Millennium Declaration (Sept. 18, 2000).

327 UNITED NATIONS CHILDREN'S FUND & WORLD HEALTH ORG., PROGRESS ON DRINKING WATER AND SANITATION: 2012 UPDATE 18–25 (2012), http://www.unicef.org/french/media/files/JMPreport2012.pdf; David J. Bradley & Jamie K. Bartram, *Domestic Water and Sanitation as Water Security: Monitoring, Concepts and Strategy*, 371 PHIL. TRANSACTIONS OF THE ROYAL SOC'Y 1, 6 (2013). *See generally* Grey & Sadoff, *supra* note 241.

328 *See, e.g.*, Larson, *The New Right in Water*, *supra* note 36 (discussing the distinction between a provision right to water and a participation right to water).

329 *Id.* at 2243.

atic because it is difficult to enforce and define, and can reduce cost recovery and incentives for water conservation.[330] The other right is a participation right, which involves a right to participate in the development of water policy and procedural rights associated with water disconnection or rate increases.[331]

The recognition of "participation" or a procedural component of a human right to water has an important connection with the integration of the Red Agenda into environmental impact statements. In 2013, California introduced and enacted its "Human Right to Water Bill."[332] That bill recognizes that "every human being has the right to safe, clean, affordable, and accessible water."[333] The most significant component of the law requires state agencies to consider the human right to water when "revising, adopting, or establishing policies, regulations, and grant criteria."[334] Under this approach, the human right to water imposes an obligation to factor water into all government actions. To the extent the right to water is reinterpreted to comprise all three agendas, then such a procedural or participation right approach would require a transparent and participatory stakeholder process in the development of water policy that includes addressing the issues addressed in the Red Agenda. For developing countries, such procedural rights are likely most critically needed and most easily implemented in the internal processes of development banks.

Ultimately, a right can hardly be characterized as a "human right" if it is not primarily concerned with protecting humans. A human right to water and a clean environment is self-parody if it results in the state providing affordable water in close proximity to the point of use, so as to meet WHO drinking water standards, for a population dying of cholera and malaria. Human rights involves prioritization of societal concerns, and should begin by putting first things first—the protection of human life.[335]

CONCLUSION

This Article seeks to highlight instances of conflict and suggests measures to avoid instances where the Green and Blue Agendas conflict with the Red because water policymakers failed to adequately integrate the Red Agenda. This Article does not attempt to catalog all the possible ways in

330 *See id.* at 2220–36.

331 *See id.* at 2237–40, 2260–66.

332 Skylar Marshall, *California Declares a Human Right to Water*, U. DENV. WATER L. REV. (June 10, 2013), http://duwaterlawreview.com/ca-human-right-to-water/.

333 CAL. WATER CODE § 106.3(a) (West 2016). *See generally* HUMAN RIGHT TO WATER BILL IN CALIFORNIA, *supra* note 69.

334 CAL. WATER CODE § 106.3(b).

335 *See* Larson, *The New Right in Water*, *supra* note 36, at 2193; *see also* ISAIAH BERLIN, *Two Concepts of Liberty*, *in* FOUR ESSAYS ON LIBERTY 118, 124 (1969) ("First things come first: there are situations, as a nineteenth-century Russian radical writer declared, in which boots are superior to the works of Shakespeare; individual freedom is not everyone's primary need.").

which the Blue and Green Agendas might clash with the Red Agenda, nor the potentially inconsistent aims of the Blue and Green Agendas. There are other possible conflicts between each water law's agendas, including between the Green and Blue (the impacts on the environment from the construction of large dams or desalination plants, for example). Additionally, agendas can have internal conflicts (competing demands for water between agriculture, industry, and hydroelectric production under the Blue Agenda, for example).

Characterizing the aims of each agenda as equity, efficiency, and resiliency is helpful for purposes of distinguishing each agenda's respective core goals, but it is also an oversimplification. Furthermore, these three agendas are not intended to be exhaustive or suggest that all aims of water law can be fit into these categories. For example, flood prevention and mitigation potentially require a separate agenda with similar potential conflicts and synergies with other agendas. Also, silo thinking and attenuated decisionmaking are at best partial explanations of the reasons why water policy agendas sometimes conflict. Some conflicts are inevitable, and trade-offs between agendas are sometimes necessary, with goals valued differently depending on the economic and environmental conditions of the given jurisdiction. Additional research will reveal how integration of these agendas is, and should be, pursued differently in developed countries as compared to developing countries.

Sustainable, clean, affordable water for the environment and for all people in current and future generations—the ultimate aim of the Blue and Green Agendas—will improve and protect human health. And improving and protecting human health is the ultimate aim of the Red Agenda. Ultimately, the purpose of this Article is to introduce this colored agenda framework to facilitate dialogue regarding the improved integration of water policy aims and stronger ties between the study of natural resource and environmental law and the discipline of epidemiology. Integration of the Red Agenda in water resource law, policy, and planning will strengthen the law's protection of human life in the time of cholera.