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Articles

WATER SECURITY

Rhett B. Larson

ABSTRACT—Climate change, as the dominant paradigm in natural resource policy, is obsolete and should be replaced by the water security paradigm. The climate change paradigm is obsolete because it fails to adequately resonate with the concerns of the general public and fails to integrate fundamental sustainability challenges related to economic development and population growth. The water security paradigm directly addresses the main reasons climate change ultimately matters to most people—droughts, floods, plagues, and wars. Additionally, this new proposed paradigm better integrates climate change concerns with other pressing global sustainability challenges—including that economic development and population growth will require 50% more food and energy and 30% more water by 2030 regardless of climate change. The water security paradigm orients all natural resource policies toward achieving a sustainable quantity and quality of water at acceptable costs and risks. Water security improves upon the climate change paradigm in several ways: it (1) replaces carbon footprints with water footprints as the metric for sustainability monitoring and reporting, (2) restructures natural resource governance at the watershed level with regional, rather than hierarchical, leadership, (3) integrates security and public health concerns into natural resource policies, (4) encourages investment in infrastructure for drought and flood resilience, and (5) facilitates the sustainable implementation of human rights.

AUTHOR—Morrison Fellow in Water Law and Associate Professor of Law, Arizona State University Sandra Day O'Connor College of Law. I would like to thank Nadia Ahmed, Lisa Benjamin, Dan Bodansky, Deborah Boorman, Karen Bradshaw, Adam Chodorow, Laura Coordes, Jason Czarnezki, Dan Farber, Victor Flatt, Michael Gerrard, Zachary Gubler, Lisa Heinzerling, Andy Hessick, Carissa Hessick, Bruce Huber, Eric Johnson, Kit Johnson, Beth Kinne, Zachary Kramer, Kaipo Matsumura, Sarah Morath, Carolina Núñez, Uma Outka, Jessica Owley, Margot Pollans, J.B. Ruhl, Troy Rule, James Salzman, Erin Scharff, and Mary Sigler for helpful comments and suggestions. Special thanks as well to the

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INTRODUCTION

Climate change should be deemphasized in law and policy. Not because the science behind climate change is bad (it is not)[1] and not because climate change is not important (it is).[2] Climate change should be

[1] *See* Sheila Jasanoff, *Serviceable Truths: Science for Action in Law and Policy*, 93 TEX. L. REV. 1723, 1741 (2015) (noting the scientific "consensus on the anthropogenic origins of climate change and some of the dire implications of unchecked global-mean-temperature rise"); *see also* Naomi Oreskes, *The Scientific Consensus on Climate Change*, 306 SCI. 1686 (2004) (summarizing the prevailing scientific consensus surrounding the causes and implications of global climate change). For a detailed discussion of climate change science and background on how anthropogenic greenhouse gas emissions impact global climate patterns, see generally INTERGOVERNMENTAL PANEL ON CLIMATE CHANGE, CLIMATE CHANGE 2001: THE SCIENTIFIC BASIS (J.T. Houghton et al. eds., 2001).

[2] Daniel C. Esty, *Good Governance at the Supranational Scale: Globalizing Administrative Law*, 115 YALE L.J. 1490, 1493 (2006) (including "climate change" in a list of "critical issues" that national governments alone struggle to address); Daniel A. Farber, *Uncertainty*, 99 GEO. L.J. 901, 907 (2011) (stressing the "importan[ce]" of "[i]ssues like climate change"); Jody Freeman & Andrew Guzman, *Climate Change and U.S. Interests*, 109 COLUM. L. REV. 1531, 1531 (2009) ("This Essay shows that

deemphasized and indeed replaced as a policy paradigm because it is incomplete and ineffective.[3] Instead, the new paradigm for natural resource law and policy should be centered on water security, a paradigm that avoids the limitations and inadequacies of the dominant climate change discourse.[4]

The climate change paradigm is inadequate for three reasons. First, climate change does not sufficiently resonate with the general public.[5] Even the phrase *climate change* evokes leaves changing colors in the fall and flowers blooming in the spring; *global warming* evokes long summer days. Talk of rising sea levels sounds only like the promise of living closer to the beach. To the average person, a problem framed in terms of a few degrees Celsius or a few feet of sea level rise does not sound very serious, and a problem framed in terms of ice caps or polar bears does not sound very relevant.[6] Furthermore, carbon footprints and greenhouse gas emissions are performance metrics so unfamiliar to most people that they struggle to assess both the severity of the problem and the likelihood of success of proposed solutions.[7] Efforts to make climate change more accessible have been moderately successful,[8] and the climate change paradigm has

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the United States has reason to take prompt and aggressive action to address climate change, not out of benevolence or guilt, but out of self-interest.").

[3] *Cf.* Orr Karassin, *Mind the Gap: Knowledge and Need in Regulating Adaptation to Climate Change*, 22 GEO. INT'L ENVTL. L. REV. 383 (2010) (noting that existing regulatory approaches to climate change adaptation incompletely address long-term sustainability challenges); John D. Sterman & Linda Booth Sweeney, *Understanding Public Complacency About Climate Change: Adults' Mental Models of Climate Change Violate Conservation of Matter*, 80 CLIMATIC CHANGE 213, 235–36 (2007) (documenting prevalent misunderstandings of basic climate science among science-educated subjects and discussing how public discourse regarding climate change has been ineffective in generating public support for climate change mitigation and adaptation policies).

[4] *See, e.g.*, Nathan Richardson, *Greenhouse Gas Regulation Under the Clean Air Act: Does* Chevron *Set the EPA Free?*, 29 STAN. ENVTL. L.J. 283, 319 (2010) (providing an example and critique of the dominant approach to climate change mitigation—through regulatory measures aimed at reducing greenhouse gas emissions).

[5] *See* Sarah E. Light, *Valuing National Security: Climate Change, the Military, and Society*, 61 UCLA L. REV. 1772, 1788–89 (2014) (proposing that reframing climate change discourse in terms of national security may improve the resonance of climate discourse with certain segments of the public, as compared to framing the discourse in terms of environmental and sustainability concerns); Cass R. Sunstein, *On the Divergent American Reactions to Terrorism and Climate Change*, 107 COLUM. L. REV. 503, 507 (2007) ("Climate change generally does not trigger strong emotions, and people are willing to consider whether significant harm is probable.").

[6] *See* Anthony A. Leiserowitz, *American Risk Perceptions: Is Climate Change Dangerous?*, 25 RISK ANALYSIS 1433, 1438 (2005) (finding that, among those tested, climate change was most commonly associated with images of "melting glaciers and polar ice," and that "[Americans] think the impacts [of climate change] will mostly affect people and places that are geographically and temporally distant").

[7] *See infra* Section I.C.

[8] *See generally* Tien Ming Lee et al., *Predictors of Public Climate Change Awareness and Risk Perception Around the World*, 5 NATURE CLIMATE CHANGE 1014, 1014–20 (2015) (discussing the

advanced important goals of sustainability and resiliency.[9] But much more is necessary to broadly engage and educate people regarding the impacts and importance of adapting to changing global climate patterns.[10]

Relatedly, the phrase *climate change* has become so politically charged as to become a liability in advancing sustainable natural resource policies, particularly in light of the election of Donald Trump as President of the United States and demonstrated by his announcement that the United States will withdraw from the Paris Accords addressing climate change mitigation.[11] *Climate change*, as a policy brand, has become so politicized as to frequently paralyze discourse on sustainability. Something that should be as controversial as carrying an umbrella when the forecast is rainy has somehow become a new third rail that is rarely discussed in political discourse. Trump's election has strengthened the political position of climate change deniers and put those who do not highly prioritize climate change mitigation and adaptation in positions of influence over federal natural resource policies.[12] If the aims of the sustainable natural resource policy agenda are to be advanced in the new administration, then scholars, activists, and policy entrepreneurs may find it necessary to talk about climate change without saying *climate change*.

The second reason the climate change paradigm is inadequate is because it is incomplete. Climate change is not the most pressing natural resource problem. The most pressing problem is that, by 2030, global population growth and economic development will increase demand for food and energy by 50% and for freshwater by 30%, whether or not the

results of a survey of 119 countries to identify predictors and effective messages for conveying the risks of global climate change).

[9] *See, e.g.*, Carol E. Lee & William Mauldin, *U.S., China Agree on Implementing Paris Climate Change Pact; Obama, Xi Seek to Demonstrate Accord Between Developed and Developing Nations*, WALL ST. J. (Sept. 3, 2016), https://www.wsj.com/articles/u-s-china-agree-on-implementing-paris-climate-change-pact-1472896645 [https://perma.cc/DC29-K7X9]. The U.N. Convention on Climate Change and its associated Kyoto Protocol and recent Paris Accords are admirable advances in international cooperation in addressing climate change.

[10] Albert C. Lin, *Evangelizing Climate Change*, 17 N.Y.U. ENVTL. L.J. 1135, 1139 (2009).

[11] For a general discussion of the politically controversial nature of climate change, see generally Eric Biber, *Climate Change and Backlash*, 17 N.Y.U. ENVTL. L. J. 1295 (2009). *See also* Clare Foran, *Donald Trump and the Triumph of Climate-Change Denial*, ATLANTIC (Dec. 25, 2016), https://www.theatlantic.com/politics/archive/2016/12/donald-trump-climate-change-skeptic-denial/510359/ [https://perma.cc/S6LH-9CLU]; Michael D. Shear, *Trump Will Withdraw U.S. from Paris Climate Agreement*, N.Y. TIMES (June 1, 2017), https://www.nytimes.com/2017/06/01/climate/trump-paris-climate-agreement.html?mcubz=0 [https://perma.cc/4PY3-J8KC] .

[12] Foran, *supra* note 11; *see also* Ben Wolfgang, *Republican Attorneys General Eager to Dismantle Obama Climate Change Agenda Under Donald Trump*, WASH. TIMES (Dec. 26, 2016), http://www.washingtontimes.com/news/2016/dec/26/republican-attorneys-general-eager-to-dismantle-ob/ [https://perma.cc/8VLM-SSCC] (detailing the efforts of Republican attorneys general to eliminate regulations based on climate change concerns).

climate continues to change.[13] Global consumption of natural resources is "unsustainable,"[14] and climate change makes this pressing problem worse.[15] While climate change is an aggravating factor in the challenge of natural resource management,[16] the current climate change paradigm results in narrowly defining "sustainable" or "green" behaviors as those that have a low carbon footprint without factoring in the myriad ways such behaviors might be otherwise harmful.[17]

Third, the deficiencies of the climate change paradigm have arisen because it is being led by the wrong people. The early development of the climate change paradigm was largely hierarchical, meaning its trajectory was set by a top-down, national and supranational agenda.[18] While this approach made sense at the time given climate change's global reach, it has resulted in decisionmaking that is frequently attenuated from the unique

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[13] *See* Patricia Wouters et al., *Water Security, Hydrosolidarity, and International Law: A River Runs Through It . . .*, 19 Y.B. INT'L ENVTL. L. 97, 98 & n.6 (2009) (citing C. McGourty, *Global Crisis 'to Strike by 2030'*, BBC NEWS (March 19, 2009), http://news.bbc.co.uk/1/hi/uk/7951838.stm [https://perma.cc/T36R-PBKS] (quoting Professor John Beddington, U.K. Government Chief Scientist, who referred to the likely water stress caused by economic development, population growth, and climate change as the "perfect storm" for a global energy and food crisis)); *see also* Rhett B. Larson, *Reconciling Energy and Food Security*, 48 U. RICH. L. REV. 929, 932 n.13 (2014) [hereinafter Larson, *Reconciling Energy*].

[14] *See* L. Hunter Lovins, *Climate Capitalism: The Business Case for Climate Protection*, 27 PACE ENVTL. L. REV. 735, 744 (2010) ("[O]n the environment front, as our financial debts have built up, so have our debts to nature—in terms of the unsustainable depletion of natural resources, measured by the loss of topsoil, forests, fresh water and biodiversity. Everybody knows that liquidating capital assets to fuel consumption is crazy but nobody seems to know how to stop it. There is a simple conclusion here: the self-same abuses of debt-driven 'casino capitalism' that have caused the global economy to collapse are what lie behind the impending collapse of the life-support systems on which we all ultimately depend." (quoting Jonathon Porritt, *Perfect Storm of Environmental and Economic Collapse Closer than You Think*, GUARDIAN (Mar. 23, 2009), https://www.theguardian.com/environment/2009/mar/23/jonathon-porritt-recession-climate-crisis [https://perma.cc/LSH6-EBTD])).

[15] Wouters et al., *supra* note 13, at 98.

[16] *See, e.g.*, Richard J. Lazarus, *Super Wicked Problems and Climate Change: Restraining the Present to Liberate the Future*, 94 CORNELL L. REV. 1153, 1175 (2009) ("Addressing climate change by reducing resource consumption can also be especially difficult to accomplish.").

[17] *See* Sarah Tran, *Expediting Innovation*, 36 HARV. ENVTL. L. REV. 123, 154–55 (2012) (noting that in the energy-usage context, the adjective "green" is "ubiquitous and implies broadly that something is 'environmentally friendly,' 'recyclable,' 'biodegradable,' or 'energy efficient'" (quoting Roger D. Wynne, *Defining "Green": Toward Regulation of Environmental Marketing Claims*, 24 U. MICH. J.L. REFORM 785, 786 (1991)); *see also infra* Section I.C. Nuclear and hydroelectric energy, for example, have low carbon footprints, but neither is obviously green or sustainable.

[18] *See* William Boyd, *Climate Change, Fragmentation, and the Challenges of Global Environmental Law: Elements of a Post-Copenhagen Assemblage*, 32 U. PA. J. INT'L L. 457, 457–58, 496 (2010) (finding that an "Earth systems governance approach to the climate change problem"—one administered through "a top-down, supra-national regime"—"has become deeply embedded as a basic objective of climate policy" (internal quotation marks omitted)); Cinnamon P. Carlarne, *Rethinking a Failing Framework: Adaptation and Institutional Rebirth for the Global Climate Change Regime*, 25 GEO. INT'L ENVTL. L. REV. 1, 26 (2012).

local, cultural, economic, and natural conditions of the resources implicated by climate change.[19] Localized leadership is necessary to take a more nuanced approach, and improved natural resource management is more likely to be achieved in a paradigm that focuses on localized resources rather than a global commons problem like climate change.[20] Our sustainability challenges should be rebranded in a way that makes sense to the general public, is adapted to the local and regional conditions and characteristics of our natural resources, and integrates the human and environmental impacts of rising food, water, and energy demands with concerns associated with climate change.

Scientists have long been searching for a unified field theory—one equation that answers all the questions we have about the physical universe.[21] Natural resource law and policy need a unified sustainability paradigm—something that integrates all of our sustainability challenges into one measurable and accessible goal.[22] To that end, this Article will argue that the current narrow and inaccessible climate change paradigm should be replaced by one that focuses on a more immediate problem: water security. Water security, as it has been previously defined, is "the availability of an acceptable quantity and quality of water . . . with an acceptable level of water-related risks."[23] Framing our policies around water not only appropriately prioritizes our problems but better integrates them. Water security directly addresses the reasons climate change matters to most people—it has exacerbated the threat of droughts, floods,

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[19] For a general discussion of how more localized approaches to natural resource governance can facilitate effective response to the challenges of climate change, see generally Hari M. Osofsky, *Is Climate Change "International"? Litigation's Diagonal Regulatory Role*, 49 VA. J. INT'L L. 585, 587 (2009) [hereinafter Osofsky, *Is Climate Change "International"?*] (arguing for the need to have "multiscalar legal approaches" to sustainability issues that incorporate greater localized regulation and engagement).

[20] For a discussion of how collaboration among regional and local leadership can lead to improved natural resource management and sustainable policies, see generally Jonathan Rosenbloom, *New Day at the Pool: State Preemption, Common Pool Resources, and Non-Place Based Municipal Collaborations*, 36 HARV. ENVTL. L. REV. 445 (2012).

[21] *See generally* BRIAN GREENE, THE ELEGANT UNIVERSE (1999) (providing an overview and history of the pursuit of the unified field theory amongst scientists).

[22] *See, e.g.*, J.B. Ruhl, *The Fitness of Law: Using Complexity Theory to Describe the Evolution of Law and Society and Its Practical Meaning for Democracy*, 49 VAND. L. REV. 1407, 1417–18, 1465–67 (1996) (examining the development of environmental law and finding that its current federal regulatory approach may be in need of evolutionary transformation).

[23] David Grey & Claudia W. Sadoff, *Sink or Swim? Water Security for Growth and Development*, 9 WATER POL'Y 545, 547–48 (2007) (defining "water security" and discussing water security in terms of anticipated costs and benefits); *see also* Rhett B. Larson, *War and Water*, HUFFINGTON POST (Dec. 7, 2014), http://www.huffingtonpost.com/rhett-b-larson/war-and-water_b_5940892.html [https://perma.cc/E87M-NSUN] [hereinafter Larson, *War and Water*].

displacement, plagues, and wars.[24] The water security paradigm would thus highlight problems and events to which the general public can relate—droughts in California and Brazil, water protests in Michigan and Ireland, water conflict in Syria and Kashmir, stagnating economic development in Ghana, water-related epidemics like cholera in Haiti, and floods in France and Louisiana.[25] That is because water is not just the most important thing.[26] Water is food and energy, war and disease, racial and gender equality, and immigration and economic development.[27] "[Water] is everything."[28]

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[24] *See* Alexandra B. Klass, *Renewable Energy and the Public Trust Doctrine*, 45 U.C. DAVIS L. REV. 1021, 1064–65 (2012) (listing increased droughts and floods among the "risks associated with climate change"). *But cf.* Jason Scott Johnston, *Problems of Equity and Efficiency in the Design of International Greenhouse Gas Cap-and-Trade Schemes*, 33 HARV. ENVTL. L. REV. 405, 407–10 (2009) (suggesting that, although popular media report that global warming may lead to dire regional consequences in developing countries, there remains "substantial uncertainty about how much, if at all, different countries would benefit from present-day reductions in [greenhouse gas] emissions"). Water insecurity frequently causes or aggravates armed conflict and poverty, leading refugees and immigrants to flee war and seek opportunity. *See* Larson, *War and Water*, *supra* note 23.

[25] Aurelien Breeden & Katarina Johannsen, *From Paris to Bavaria, Heavy Rains Cause Deadly Floods*, N.Y. TIMES (June 2, 2016), https://www.nytimes.com/2016/06/03/world/europe/france-germany-floods-rain.html [https://perma.cc/NP53-74QT]; Mary M. Chapman, *Hundreds in Detroit Protest over Move to Shut Off Water*, N.Y. TIMES (July 18, 2014), https://www.nytimes.com/2014/07/19/us/protesters-picket-detroit-over-move-to-shut-off-water.html [https://perma.cc/56L2-Y9CK]; Suzanne Daley, *A New Irish Rebellion, This Time Against Water Fees*, N.Y. TIMES (Mar. 26, 2015) https://www.nytimes.com/2015/03/27/world/europe/many-in-ireland-vow-not-to-pay-a-new-water-tax.html [https://perma.cc/5CBY-FLJU]; Moses Mozart Dzawu, *A Water Crisis Threatens Ghana's Economic Growth*, BLOOMBERG (Apr. 11, 2013, 6:46 PM), https://www.bloomberg.com/news/articles/2013-04-11/a-water-crisis-threatens-ghanas-economic-growth [https://perma.cc/ACC7-F33N]; Joshua Hammer, *Is a Lack of Water to Blame for the Conflict in Syria?*, SMITHSONIAN MAG. (June 2013), https://www.smithsonianmag.com/innovation/is-a-lack-of-water-to-blame-for-the-conflict-in-syria-72513729/ [http://perma.cc/ST8F-ZAHQ]; Jenny Jarvie, *Historic Flooding Kills 8 in Louisiana as Thousands Scramble for Safety*, L.A. TIMES (Aug. 15, 2016, 8:25 PM), http://www.latimes.com/nation/nationnow/la-na-louisiana-flooding-20160815-snap-story.html [http://perma.cc/98VE-44WG]; Niharika Mandhana, *Water Wars: Why India and Pakistan are Squaring Off over Their Rivers*, TIME (Apr. 16, 2012), http://content.time.com/time/world/article/0,8599,2111601,00.html [http://perma.cc/U7BE-GRWH]; Adam Nagourney et al., *California Drought Tests History of Endless Growth*, N.Y. TIMES (Apr. 4, 2015) https://www.nytimes.com/2015/04/05/us/california-drought-tests-history-of-endless-growth.html?mcubz=0 [http://perma.cc/R56W-3CUX]; Renaud Piarroux, *The U.N.'s Responsibility in Haiti's Cholera Crisis*, N.Y. TIMES (Sept. 7, 2016), https://www.nytimes.com/2016/09/08/opinion/the-uns-responsibility-in-haitis-cholera-crisis.html?mcubz=0 [http://perma.cc/6X2X-NSRZ]; Kenneth Rapoza, *Brazil's Biggest Drought in Decades Also Worsens Interest Rate Outlook*, FORBES (Mar. 25, 2014, 8:24 AM), https://www.forbes.com/sites/kenrapoza/2014/03/25/brazils-biggest-drought-in-decades-also-worsens-interest-rate-outlook/ [https://perma.cc/R7WR-FH3T].

[26] *See* Rhett B. Larson, *The New Right in Water*, 70 WASH. & LEE L. REV. 2181, 2187 (2013) [hereinafter Larson, *The New Right*].

[27] *See generally* Larson, *Reconciling Energy*, *supra* note 13 (discussing how water security integrates concerns surrounding food and energy production and transmission); Inga T. Winkler et al., *Treasuring What We Measure and Measuring What We Treasure: Post-2015 Monitoring for the Promotion of Equality in the Water, Sanitation, and Hygiene Sector*, 32 WIS. INT'L L.J. 547 (2014)

This Article proceeds in four parts. Part I describes and evaluates the shifting dominant paradigms in natural resource law and policy up to the most recent: the climate change paradigm. The climate change paradigm has made important progress in addressing a critical issue, but its inaccessibility and incompleteness—partially driven by its top-down leadership—renders it inadequate and ripe for replacement. That incompleteness is partly due to the limitations of a "hierarchist"-led movement. These movements are characterized by decisionmakers who are remote from and unfamiliar with unique local conditions and, thus, less informed about the impact of their interventions on communities.

Part II defines the water security paradigm and explains why it should replace the climate change paradigm. The water security paradigm responds to the two fundamental limitations of the climate change paradigm—its inaccessibility and lack of resonance with the general public and its failure to address rising food, water, and energy demands that exist independent of climate change. The new paradigm is labeled *water security* to explicitly engage with the ongoing dialogue regarding both food and energy security and to elevate water to the prime consideration in this dialogue.[29] The water security paradigm focuses on the issues most accessible and relevant to the general public in part by replacing the carbon emissions regime with the more integrated and understandable water footprint, including "virtual water." Virtual water is the water embedded in all products.[30] As such, water footprint reporting that accounts for virtual water would give a more accurate and integrated picture of sustainability than mere carbon footprint reporting.[31] Part II also describes how the water security paradigm could affect governance structures. In particular, wherever possible, jurisdictional boundaries should be drawn to correspond to the watershed by interjurisdictional agreements to encourage cost

(noting the disproportionate burden water insecurity has on women and girls and on racial and ethnic minorities).

[28] Jacinta Ruru, *The Right to Water as the Right to Identity: Legal Struggles of Indigenous Peoples of Aotearoa New Zealand*, *in* THE RIGHT TO WATER 110, 110 (Farhana Sultana & Alex Loftus eds., 2012).

[29] In a previous article, I described the concept of water security as a policy paradigm and situated that paradigm within a broader discussion of security in food and energy policy. The discussion of water security in Part II of this Article draws largely from the ideas developed in that article. *See* Larson, *Reconciling Energy*, *supra* note 13.

[30] *See* J.A. (Tony) Allan, *Virtual Water - the Water, Food, and Trade Nexus: Useful Concept or Misleading Metaphor?*, 28 WATER INT'L 4, 5 (2003) [hereinafter Allan, *Virtual Water*] (defining virtual water as "the water needed to produce agricultural commodities" but acknowledging that "[t]he concept could be expanded to include the water needed to produce non-agricultural commodities" as well).

[31] Larson, *Reconciling Energy*, *supra* note 13, at 952–55.

internalization and lower transaction costs.[32] Because of this more localized approach, the water security paradigm should be led by embedded norm entrepreneurs at the basin level—what this Article calls "regionalists."

Part III proposes three reforms in environmental and natural resource law that will advance the water security paradigm and explains why successful implementation of those reforms is more likely under a water security paradigm than a climate change paradigm. First, nations should recognize a sustainable human right to water. Many nations currently recognize a human right to water but implement it in a way that is neither economically nor ecologically sustainable.[33] A sustainable human right to water facilitates public participation in water resource planning, encourages full cost recovery and water conservation through cost internalization, and promotes transparency and investment in water utilities infrastructure.[34]

Second, water law has historically focused primarily on what this Article refers to as the "Green Agenda" (water quality) and the "Blue Agenda" (water supply), often to the exclusion or detriment of the "Red Agenda" (control of pathogens and disease vectors, such as mosquitoes).[35] The water crisis in Flint, Michigan, illustrates one way in which the Blue Agenda (seeking a cheaper water source from the Flint River) conflicted with the Green Agenda (high chloride concentrations in raw water leaching lead out of an outdated infrastructure) and the Red Agenda (outbreaks of Legionnaires' Disease).[36] Water law should be reformed to better integrate the Red Agenda.[37] Approvals of water projects like dams and irrigation systems should include mandatory assessments of the impact of water infrastructure projects on disease vector habitat.[38] Third and finally, legal reforms that facilitate investment in innovative water augmentation and conservation technologies, such as desalination, and investment in water infrastructure to increase drought and flood resiliency, such as dams and reservoirs, should be implemented. Ultimately, the greatest challenge of

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[32] I described the importance of river-basin-level governance for water resources in a previous article. The discussion in Part II on basin-level governance draws largely from the ideas developed in that article. *See generally* Rhett B. Larson, *Interstitial Federalism*, 62 UCLA L. REV. 908 (2015) [hereinafter Larson, *Interstitial Federalism*].

[33] *See* Rhett B. Larson, *Adapting Human Rights*, 26 DUKE ENVTL. L. & POL'Y F. 1 (2015) [hereinafter Larson, *Adapting Human Rights*] (discussing how guaranteeing water provision under a human rights approach can result in poor cost recovery and limited incentives for conservation).

[34] *Id.*

[35] *See generally* Rhett B. Larson, *Law in the Time of Cholera*, 92 NOTRE DAME L. REV. 1271 (2017) [hereinafter Larson, *Time of Cholera*] (describing the framework for evaluating the different water agendas of supply, quality, and public health based on color).

[36] *Id.* at 1299–1300.

[37] *Id.* at 1275–76.

[38] *Id.* at 1311, 1315–17.

climate change will be increased water variability,[39] and that variability can be mitigated by advancing water conservation and augmentation technologies and responsibly developing large dams. The proposed legal reforms are more likely to be effectively implemented under a new hydrocentric policy paradigm and will serve both to orient law and policy toward the aims of water security and to help achieve water security at local, national, and international levels.

Part IV concludes by discussing the theoretical core of the water security paradigm, which is based on two related concepts: (1) adaptive capacity in the law as a means of achieving fairness, and (2) the abandonment of "normal" in resource management toward an approach of resilience to extreme conditions. Water security requires laws that adapt to water reality and produce resilience to water extremes. Part IV also addresses the promise, and potential limitations and criticisms, of the water security paradigm, concluding that reframing our natural resource policy dialogue around water security will lead to improved resource management and avoid policy stalemates associated with the climate change paradigm. Water security reframes the discussion for those who do not want to talk about *climate change*—without abandoning its essential message—and simultaneously starts a conversation about sustainability grounded in our most critical resource.

I. THE RISE AND FALL OF THE CLIMATE CHANGE PARADIGM

Before reorienting the aims of natural resource law and policy toward water security, it is essential to first understand the current climate change paradigm, how it has evolved, and why it no longer suffices to address sustainability challenges. Section A describes the historical evolution of natural resource policy paradigms, Section B distinguishes the climate change paradigm from its predecessor paradigms and argues that climate change is the current dominant natural resource policy paradigm, and Section C explains why the climate change paradigm is no longer adequate and needs to be supplanted.

A. The Evolution of Natural Resource Policy Paradigms

A policy paradigm is a distinct conceptual framework within which policy decisions are made and justified.[40] A policy paradigm includes

[39] Larson, *Reconciling Energy*, *supra* note 13, at 951.

[40] *See* Daniel Béland & Robert Henry Cox, *Introduction to Special Issue: The Politics of Policy Paradigms*, 26 GOVERNANCE 193, 193 (2013) ("Policymaking is dominated by paradigmatic thinking—widely shared ways of thinking about policy challenges that lead to broad consensus about the appropriateness of a policy response."); Peter A. Hall, *Policy Paradigms, Social Learning, and the*

shared assumptions about problems and solutions, and it is often reinforced by framing those problems and proposed solutions within the context of that existing paradigm.[41] Paradigms shift when predominant modes of thinking are challenged because those modes have proven inadequate or unsatisfactory.[42] Initially, policymakers resist new paradigms because they do not fit within the existing paradigm.[43] As the nascent paradigm proves effective at explaining or solving problems, and better than the old paradigm at integrating new technologies and information, it gains acceptance and legitimacy.[44] As paradigms rise and fall, multiple paradigms may exist simultaneously within the same sphere,[45] but typically one paradigm predominates.[46] A new paradigm is often characterized and distinguished by the identity of the policy advocates who develop and rely on its increasingly accepted framework.[47] Understanding why paradigms succeed and fail requires an examination of the actors who influenced the movement. Early advocates not only set the course but are often

State: The Case of Economic Policymaking in Britain, 25 COMP. POL. 275, 279 (1993) ("[P]olicymakers customarily work within a framework of ideas and standards that specifies not only the goals of policy and the kind of instruments that can be used to attain them, but also the very nature of the problems they are meant to be addressing . . . . I am going to call this interpretive framework a policy paradigm.").

[41] Michael H. Cohen, *A Fixed Star in Health Care Reform: The Emerging Paradigm of Holistic Healing*, 27 ARIZ. ST. L.J. 79, 85 (1995) (discussing the general concept of paradigm shifts while examining the rising paradigm of holistic healing and the ebbing paradigm of individual systems diagnostics and treatment in health care approaches).

[42] *See, e.g.*, George A. Martínez, *Race and Immigration Law: A Paradigm Shift?*, 2000 U. ILL. L. REV. 517, 524 (2000); Eduardo Moisés Peñalver, *The Persistent Problem of Obligation in International Law*, 36 STAN. J. INT'L L. 271, 285–86 (2000).

[43] *See, e.g.*, ANATOLE KALETSKY, CAPITALISM 4.0 186 (2010) (noting that "academic establishments fight hard to resist paradigm shifts"); THOMAS S. KUHN, THE STRUCTURE OF SCIENTIFIC REVOLUTIONS 150–52 (2d ed. 1970) (noting that older scientists resist paradigm shifts due in part to professional investments in existing paradigms).

[44] *See, e.g.*, Steven D. Smith, *The Plight of the Secular Paradigm*, 88 NOTRE DAME L. REV. 1409, 1418 (2013) (describing how a paradigm that persistently fails to "address[] anomalies and puzzles" may be "discarded in favor of a new one that" better "account[s] for all the evidence").

[45] *See, e.g.*, Stephen A. Conrad, *The Rhetorical Constitution of "Civil Society" at the Founding: One Lawyer's Anxious Vision*, 72 IND. L.J. 335, 347–48 (1997) (noting one scholar's "emphasis on multiple, simultaneous, or chronologically overlapping paradigms of society" in the eighteenth century).

[46] *See, e.g.*, Richard B. Stewart & Cass R. Sunstein, *Public Programs and Private Rights*, 95 HARV. L. REV. 1193, 1241 (1982) (acknowledging that "[i]n many studies . . . a single paradigm is seen to dominate an entire discipline for a lengthy period, only to be succeeded by another dominant paradigm following a revolutionary struggle" but ultimately finding a different pattern in which "a number of conflicting remedial paradigms coexist over a considerable period of time").

[47] *See* J. A. Allan, *Water in the Environment/Socio-Economic Development Discourse: Sustainability, Changing Management Paradigms and Policy Responses in a Global System*, 40 GOV'T & OPPOSITION 181, 193–95 (2005) [hereinafter Allan, *Water in the Environment*] (identifying each of five water management paradigms with the sector of society that chiefly participates in that paradigm).

disproportionately influential in outlining the goals of a paradigm's policies and defining success.[48] Some policy paradigms are hierarchical, in that they are top-down and driven by high-level government leadership at the national or even supranational governmental level. Borrowing Professor Allan's term, I call these leaders hierarchists.[49] Other policy paradigms are bottom-up initiatives, characterized as civil movements and distinguished by the leadership of ethicists concerned primarily with social justice.[50] Some policy paradigms are led by entrepreneurs in the private for-profit sector and focus on wealth maximization and efficiency.[51] Of course, it is possible that multiple stakeholders lead the paradigm, in that ethicists, entrepreneurs, and hierarchists all work together.[52] Still, it can be helpful to look to the earliest advocates of a particular paradigm as a means of categorizing paradigms and examining how their earliest advocates influence the trajectory of a paradigm's development.[53]

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[48] John W. Lee & W. Eugene Seago, *Policy Entrepreneurship, Public Choice, and Symbolic Reform Analysis of Section 198, the Brownfields Tax Incentive: Carrot or Stick or Just Never Mind?*, 26 WM. & MARY ENVTL. L. & POL'Y REV. 613, 639 (2002) ("Policy entrepreneurs adopt policy proposals in order to promote their own interests, gain favors and obligations for future bargaining . . . or just because they personally favor those particular policies as a matter of ideology or otherwise.").

[49] *See* Allan, *Water in the Environment*, *supra* note 47, at 193–95.

[50] *See, e.g.*, JEFFREY D. SACHS, THE END OF POVERTY: ECONOMIC POSSIBILITIES FOR OUR TIME (2005) (discussing the civil movements aimed at economic development and social justice for disadvantaged communities, with particular emphasis on the United Nations Millennium Development Goals); Allan, *Water in the Environment*, *supra* note 47, at 193–95.

[51] *See, e.g.*, Allan, *Water in the Environment*, *supra* note 47; *see also* Yochai Benkler, *Commons and Growth: The Essential Role of Open Commons in Market Economies*, 80 U. CHI. L. REV. 1499 (2013) (reviewing BRETT M. FRISCHMANN, INFRASTRUCTURE (2012) (noting the ongoing debate over the role of private sector leadership in shifting paradigms regarding management of shared resources)); Muthukumara Mani & Shreyasi Jha, *Trade Liberalization and the Environment in Vietnam* 2 (World Bank Policy Research, Working Paper No. 3879, 2006) (noting the role of entrepreneurs and the for-profit sector in shifting paradigms to trade liberalization in Vietnam).

[52] *See, e.g.*, David J. Bederman, *An Evaluation of the Contribution of the Conference*, 22 EMORY INT'L L. REV. 201, 202 (2008) (noting the tension created by the simultaneous roles of both top-down and bottom-up leadership in the formulation of international law, particularly in the context of public health).

[53] *See, e.g.*, J. Peter Byrne, *Academic Freedom: A "Special Concern of the First Amendment,"* 99 YALE L.J. 251, 274–77 (1989) (noting the role of changing leadership in universities in the development of the academic freedom paradigm in higher education); Allen N. Sultan, *Principal and Practical Foundations of a Global Constitutional Order*, 3 WASH. U. GLOBAL STUD. L. REV. 155, 161–62 (2004) (noting the role of early leaders' "moral courage" in setting a trajectory for paradigms in constitutional law).

1. The Industrial Paradigm

The earliest broad frameworks for the management of natural resources emerged from the Industrial Revolution.[54] The industrial paradigm was characterized by the leadership of entrepreneurs and driven by a reliance on market incentives.[55] These incentives encouraged the development of natural resources and improved efficiencies in natural resource exploitation and in technological innovation but also led to many instances of the tragedy of the commons and negative externalities.[56] The industrial paradigm is characterized by the leadership of entrepreneurs, such as John D. Rockefeller, who spurred economic development and technological innovation but at a heavy price of resource contamination and depletion.[57]

In the context of water law and policy, the era of the industrial paradigm is characterized by the "hydraulic mission" whose hallmark is the subjugation and exploitation of water in pursuit of political legitimacy and economic development.[58] The hydraulic mission was driven by "the strong conviction that every drop of water flowing to the ocean is a waste and that the state should develop hydraulic infrastructure to capture as much water as possible for human uses."[59] Water was dammed and polluted in pursuit of economic development, and it was treated as a commodity with economic, but not necessarily inherent, value.[60] Furthermore, water was a

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[54] Robin Morris Collin & Robert William Collin, *Where Did All the Blue Skies Go? Sustainability and Equity: The New Paradigm*, 9 J. ENVTL. L. & LITIG. 399, 410 (1994) (providing an overview of the values of the industrial paradigm).

[55] *See generally* THOMAS C. COCHRAN, FRONTIERS OF CHANGE (1981) (providing a comparative history of the early Industrial Revolution in the U.S. and Europe and noting the role of entrepreneurs and financiers in shaping that era).

[56] *See* Collin & Collin, *supra* note 54, at 408–11.

[57] *See* Itzchak E. Kornfeld, *Cleaning Up Superfund: A Proposal for Permanent Cleanups and Returning Land Back to Nature—With Applications to the Petroleum Industry*, 9 J. NAT. RESOURCES & ENVTL. L. 335, 357–58 (1994) (detailing case studies demonstrating the public health, economic, and environmental impacts of resource exploitation in the oil and gas industry).

[58] *See* Jeremy Allouche, *The Multi-Level Governance of Water and State-Building Processes: A* Longue Durée *Perspective*, *in* THE POLITICS OF WATER: A SURVEY 45, 58–59 (Kai Wegerich & Jeroen Warner eds., 1st ed. 2010) (defining the "hydraulic mission" as "an attempt to control and manipulate water resources of a country so that its constituents may meet their domestic, industrial and agricultural needs"); *see also* Kate Darling, *A Weight for Water: An Ecological Feminist Critique of Emerging Norms and Trends in Global Water Governance*, 13 MELBOURNE J. INT'L L. 368, 378 (2012) (discussing Allouche, *supra*); Mary Christina Wood, *Protecting the Attributes of Native Sovereignty: A New Trust Paradigm for Federal Actions Affecting Tribal Lands and Resources*, 1995 UTAH L. REV. 109, 151–54 (1995) [hereinafter Wood, *Protecting the Attributes*].

[59] Philippus Wester et al., *The Hydraulic Mission and the Mexican Hydrocracy: Regulating and Reforming the Flows of Water and Power*, 2 WATER ALTERNATIVES 394, 396 (2009).

[60] Darling, *supra note* 58, at 378.

symbol of political legitimacy,[61] with operation of large water infrastructure perceived as essential to and demonstrative of political power: large dams, for example, stood as symbols of a regime's strength and beneficence.[62] As with any paradigm, the earliest advocates set the trajectory of the hydraulic mission and defined what success meant.[63] Much like the industrial paradigm broadly,[64] this trajectory was one of resource development and exploitation, and leaders sought to wring the maximum amount of economic value from each drop of water.[65]

2. The Green Paradigm

The growing challenges of pollution and resource depletion exposed the industrial paradigm's failure to integrate consideration of these externalities.[66] The industrial paradigm was ultimately challenged and supplanted by what I term the "green paradigm,"[67] which focused on broadly limiting environmental damage through a system of "direct regulatory proscription."[68] The green paradigm also introduced other specific mechanisms for internalizing costs that were previously externalized; these include the permitting requirements of the Clean Water Act and Clean Air Act and the "polluter pays" principle of Superfund.[69] Additionally, the green paradigm saw the enactment of significant pieces of

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[61] *See id.*

[62] Allouche, *supra* note 58, at 58–59; *see also* Wester et al., *supra* note 59, at 397–400 (detailing how Mexico's *Partido Revolucionario Institucional* (Revolutionary Institutional Party) consolidated power in the twentieth century through water infrastructure development as an example of the hydraulic mission).

[63] François Molle et al., *Hydraulic Bureaucracies and the Hydraulic Mission: Flows of Water, Flows of Power*, 2 WATER ALTERNATIVES 328, 329–31 (2009) (describing political regimes throughout the world that relied on the ethos of the hydraulic mission to gain and secure power).

[64] *See* Wood, *Protecting the Attributes*, *supra* note 58, at 152–56 (describing the "industrial development model" as one of two main economic paradigms in modern Indian Country and noting its focus on resource exploitation which has been to the long-term detriment of many tribes).

[65] Molle et al., *supra* note 63, at 332.

[66] *See* Daniel C. Esty, *Environmental Protection in the Information Age*, 79 N.Y.U. L. REV. 115, 149–50 (2004) (noting the aims of environmental law were in part to internalize externalities of industrial-scale pollution); Wyatt G. Sassman, *Environmental Justice as Civil Rights*, 18 RICH. J.L. & PUB. INT. 441, 456 (2015) (noting the role of environmental law in internalizing the costs of the industrial economy).

[67] *See generally* GREEN PARADIGMS AND THE LAW (Nicole Rodgers ed., 1998) (providing, through a series of chapters, an overview and discussion of the "green paradigm" as an evolving set of norms and aims associated with environmental protection and resource sustainability).

[68] Bradley C. Karkkainen, *Framing Rules: Breaking the Information Bottleneck*, 17 N.Y.U. ENVTL. L.J. 75, 75–77 (2008).

[69] Clean Water Act, 33 U.S.C. § 1251 *et seq.* (2012); Clean Air Act, 42 U.S.C. § 7401 *et seq.* (2012); Comprehensive Environmental Response, Compensation, and Liability Act (CERCLA or Superfund), 42 U.S.C. § 9601 *et seq.* (2012).

environmental protection legislation,[70] and it encouraged greater transparency in natural resource management. Examples of this include environmental impact assessments under the National Environmental Protection Act (NEPA) and the listing and consultation requirements under the Endangered Species Act (ESA).[71]

The green paradigm was marked by the leadership of ethicists,[72] or nongovernmental actors, and by grassroots advocacy led by individuals such as Rachel Carson and Lois Gibbs.[73] Beyond legislative reforms, the green paradigm led to Earth Day, a marked increase in "press coverage of the environment," and generally broader awareness of human impacts on the environment.[74] Ethicists set the green paradigm on a trajectory favoring bottom-up advocacy for interventions focused on the prevention of environmental harms and for a broader and stronger public "environmental ethos."[75]

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[70] WILLIAM N. ESKRIDGE, JR. & JOHN FEREJOHN, A REPUBLIC OF STATUTES: THE NEW AMERICAN CONSTITUTION 256, 301 (2010); *see also* Jim Chen, *Legal Mythmaking in a Time of Mass Extinctions: Reconciling Stories of Origins with Human Destiny*, 29 HARV. ENVTL. L. REV. 279, 292 (2005) (placing the Endangered Species Act and the National Environmental Policy Act within the category of "'super-statutes' whose 'institutional [and] normative' impact reaches issues ordinarily addressed through constitutional law" (citing William Eskridge, Jr. & John Ferejohn, *Super-Statutes*, 50 DUKE L.J. 1215, 1216 (2001) [hereinafter Eskridge & Ferejohn, *Super-Statutes*]); Eskridge & Ferejohn, *Super Statutes*, *supra*, at 1242–46 (describing the scope and significance of the Endangered Species Act in particular).

[71] *See* Endangered Species Act (ESA), 16 U.S.C. § 1531 *et seq.* (2012); National Environmental Policy Act (NEPA), 42 U.S.C. § 4321 *et seq.* (2012); Shannon M. Roesler, *The Nature of the Environmental Right to Know*, 39 ECOLOGY L.Q. 989, 1015–16 (2012) (discussing the NEPA requirements).

[72] *Cf., e.g.*, Roesler, *supra* note 71 (identifying the fundamental interests that underlie the right to demand disclosure of environmental information, including intellectual freedom, personal liberty, self-government, and human health).

[73] *See* Timur Kuran & Cass R. Sunstein, *Availability Cascades and Risk Regulation*, 51 STAN. L. REV. 683, 691–99 (1999) (describing the ultimately exaggerated public response to the 1976 Love Canal overflow, the "key role" that local resident Lois Marie Gibbs "played . . . in reinforcing fears of adverse health effects [from the overflow] and mobilizing public attention," and the resulting passage of the Comprehensive Environmental Response, Compensation and Liability Act (CERCLA)); *see, e.g.*, RACHEL CARSON, SILENT SPRING (1962); Roesler, *supra* note 71 (example of the incorporation of ethical considerations in environmental law illustrating the role of ethicists).

[74] *See* Cary Coglianese, *Social Movements, Law, and Society: The Institutionalization of the Environmental Movement*, 150 U. PA. L. REV. 85, 94–95 (2001).

[75] *See* Robin Kundis Craig, *A Comparative Guide to the Western States' Public Trust Doctrines: Public Values, Private Rights, and the Evolution Toward an Ecological Public Trust*, 37 ECOLOGY L.Q. 53, 83 (2010) (discussing the "expansion of public trust concepts to the environment" as an improvement on regulatory law because a public trust is "more comprehensive in its considerations," and noting one scholar's description of the public trust doctrine as "the most compelling beacon for a fundamental and rapid paradigm shift towards sustainability" (quoting Mary Christina Wood, *Advancing the Sovereign Trust of Government to Safeguard the Environment for Present and Future Generations (Part I): Ecological Realism and the Need for a Paradigm Shift*, 39 ENVTL. L. 43, 45 (2009) [hereinafter Wood, *Advancing the Sovereign Trust*])).

However, the green paradigm failed to account fully for the growing threat of global climate change and did not adequately address concerns of intergenerational equity.[76] For example, the green agenda's focus on pollution prevention and remediation aimed to achieve acceptable resource quality for the current generation but not necessarily resource sustainability for future generations.[77] Furthermore, the green paradigm's aims were diffuse and lacked integration, with efforts to address air pollution, hazardous waste, clean water, and endangered species embodied in independent regulatory schemes.[78] What was needed, then, was a new paradigm that found ways to connect the disjointed aspects of the green movement and raise the priority of climate change adaptation and mitigation relative to these other environmental concerns.

B. Climate Change as the Dominant Natural Resource Policy Paradigm

The climate change paradigm followed the green paradigm and has been a direct response to the green paradigm's limitations. Climate change is about more than just the impacts of changing climate patterns brought on by anthropogenic greenhouse gases: it is a paradigm aimed at integrating environmental protection with sustainable resource management.[79] This paradigm is distinct from the green paradigm in many ways, particularly in its focus on adaptation and resiliency rather than establishing minimum standards of environmental quality.[80] The climate change paradigm

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[76] *But see* Wood, *Advancing the Sovereign Trust*, *supra* note 75, at 46 ("Society is exhausting life-sustaining natural resources at a pace that threatens the lives, comfort, and economic prosperity of individuals—not just future generations, but those living on Earth today."); *cf.* Alice Kaswan, *Greening the Grid and Climate Justice*, 39 ENVTL. L. 1143, 1158–59 (2009) (predicting political opposition to the "green movement" in the case that it fails to "address social justice" concerns).

[77] *See* Wood, *Advancing the Sovereign Trust*, *supra* note 75, at 54–55, 67–71 (advocating that, in the environmental context, the government function "as [t]rustee of [p]ublic [a]ssets for [p]resent and [f]uture [g]enerations," and contrasting this public trust model with "the [f]ailed [p]aradigm of [e]nvironmental [l]aw" and its bloated "administrative state").

[78] *See* Scott M. Davidson, *On Environmental Thought at the Turn of the Century*, 42 NAT. RESOURCES J. 433, 438 (2002) (reviewing JOHN MARTIN GILLROY, JUSTICE & NATURE: KANTIAN PHILOSOPHY, ENVIRONMENTAL POLICY, AND THE LAW (2000) (noting "the division of environmental regulation according to environmental media" with specific reference to air pollution (Clean Air Act) and water pollution (Clean Water Act))).

[79] *See, e.g.*, Anika E. Leerssen, *Smart Growth and Green Building: An Effective Partnership to Significantly Reduce Greenhouse Gas Emissions*, 26 J. ENVTL. L. & LITIG. 287, 301–02 (2011) (noting, in the last decade, the emergence in federal policymaking of "smart growth" efforts "to reduce GHG [(greenhouse gas)] emissions in the U.S. transportation sector through integration of land use and transportation planning").

[80] *See generally* Carlarne, *supra* note 18 (discussing the need for integrating adaptive management principles as part of climate change policy); J.B. Ruhl, *Climate Change Adaptation and the Structural Transformation of Environmental Law*, 40 ENVTL. L. 363, 367–70, 391–92 (2010) (discussing the

attempts to integrate broader concerns for intergenerational equity (sustainable resource management) with concerns of intragenerational equity (the disparate impacts that environmental contamination and resource depletion have on developing countries and economically disadvantaged communities).[81] Climate change also prioritizes natural resource policies that promote both adaptation or resilience to changing climate patterns and mitigation of those impacts through the reduction of greenhouse gas emissions.[82] Currently, policymakers frequently rely on carbon footprints to integrate these concerns.[83] Carbon footprints, as a metric and policy tool, potentially integrate concerns of resource overexploitation, income inequities in resource allocation, deforestation, and sustainable development.[84]

The climate change paradigm is led by hierarchists at the national or supranational level.[85] Climate change is a problem of planetary scope, involving the entire atmosphere, oceans, mountains, forests, energy and food.[86] In that light, climate change regulation is effectively the regulation of the global commons, and thus the paradigm's leaders saw a cooperative international framework as the ideal approach.[87] Such an approach arguably

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often-competing mitigation and adaptation policy approaches in environmental law and stating the need for increased focus on adaptation).

[81] *See* EDITH BROWN WEISS, IN FAIRNESS TO FUTURE GENERATIONS 117, 345 (1989) (quoting Edith Brown Weiss, *Climate Change, Intergenerational Equity and International Law: An Introductory Note*, 15 Climatic Change 327, 327 (1989)) (on intergenerational equity); Victor B. Flatt, *Adapting Laws for a Changing World: A Systemic Approach to Climate Change Adaptation*, 64 FLA. L. REV. 269, 289–91 (2012) (on intragenerational equity).

[82] Robin Kundis Craig, *"Stationarity is Dead" — Long Live Transformation: Five Principles for Climate Change Adaptation Law*, 34 HARV. ENVTL. L. REV. 9, 43–44 (2010).

[83] Alessandro Galli et al., *Integrating Ecological, Carbon and Water Footprint into a "Footprint Family" of Indicators: Definition and Role in Tracking Human Pressure on the Planet*, 16 ECOLOGICAL INDICATORS 100, 102 (2012) ("The Carbon Footprint measures the total amount of GHG emissions that are directly and indirectly caused by an activity or are accumulated over the life stages of a product."); *see also* Michael P. Vandenbergh & Mark A. Cohen, *Climate Change Governance: Boundaries and Leakage*, 18 N.Y.U. ENVTL. L.J. 221, 224–25 (2010) (noting the use of the carbon footprint metric in establishing a threshold over which facilities must report carbon emissions).

[84] *See, e.g.*, Jody M. Endres, *Agriculture at a Crossroads: Energy Biomass Standards and a New Sustainability Paradigm?*, 2011 U. ILL. L. REV. 503, 530 (2011) (discussing how various agencies use the carbon footprint metric in the agricultural context); Galli et al., *supra* note 83, at 101–02 (discussing the importance of the carbon footprint as it relates to overall ecosystem sustainability).

[85] *See* Katherine A. Trisolini, *All Hands on Deck: Local Governments and the Potential for Bidirectional Climate Change Regulation*, 62 STAN. L. REV. 669, 671–74 (2010) ("It is not surprising that scholars are skeptical of local governments' ability to contribute meaningfully to greenhouse gas reductions. The very nature of climate change seems to render it incompatible with local control.").

[86] Eric W. Orts, *Climate Contracts*, 29 VA. ENVTL. L.J. 197, 199–202 (2011).

[87] *See* Kirsten H. Engel & Scott R. Saleska, *Subglobal Regulation of the Global Commons: The Case of Climate Change*, 32 ECOLOGY L.Q. 183, 187–88 (2005) ("With respect to global environmental

requires a hierarchical, top-down approach within a supranational organization.[88] Thus, given the sheer geographic scope of the challenge of mitigating anthropogenic climate change, and the inevitable spillover effects of greenhouse gas emissions, the movement began with intervention by the United Nations to cooperatively address climate change through an international framework convention.[89] Unsurprisingly, given these global beginnings, the climate change paradigm pursues policies that embrace broader considerations than the green paradigm—including energy consumption and the differentiated responsibilities of developed nations compared to developing nations regarding resource protection.[90]

Climate change became the dominant paradigm in part because a hierarchical, integrated approach can spread quickly, penetrating different industries, levels of government, and policy arenas. It benefited from top-down regulation developed through political and scientific consensus with broad economic and geographic scope.[91] Given the implications of global climate change, it arguably should dominate all other natural resource policy paradigms out of sheer necessity.[92] Its scope and significance inevitably have resulted in debates about how best to characterize the paradigm and its goals, including the deployment of descriptive terms or goals such as sustainability, resilience, or adaptation.[93] The challenges presented by climate change also include debates regarding issues of environmental justice, such as the role of human rights in environmental law and the disproportionate impact climate change has on economically

problems such as global climate change or ozone depletion, the 'matching principle' calls for an international framework or response, as opposed to unilateral subglobal action.").

[88] *See id.*; *see also* Daniel Bodansky, *International Law and the Design of a Climate Change Regime*, *in* INTERNATIONAL RELATIONS AND GLOBAL CLIMATE CHANGE 201–04 (Urs Luterbacher & Detlef F. Sprinz eds., 2001) (describing the current model of international cooperation in climate change law).

[89] *See generally* Daniel Bodansky, *A Tale of Two Architectures: The Once and Future U.N. Climate Change Regime*, 43 ARIZ. ST. L.J. 697 (2011) (describing the history behind U.N. efforts to address climate change).

[90] Alexandre Genest, *The Fight Against Global Warming: Progress Made and Priorities for a Successor to the Kyoto Protocol*, 46 REVUE JURIDIQUE THÉMIS 525, 574–75 (2012) (describing the different climate change responsibilities of developed and developing countries).

[91] *See* Suh-Yong Chung, *Is the Mediterranean Regional Cooperation Model Applicable to Northeast Asia?*, 11 GEO. INT'L ENVTL. L. REV. 363, 372 (1999) ("Generally, in the environmental cooperation field, scientific knowledge is critical in terms of defining issues and making policies. Its increasing role can bring national participation into international environmental cooperation negotiation efforts.").

[92] *See* Ross Astoria, *Climate Hawks and California's Carbon Offsets*, 28 J. LAND USE & ENVTL. L. 227, 229 (2013) ("Indeed, if we are to avoid catastrophic climate change, global warming policy must become the dominant form of governmentality.").

[93] *See, e.g.*, Craig, *supra* note 82 (describing debates over prioritizing adaptation and resiliency over restoration or preservation).

and politically marginalized communities.[94] While the debates around these goals and terms are important, for purposes of this Article, these debates fall within the broader climate change paradigm originally advocated by hierarchists, which focuses on responding to the consequences of anthropogenic greenhouse gas emissions. Typically, when scholars or policy advocates speak of resiliency or adaptation or environmental justice or sustainability, it is against the backdrop of climate change.

While the climate change paradigm has replaced the green paradigm as the dominant paradigm in environmental and natural resource law and policy, its dominant position in the scholarly debate has not absolutely crowded out prior paradigms.[95] Prior paradigms have not disappeared, and they continue to influence the current climate change paradigm.[96] Both the industrial paradigm and the green paradigm persist and even affect the climate change paradigm itself. For example, market incentives and private governance approaches to address greenhouse gas emissions derive from the industrial paradigm's entrepreneurial approach.[97] Grassroots advocacy in climate change, Pigovian carbon taxes, and the view of greenhouse gas emissions as "pollution" to be regulated under command-and-control statutes like the Clean Air Act have their roots in the green paradigm.[98]

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[94] *See, e.g.*, Hari M. Osofsky, *Learning from Environmental Justice: A New Model for International Environmental Rights*, 24 STAN. ENVTL. L.J. 71, 77 (2005) ("[P]rovid[ing] a starting point for grappling with the complicated legal intersections at the heart of achieving greater environmental justice at an international level.").

[95] *See, e.g.*, Carlarne, *supra* note 18, at 32 (discussing the broad proliferation of scholarship and policy proposals addressing climate change); Engel & Saleska, *supra* note 87, at 184–86 (noting the proliferation of efforts in civil society to address climate change impacts); Stephen M. Gardiner, *A Perfect Moral Storm: Climate Change, Intergenerational Ethics and the Problem of Moral Corruption*, 15 ENVTL. VALUES 397, 398 (2006) (noting the prominent role of ethical considerations in climate change discussions).

[96] *See, e.g.*, Holly Doremus & W. Michael Hanemann, *Of Babies and Bathwater: Why the Clean Air Act's Cooperative Federalism Framework Is Useful for Addressing Global Warming*, 50 ARIZ. L. REV. 799, 800–01 (2008) (arguing that key parts of the Clean Air Act—representative of the green paradigm's legacy—have continued use in "fill[ing] some of the gaps" that would be left by another environmental regulatory structure based on "carbon dioxide emission-trading programs").

[97] *See, e.g.*, Kenneth W. Abbott, *Strengthening the Transnational Regime Complex for Climate Change*, 3 TRANSNAT'L ENVTL. L. 57, 60–62 (2014) (proposing a strengthened transnational, private-governance response to climate change); David M. Driesen & Amy Sinden, *The Missing Instrument: Dirty Input Limits*, 33 HARV. ENVTL. L. REV. 65, 77–79 (2009) (proposing a new regulatory instrument relying on market incentives to address greenhouse gas emissions).

[98] *See* Reuven S. Avi-Yonah & David M. Uhlmann, *Combating Global Climate Change: Why a Carbon Tax Is a Better Response to Global Warming than Cap and Trade*, 28 STAN. ENVTL. L.J. 3, 6–7 (2009) (proposing a carbon tax); Shalanda H. Baker, *Climate Change and International Economic Law*, 43 ECOLOGY L.Q. 53, 73–74 (2016) (discussing environmental grassroots activists in El Salvador); Robert L. Glicksman & Richard E. Levy, *A Collective Action Perspective on Ceiling Preemption by Federal Environmental Regulation: The Case of Global Climate Change*, 102 NW. U. L. REV. 579, 643 (2008) (referring to greenhouse gas emissions as "pollution").

Additionally, it is necessary to point out that the climate change paradigm has not been entirely hierarchical. Climate change has a "multi-scalar character," wherein activists, entrepreneurs, and regulators function at different jurisdictional scales from the local to the supranational.[99] As larger scale national and supranational jurisdictions leave niches unfilled in addressing climate change, smaller scale jurisdictions, such as municipal governments or river-basin commissions, may step in to fill these policy niches.[100] These efforts of state and local governments in the U.S. to respond to greenhouse gas emissions are examples of nonhierarchical approaches to climate change.[101] Still, these more localized approaches are responses to the limitation of the general hierarchical character of the climate change paradigm because policies are developed and implemented by those most familiar with the unique geographical and cultural characteristics of natural resources in a particular region.

Climate change has not necessarily dominated policy discussions at all levels and in all instances, and vestiges of the green paradigm and industrial paradigm continue to dictate policy choices. There remain many, even in positions of influence, who are skeptical of climate change science and the importance of addressing climate change for future generations.[102] But amongst scholars and advocates within the natural resources and environmental policy spheres, climate change dominates the discourse, particularly if one accepts that debates about resiliency, sustainability, adaptation, and environmental justice are conducted within the context of climate change.[103] The dominance of the climate change paradigm has facilitated critical advances in environmental and natural resource policy, including raising public awareness of the threat of global climate change,

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[99] *See, e.g.*, Jody Freeman, *The Obama Administration's National Auto Policy: Lessons from the "Car Deal,"* 35 HARV. ENVTL. L. REV. 343, 363 (2011) (describing the key stakeholders in the process of regulating automobile greenhouse gas emissions); Osofsky, *Is Climate Change "International"?*, *supra* note 19, at 591–93 (describing climate change as a multi-scalar problem).

[100] Larson, *Interstitial Federalism*, *supra* note 32, at 926–31 (discussing the role of river-basin commissions in improving water management).

[101] Freeman, *supra* note 99, at 362 (describing cooperation between the federal government and California in creating a program for regulating automobile greenhouse gas emissions); *see also* Garrick B. Pursley & Hannah J. Wiseman, *Local Energy*, 60 EMORY L.J. 877, 948–51 (2011) (discussing the roles of local, state, and federal governments in regulating the renewable energy industry).

[102] *See, e.g.*, Lyle Scruggs & Salil Benegal, *Declining Public Concern About Climate Change: Can We Blame the Great Recession?*, 22 GLOBAL ENVTL. CHANGE 505, 505 (2012) (noting a public "'crisis of confidence' in climate science"); John D. Sterman, *Communicating Climate Change Risks in a Skeptical World*, 108 CLIMATIC CHANGE 811, 812 (2011) (noting "widespread confusion, complacency and denial [about climate change] among policymakers, the media and the public").

[103] *See* Steven Burns, *Environmental Policy and Politics: Trends in Public Debate*, 23 NAT. RESOURCES & ENV'T 8, 8 (2008) ("Climate change has come to dominate the public discourse on the environment unlike any other issue today.").

reforming laws and regulations to better address anthropogenic greenhouse gases, increasing investment in adaptation and resiliency, encouraging greater focus on the disparate impacts of climate change upon the poor, and driving greater integration of environmental and natural resource issues under the rubric of carbon footprints and sustainable development.[104] However, as the following Section shows, the climate change paradigm cannot adequately address many of our more pressing environmental and natural resource concerns.

C. The Inadequacy of the Climate Change Paradigm

Despite improving on the green paradigm, the climate change paradigm is nevertheless incomplete, inadequately framed, and ultimately obsolete. The climate change paradigm fails to adequately address the primary concern of natural resource policy (increasing global demand for food, energy, and water) by focusing too much on greenhouse gas emissions and carbon footprints.[105] Despite the strong science underlying anthropogenic climate change, there have been decades of public debate about the reality of the threat, its significance, and its salience.[106] The climate change paradigm has sought to move past this debate through education or improved messaging.[107] But perhaps it would have been better to abandon the debate as an expensive drag on progress by recognizing that

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[104] *See* Mary Jane Angelo & Joanna Reilly-Brown, *Whole-System Agricultural Certification: Using Lessons Learned from LEED to Build a Resilient Agricultural System to Adapt to Climate Change*, 85 U. COLO. L. REV. 689, 694 (2014) (noting the increased emphasis on sustainability in the agriculture industry); Margaux J. Hall & David C. Weiss, *Avoiding Adaptation Apartheid: Climate Change Adaptation and Human Rights Law*, 37 YALE J. INT'L L. 309, 336 (2012) (discussing the increased sensitivity of vulnerable regions and communities to effects of climate change); Douglas A. Kysar, *What Climate Change Can Do About Tort Law*, 41 ENVTL. L. 1, 3–4 (2011) (describing the ways in which tort law might positively address climate change, but also investigating the potential impact of climate change on tort law); J.B. Ruhl, *General Design Principles for Resilience and Adaptive Capacity in Legal Systems — with Applications to Climate Change Adaptation*, 89 N.C. L. Rev. 1373 (2011); Lisa Schenck, *Climate Change "Crisis" – Struggling for Worldwide Collective Action*, 19 COLO. J. INT'L ENVTL. L. & POL'Y 319, 346 (2008) (noting that although calls for "more immediate action" are lacking, "public awareness regarding climate change is increasing").

[105] Larson, *Reconciling Energy*, *supra* note 13, at 952–53.

[106] *See generally* Riley E. Dunlap & Aaron M. McCright, *Organized Climate Change Denial*, *in* OXFORD HANDBOOK OF CLIMATE CHANGE AND SOCIETY 144–60 (John S. Dryzek et al. eds., 2011) (discussing partisanship and other causes of ongoing debate over reality, significance, and relative costs and benefits of climate change and approaches to its mitigation); Dan M. Kahan et al., *The Polarizing Impact of Science Literacy and Numeracy on Perceived Climate Change Risks*, 2 NATURE CLIMATE CHANGE 732, 732–35 (2012) (discussing the role of science literacy on public engagement in, and perception of, debates on climate change risks).

[107] *See, e.g.*, Karl S. Coplan, *Climate Change, Political Truth, and the Marketplace of Ideas*, 2012 UTAH L. REV. 545, 573 (2012); Matthew C. Nisbet, *Communicating Climate Change: Why Frames Matter for Public Engagement*, 51 ENV'T MAG. 12, 14–23 (2009).

the central issue in question—anthropogenic climate change—is not in fact the greatest or most pressing natural resource problem facing humanity. Indeed, though climate change is enormously important, it is ultimately an aggravating factor of a more fundamental and proximal concern and one with far less scientific uncertainty. By 2030, the planet will need 50% more food and energy and 30% more fresh water, regardless of climate change, as a result of population growth and increased consumption patterns.[108]

Perhaps because it is a hierarchist paradigm, the climate change paradigm frames the discussion in terms inaccessible to, and remote from, most people.[109] Advocates and scholars regularly assure the general public that there is a scientific consensus regarding climate change,[110] but their message is built upon jargon-laden scholarly exchanges regarding complex mathematical models.[111] That consensus is fundamentally about the role of human sources of greenhouse gas impacts and involves agreements over a range of possibilities and some inherent and acceptable degree of uncertainty.[112] The message on climate change does not lend itself well to simple transmission to typical policymakers, voters, and consumers.[113]

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[108] *See supra* note 13 and accompanying text.

[109] Brooks E. Harlow & Roy W. Spencer, *An Inconvenient Burden of Proof? CO_2 Nuisance Plaintiffs Will Face Challenges in Meeting the* Daubert *Standard*, 32 ENERGY L.J. 459, 462 (2011) (noting the difficulty nonscientists have in understanding the basis for and implications of "the climate science underpinning the AGW [anthropogenic global warming] theory"); *see also* Michael P. Vandenbergh, *Climate Change: The China Problem*, 81 S. CAL. L. REV. 905, 954 (2008) (noting how consumers might have failed to respond to certain market and marketing signals regarding climate change because "[i]n the last two decades, climate change has been largely a matter of complex, inaccessible predictions").

[110] Ann Moritz, *Scientific Consensus on Climate Change*, *in* CLIMATE CHANGE: A READER 16 (William H. Rodgers Jr. et al. eds., 2011); Coplan, *supra* note 107, at 553 (identifying and discussing challenges that the scientific consensus on climate change faces in "achieving acceptance as a political truth in the marketplace of ideas"); Open letter from Gary W. Yohe et al. (Mar. 12, 2010), http://e360.yale.edu/assets/site/digest/ipcc-scientists-letter.pdf [https://perma.cc/F33B-NCWA].

[111] John D. Sterman, *Communicating Climate Change Risks in a Skeptical World*, 108 CLIMATIC CHANGE 811, 815–16 (2011).

[112] James M. Murphy et al., *Quantification of Modelling Uncertainties in a Large Ensemble of Climate Change Simulations*, 430 NATURE 430 (2004) (discussing the challenge of evaluating uncertainty in global climate models); Naomi Oreskes, *The Scientific Consensus on Climate Change: How Do We Know We're Not Wrong?*, *in* CLIMATE CHANGE: WHAT IT MEANS FOR US, OUR CHILDREN, AND OUR GRANDCHILDREN 65, 69–75 (Joseph F. C. DiMento & Pamela Doughman eds., 2007).

[113] *See* Caleb W. Christopher, *Success by a Thousand Cuts: The Use of Environmental Impact Assessment in Addressing Climate Change*, 9 VT. J. ENVTL. L. 549, 579 (2008); Lawrence C. Hamilton, *Education, Politics and Opinions About Climate Change Evidence for Interaction Effects*, 104 CLIMATE CHANGE 231, 235–42 (2011) (discussing the difficulties of effectively conveying risks of climate change to voters); Willett Kempton, *Lay Perspectives on Global Climate Change*, 1 GLOBAL ENVTL. CHANGE 183, 183 (1991) ("[G]lobal climate change remains a challenge to lay comprehension. The scientific issues are staggeringly complex, with major predictions still debated by climatologists."); Victoria K. Wells et al., *Behaviour and Climate Change: Consumer Perceptions of Responsibility*, 27 J.

Attempts to make the research underlying climate change more accessible often oversimplifies, and the general public is left wondering how their local weatherman can continually be wrong about the next day's weather but thousands of scientists can be so confident about the planet's climate in the coming decades and centuries.[114] Even in instances where the science is adequately conveyed, the relevance and significance is often lost on the general public.[115] The initial framing of the challenge was often in terms of "global warming," but this frame failed to raise concerns for many people busy shoveling snow from their driveways or for those who may not be terribly familiar with polar ice caps or glaciers.[116] The pitch changed to "climate change" because global warming did not adequately describe a problem that was instead about increased extreme climate events and altered climate patterns.[117] Though public awareness and understanding of climate change causes and impacts have increased since this reframing, efforts to mobilize both individuals and nations to respond to the threat have faltered.[118] Framing the challenge in terms of either low-probability or temporally remote catastrophic events arguably generated apathy and created a wave of skeptics and deniers.[119]

Moreover, the relatively narrow focus of the climate change paradigm inevitably fails to fully integrate critical considerations into natural resource policy decisions. For example, the paradigm's narrow focus on carbon emissions neglects the other environmental costs associated with

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MARKETING MGMT. 808 (2011) (discussing the difficulty in informing consumers about the impacts of their decisions in climate change mitigation efforts).

[114] Maxwell T. Boykoff & Jules M. Boykoff, *Climate Change and Journalistic Norms: A Case-Study of US Mass-Media Coverage*, 38 GEOFORUM 1190, 1200–01 (2007).

[115] *See* Graham Frederick Dumas, Note, *A Greener Revolution: Using the Right to Food as a Political Weapon Against Climate Change*, 43 N.Y.U. J. INT'L L. & POL. 107, 148 (2010); Alice Kaswan, *Greening the Grid and Climate Justice*, 39 ENVTL. L. 1143, 1159 (2009).

[116] *See* DEBIKA SHOME & SABINE MARX, THE PSYCHOLOGY OF CLIMATE CHANGE COMMUNICATION 9 (Andria Cimino ed., 2009), http://guide.cred.columbia.edu/pdfs/CREDguide_full-res.pdf [https://perma.cc/6DPA-KEVW].

[117] John J. Delaney et al., 2 HANDLING THE LAND USE CASE § 42:1 (3d ed. 2017) ("Often used interchangeably with 'global warming,' the National Academies of Sciences has pointed out that the phrase 'climate change' is growing in preferred use to 'global warming' because it helps convey that there are changes in addition to rising temperatures.").

[118] *See* Biber, *supra* note 11, at 1352–54 (noting the high costs, uncertainties, and time periods associated with any human efforts to adapt to climate change); Marc Limon, *Human Rights and Climate Change: Constructing a Case for Political Action*, 33 HARV. ENVTL. L. REV. 439, 440 (2009) ("[T]here was a general frustration [leading up to 2005] on the part of vulnerable communities at the slow pace of progress in tackling climate change using the traditional politico-scientific approach.").

[119] Gary E. Marchant & Karen Bradshaw, *The Short-Term Temptations and Long-Term Risks of Environmental Catastrophism*, 56 JURIMETRICS 345, 356–57 (2016).

new energy sources.[120] Developments of nuclear or hydroelectric energy are low-carbon-emitting energy sources and may be necessary to meet rising energy demands, but their benefits may not ultimately justify their long-term environmental costs.[121] Similarly, solar energy requires extraction of natural resources like copper, which also may adversely impact the environment.[122] While these new developments may be optimal for long-term climate change, they may have other detrimental environmental effects.

Additionally, regulators who seek to address climate change may not adequately consider the effects on the cost of food, water, and energy. For example, recent federal regulations impose more stringent emissions standards on coal-fired power plants,[123] and producers may pass associated compliance costs on to consumers, thereby making energy more expensive. A critical example of this can be seen in the effect of strengthened emissions standards on populations that rely on these plants for water. The Navajo Generating Station (NGS), a coal-fired power plant, provides the necessary energy to bring Arizona's allocation of Colorado River water through to the Central Arizona Project (CAP) canal system and to water users throughout the state.[124] CAP is critical for delivering water to Native American tribes in Arizona who have settled their water rights claims to central Arizona rivers in exchange for the more reliable CAP water.[125] Tribes typically pay for the energy costs to transport the water through the CAP.[126] Increased costs from more stringent emissions standards on NGS could make water provision through CAP unaffordable for some tribes,

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[120] *See* Elizabeth Thomas, *The Myth of a Single, "Green" Power Resource*, 10 NAT. RESOURCES & ENV'T 65, 65–67 (1996).

[121] *See* Howard A. Latin, *Climate Change Mitigation and Decarbonization*, 25 VILL. ENVTL. L.J. 1, 65–66, 69–70 (2014) (listing both hydroelectric and nuclear power as potential "low-GHG replacement technologies" but also noting the large water needs of nuclear generating facilities); Thomas, *supra* note 120, at 66–67 (discussing the environmental costs of large dams needed for hydropower projects).

[122] Peter Huber, *Electricity and the Environment: In Search of Regulatory Authority*, 100 HARV. L. REV. 1002, 1004–05, app. at 1065 (1987).

[123] *See* Steven Ferrey, *International Power on "Power,"* 45 ENVTL. L. 1063, 1084–85, 1085 n.146 (2015).

[124] *See* Scott K. Miller, *Undamming Glen Canyon: Lunacy, Rationality, or Prophecy*?, 19 STAN. ENVTL. L.J. 121, 156 (2000).

[125] John B. Weldon, Jr. & Lisa M. McKnight, *Future Indian Water Settlements in Arizona: The Race to the Bottom of the Waterhole?*, 49 ARIZ. L. REV. 441, 441–42 (2007) (discussing CAP's role in tribal water settlements).

[126] *Id.*; *see also* Ryan Randazzo, *10 Challenges to Keeping the Navajo Generating Station Open*, AZ CENTRAL (May 22, 2017, 7:00 AM), http://www.azcentral.com/story/money/business/energy/2017/05/22/arizona-10-challenges-keeping-navajo-generating-station-open/332911001/ [https://perma.cc/3YDH-NUKQ] (noting the potential increased CAP rates due to more stringent emissions controls and the desire of tribes not to pay an energy premium for water deliveries).

effectively depriving the tribes of the water rights they agreed to in settlement.[127] Thus, well-intentioned regulators narrowly focused on carbon emissions may inadvertently make water unaffordable for thousands of Native Americans in Arizona.[128]

Defenders of the climate change paradigm may point to recent successes in moving the climate change agenda forward, including the commitments of major greenhouse gas emissions reductions under the Paris Accords.[129] The agreed-upon reductions in the United Nations Framework Convention on Climate Change in the Conference of the Parties (COP) 21 represent important progress in international cooperation in addressing climate change and one of the true success stories of the climate change paradigm.[130] Indeed, the climate change paradigm has encouraged international cooperation to address a pressing global crisis. Nevertheless, the Paris Accords do not address the short-term natural resource challenges—the increased demand for water, food, and energy. Natural resource law and policy must move away from the narrow climate change paradigm and toward a new approach that integrates the broader and more pressing concerns of water, food, and energy demands. President Trump's announcement regarding the United States' withdrawal from the Paris Accords only further illustrates how a focus on the rhetoric of climate change may create some political obstacles that might be overcome by simply shifting the dialogue toward a different rhetoric[131]—perhaps the rhetoric of water security.

This Article does not argue that the climate change paradigm is a failure or that it was unnecessary or counterproductive. Each natural resource paradigm has made important contributions and likely will endure

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[127] *See* Chuck DeVore, *The EPA's All Pain, No Gain Plan to Nationalize the Electric Grid*, FORBES (Mar. 23, 2016, 5:41 PM), https://www.forbes.com/sites/chuckdevore/2016/03/23/the-epas-all-pain-no-gain-plan-to-nationalize-the-electric-grid/#3fe16aa02813 [https://perma.cc/QTQ7-H6KY].

[128] *See* Abrahm Lustgarten, *End of the Miracle Machines: Inside the Power Plant Fueling America's Drought*, PROPUBLICA (June 16, 2015), https://projects.propublica.org/killing-the-colorado/story/navajo-generating-station-colorado-river-drought [https://perma.cc/YRT3-XWML] ("But in pushing for dramatic changes at the Navajo plant, the EPA underestimated how intertwined the plant had become with every aspect of life in the region — from providing its power to moving its water to buttressing the tribal economy.").

[129] *See* Michael Burger et al., *Legal Pathways to Reducing Greenhouse Gas Emissions Under Section 115 of the Clean Air Act*, 28 GEO. ENVTL. L. REV. 359, 381–82 (2016) (discussing the success of the Paris Accords and how the U.S. might implement its commitments under those agreements).

[130] Coral Davenport, *Nations Approve Landmark Climate Accord in Paris*, N.Y. TIMES (Dec. 12, 2015), https://www.nytimes.com/2015/12/13/world/europe/climate-change-accord-paris.html [https://perma.cc/V2KA-57MJ].

[131] Michael D. Shear, *Trump Will Withdraw U.S. from Paris Climate Agreement*, N.Y. TIMES (June 1, 2017), https://www.nytimes.com/2017/06/01/climate/trump-paris-climate-agreement.html [https://perma.cc/9LN3-WUDE].

as part of the paradigm portfolio of natural resource law and policy in some form. However, though the climate change paradigm has played an important role, its limitations have inhibited mobilization. A new paradigm should now assume primacy in natural resource policy to address those limitations by integrating climate change concerns with increasing resource demands in a way that is relatable to the general public.

II. WATER SECURITY: THE RISING PARADIGM

Given the climate change paradigm's limitations, a new paradigm is needed, one that is more integrated, accessible, and focused. One not characterized by the limitations and trajectories of past paradigms set by hierarchists, entrepreneurs, or ethicists but rather guided by regionalists who understand the unique characteristics of local watersheds. Water security should be the new preeminent paradigm in environmental and natural resource law and policy. Section A defines the water security paradigm and its scope and importance. Section B next explains why and how the water security paradigm should supplant the climate change paradigm, with the more accessible and integrated water footprint metric replacing the carbon footprint. Section C then describes governance under the water security paradigm, arguing that the water security paradigm should be led by regionalists focused on basin-level policy reforms and that jurisdictional boundaries should be redrawn, to the extent possible, to correspond to watersheds.

A. Defining the Water Security Paradigm

The water security paradigm reorients the goals of natural resource and environmental law and policy to achieve "an acceptable quantity and quality of water" with acceptable costs and risks.[132] Water lies at the heart of human conflict and cooperation. Water security is the more integrated and accessible paradigm needed to address the limitations of the climate change paradigm and move natural resource law and policy forward. A water-based policy paradigm broadly integrates complex legal issues.

Human civilization arose around desert river basins because survival in the desert required an unprecedented level of cooperation, specialization, and investment in public works to develop water resources.[133] The inherent

[132] Grey & Sadoff, *supra* note 23, at 547–48; *see also* Dan Tarlock & Patricia Wouters, *Reframing the Water Security Dialogue*, 20 J. WATER L. 53, 53 (2009) (describing "the increased incidences of local and regional water problems" as "a global water security problem").

[133] Ludwik A. Teclaff, *Fiat or Custom: The Checkered Development of International Water Law*, 31 Nat. Resources J. 45, 55–60 (1991) (noting that some of the greatest civilizations of antiquity arose

challenge of developing and sharing a scarce resource like a desert river gave rise to the first complex political and legal systems to facilitate collaboration and resolve disputes.[134] Indeed, "the word 'rival' [comes] from the Latin word '*rivalis*,' meaning persons who live on opposite banks of a river."[135] Thus water lies at the heart of human conflict and cooperation and is, therefore, the foundational element not only of life but also of law.

Given this elementary nature of water, water security underlies virtually every major societal problem. Drought and floods are obvious examples. In 2015, thousands of people were killed worldwide in flood events, with millions of people displaced and damage in the billions of dollars.[136] Drought has plagued countries all over the world, with particularly disastrous impacts in Brazil, Venezuela, and the southwestern United States.[137] The cost of the historic drought in California for 2015 alone was $2.7 billion.[138]

Beyond droughts and floods, many of the major violent conflicts around the globe have an important and underappreciated water component.[139] It is not a coincidence that the rise of ISIS in Syria or the rise of the Taliban in Afghanistan occurred during historic droughts in these countries, which led to mass urbanization and higher food prices.[140]

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in regions coexistent with drainage basins in arid regions, such as the Indus, Nile, Tigris and Euphrates, and that early empires were an attempt to impose cooperative frameworks to develop water resources).

[134] *Id.*

[135] Joseph W. Dellapenna, *International Law's Lessons for the Law of the Lakes*, 40 U. MICH. J.L. REFORM 747, 763–64 (2007).

[136] *See* Adam B. Smith & Jessica L. Matthews, *Quantifying Uncertainty and Variable Sensitivity Within the US Billion-Dollar Weather and Climate Disaster Cost Estimates*, 77 NAT. HAZARDS 1829 (2015); *Space-based Measurement, Mapping, and Modeling of Surface Water*, DARTMOUTH FLOOD OBSERVATORY, http://floodobservatory.colorado.edu/ (follow the "DFO Flood Archive" hyperlink), http://floodobservatory.colorado.edu/Archives/MasterListrev.htm [https://perma.cc/8XYC-UXE8].

[137] Carrie Kahn & Lulu Garcia-Navarro, *Drought Conditions Wreak Havoc on Latin America*, NPR (Aug. 29, 2014, 5:02 AM), http://www.npr.org/2014/08/29/344193332/drought-conditions-wreak-havoc-on-latin-america [https://perma.cc/YZ9X-DKSB]; Michael Martinez & Alexandra Meeks, *How Historic California Drought Affects Rest of Nation, Often for the Worse*, CNN (Apr. 3, 2015, 8:39 PM), http://www.cnn.com/2015/04/03/us/california-drought/ [https://perma.cc/AQ8U-KJN5].

[138] Doyle Rice, *California Drought Cost Is $2.7 Billion in 2015*, USA TODAY (Aug. 19, 2015, 5:51 PM), https://www.usatoday.com/story/weather/2015/08/19/california-drought-cost-27-billion-2015/32007967/ [https://perma.cc/HL8N-T883].

[139] *See* Larson, *War and Water*, *supra* note 23.

[140] *See* David Arnold, *Drought Called a Factor in Syria's Uprising*, VOA NEWS (Aug. 20, 2013, 8:19 AM), http://www.voanews.com/a/drought-called-factor-in-syria-uprising/1733068.html [https://perma.cc/4UZC-E4XA]; Paula Hanasz, *The Politics of Water Security in the Kabul River Basin*, FUTURE DIRECTIONS INT'L (Nov. 10, 2011), http://www.futuredirections.org.au/publication/the-politics-of-water-security-in-the-kabul-river-basin/ [https://perma.cc/AN4D-L5JZ]; Justin Worland, *Why Climate Change and Terrorism Are Connected*, TIME (Nov. 15, 2015), http://time.com/4113801/climate-change-terrorism/ [https://perma.cc/4L42-5CGE].

Desperate people in crowded cities without jobs and affordable food are like dry kindling for the spark of radicalization.[141]

Similarly, water security has led to conflict between countries. Indian dam development on the Indus River has represented one of the most fraught issues in the ongoing, and sometimes violent, confrontations between India and Pakistan in the disputed Kashmir region.[142] A battle cry for some in the region is: "[W]ater must flow, or blood must flow."[143] The Six Day War of 1967 between Israel and its Arab neighbors began in part as a water conflict, with competing attempts to divert the Jordan River resulting in several Israeli attacks.[144] Even in the United States, water disputes between states over the Colorado River escalated to the point of a narrowly avoided civil war.[145]

Similarly, many of the immigration and refugee challenges confronting the globe are merely examples of people doing what they have done for thousands of years: following water. Refugees from the conflict in Syria are perhaps the most obvious "water refugees" because, as noted above, the Syrian conflict was precipitated, and partly caused, by a drought in the Euphrates River basin.[146] But even more fundamentally and broadly, humans move in search of water security. Modern human migration patterns reflect moves from water-insecure regions—often exemplified by limited reservoir storage capacity and thus limited drought and flood resiliency—to water-secure regions—exemplified by expansive reservoir capacity and thus high drought and flood resiliency.[147] Even when migrants

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[141] *See* Hilal Khashan, *The Curse of Underdevelopment and the Radicalization of the Arab City*, 17 BROWN J. WORLD AFF. 7, 8, 12 (2010) (discussing the role of high food prices and limited economic opportunities in radicalization).

[142] Nicole Livanos, *Grab for Water Could Spark Conflict in Pakistan and India*, 19 LOY. PUB. INT. L. REP. 24 (2013); Neal A. Kemkar, Note, *Environmental Peacemaking: Ending Conflict Between India and Pakistan on the Siachen Glacier Through the Creation of a Transboundary Peace Park*, 25 STAN. ENVTL. L.J. 67, 75 (2006).

[143] *Unquenchable Thirst*, THE ECONOMIST (Nov. 19, 2011), http://www.economist.com/node/21538687 [https://perma.cc/4PZV-WJ68].

[144] Donald Neff, *Israel–Syria: Conflict at the Jordan River, 1949–1967*, 23 J. PALESTINE STUD. 26, 35–37 (1994).

[145] Larson, *Interstitial Federalism*, *supra* note 32, at 917 (describing how Arizona marched National Guard troops against California construction crews building the Parker Dam on the Colorado River when those crews crossed into Arizona's territory, and how violence was avoided when the U.S. Secretary of the Interior "halted construction of the dam in exchange for troops being recalled").

[146] John Wendle, *Syria's Climate Refugees*, SCI. AM., Mar. 2016, at 50, 52–55. Of course, the Syrian conflict and resulting refugee crisis cannot adequately be explained by water insecurity alone—there are a multitude of factors with complex interrelationships. But water insecurity is perhaps the least obvious, and therefore most underrated, aggravating factor.

[147] *See* Grey & Sadoff, *supra* note 23, at 551–52, 558–59 (comparing the economic plight of water insecure countries with the "range of productive opportunities" that water provides in water-secure countries).

express their motivations as seeking peace, political stability, or economic opportunity, those attributes are partly functions of water security.[148] Hydrodiplomatic relations between the United States and Mexico are connected to immigration issues between the two nations, as limited water storage capacity in Mexico and salt-contaminated water reaching Mexico from the United States aggravate economic concerns, thus driving Mexican northern migration.[149] As climate change causes ocean levels to rise, flooding and saline intrusion into freshwater aquifers will further aggravate the already critical global water-refugee crisis.[150]

Additionally, water security is a critical prerequisite for achieving racial and gender equality. One of the primary indicators of gender inequality globally is a lack of educational opportunities for girls and young women.[151] Women and children in developing countries spend up to six hours each day gathering water, making education and schooling difficult.[152] Further, water provision frequently aggravates racial inequalities. Water provision, rates, and payment structures in many parts of the world have been implemented in ways that have disparate racial impacts.[153] For example, in post-apartheid South Africa, the city of Johannesburg imposed requirements to prepay for water services on predominantly black communities, such as Phiri, whereas predominantly white townships could continue to purchase water based on credit.[154]

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[148] *See generally* Tom I. Romero, II, *Bridging the Confluence of Water and Immigration Law*, 48 TEX. TECH. L. REV. 779 (2016) (evaluating the role of water resource management in Mexican immigration to the U.S.).

[149] *See* Jonathan S. King et al., *Getting to the Right Side of the River: Lessons for Binational Cooperation on the Road to Minute 319*, 18 U. DENV. WATER L. REV. 36, 63, 66–67, 82 (2014) (discussing the history of U.S.–Mexico relations on the Colorado River and the impact of river management on agriculture and immigration in northern Mexico).

[150] Craig Anthony (Tony) Arnold, *Fourth-Generation Environmental Law: Integrationist and Multimodal*, 35 WM. & MARY ENVTL. L. & POL'Y REV. 771, 818 (2011) ("Coastal areas will experience significant sea level rise, but will likely find their groundwater sources of drinking water contaminated from saltwater intrusion even before large amounts of coastal lands are lost to ocean levels." (footnote omitted)).

[151] Naila Kabeer, *Gender Equality and Women's Empowerment: A Critical Analysis of the Third Millennium Development Goal*, 13 GENDER & DEV. 13, 13, 16–18 (2010).

[152] *See* David Hemson, *'The Toughest of Chores': Policy and Practice in Children Collecting Water in South Africa*, 5 POL'Y FUTURES IN EDUC. 315, 317, 320 (2007) (reporting that for children in South Africa, this figure is around six hours per week); Michael R. Ulrich, *The Impact of Law on the Right to Water and Adding Normative Change to the Global Agenda*, 48 GEO. WASH. INT'L L. REV. 43, 69–70 (2015).

[153] *See generally* Martha F. Davis, *Let Justice Roll Down: A Case Study of the Legal Infrastructure for Water Equality and Affordability*, 23 GEO. J. ON POVERTY L. & POL'Y 355 (2016) (illustrating how recent drinking water problems in the U.S. reflect racial disparities and in some cases discrimination in the quality, affordability, and reliability of drinking water provision).

[154] Larson, *The New Right*, *supra* note 26, at 2253.

Similarly, the water crisis in Flint, Michigan, has clear racial implications.[155] The majority of the residents of Flint are black, and the state's "slow and often antagonistic response" to citizen complaints about water quality and the city's reliance on dangerous, outdated infrastructure to deliver cheaper (and toxic) water, have raised claims of environmental racism behind the lead-poisoning crisis.[156]

Water is also a major component of global health and the control of, and response to, pandemics.[157] The deadly water crisis in Flint, Michigan, has, in addition to the threats of lead poisoning, included a spike in Legionnaires' Disease.[158] The still-ongoing cholera epidemic in Haiti, for example, had killed over 8,500 people and sickened over 600,000 as of December 31, 2013.[159] It has been estimated that 2.3 billion people live in areas of "water stress"—defined by a per capita supply of 1,700 cubic meters per year; "almost 6,000 children under the age of five die every day from water[-]related diseases."[160] And, as I wrote previously:

> Officials throughout the Western Hemisphere are currently struggling to contain the growing Zika virus outbreak, spreading by mosquitoes [that breed in water] and resulting in serious birth defects and death . . . . The serious

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[155] Shea Diaz, *Getting to the Root of Environmental Injustice*, GEO. ENVTL. L. REV. (2016), *syndicated on* ENVTL. L. REV. SYNDICATE, https://gelr.org/2016/01/29/getting-to-the-root-of-environmental-injustice/ [https://perma.cc/PTW9-U5R8] (discussing the environmental justice issues associated with impacts of natural resource policies on vulnerable communities and racial minorities in St. Joseph, Louisiana, and Flint, Michigan).

[156] John Eligon, *A Question of Environmental Racism in Flint*, N.Y. TIMES (Jan. 21, 2016), https://www.nytimes.com/2016/01/22/us/a-question-of-environmental-racism-in-flint.html [https://perma.cc/YF7W-GPPS]. There are many examples of environmental and natural resource policy implementation with disparate negative impacts on racial minorities in the U.S. *See, e.g.*, David A. Dana & Deborah Tuerkheimer, *After Flint: Environmental Justice as Equal Protection*, 111 NW. U. L. REV. 879, 883 (2017).

[157] For a discussion of the following recent water-based, waterborne, and water-related disease outbreaks, see Larson, *Time of Cholera*, *supra* note 35, at 1273–75.

[158] *Id.* at 1274–75 (citing Matt Ford, *A Legionnaires' Disease Outbreak in Flint*, ATLANTIC (Jan. 13, 2016), https://www.theatlantic.com/politics/archive/2016/01/flint-michigan-water-crisis/424062/ [https://perma.cc/7XWS-D7JQ]).

[159] Enrico Bertuzzo et al., *On the Probability of Extinction of the Haiti Cholera Epidemic*, 30 STOCHASTIC ENVTL. RES. & RISK ASSESSMENT 2043, 2043 (2016); *see also* Larson, *Time of Cholera*, *supra* note 35, at 1273.

[160] Malgosia Fitzmaurice, *The Human Right to Water*, 18 FORDHAM ENVTL. L. REV. 537, 538 (2007); *see also* Larson, *Time of Cholera*, *supra* note 35, at 1274. "Water scarcity" occurs where inadequate water quantity or quality prevents water supply from meeting demand during a period of time. *See Water Scarcity*, UNITED NATIONS DEP'T ECON. & SOC. AFFAIRS (Nov. 24, 2014), http://www.un.org/waterforlifedecade/scarcity.html [https://perma.cc/6HHG-PLHM].

> threat to human health posed by such diseases is likely to be aggravated by global climate change.[161]

Given the vital role water plays in so many societal issues, the bounds of what can be called *water law* or *water policy* can be difficult to delineate.[162] Water law thus can take on the "law of the horse" problem, where the scope of an area of law is defined so broadly that the definition is meaningless.[163] For the purposes of this Article, however, water law and policy refers to the explicit governance of water rights and water quality, water delivery and treatment, and the management and mitigation of drought and flood. Such a definition does not represent the takeover of other policy spheres by water, nor does it seek to define all policy realms as essentially only a question of water. Water law and policy does not need to be defined broadly to address the broad impacts and implications of water security. A new paradigm that focuses on the expansive implications of water security, with water law and policy narrowly defined, would meaningfully advance sustainable and resilient natural resource and environmental policy, while also addressing issues of climate change, war, immigration, disease, and inequality.

B. Why Water Security Should Replace Climate Change

The water security paradigm described above should become the predominant paradigm because it addresses the two fundamental limitations of the current climate change paradigm. First, unlike the climate change paradigm, water security integrates the growing demand for food and energy, as the energy and agriculture sectors are our largest water consumers.[164] Second, the water security paradigm improves upon the climate change paradigm by making sustainability issues more salient and accessible to the general public.

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[161] Larson, *Time of Cholera*, *supra* note 35, at 1274–75 (footnote omitted). *See generally* Lisa Heinzerling, *Climate Change, Human Health, and the Post-Cautionary Principle*, 96 GEO. L.J. 445, 447 (2008) (discussing the human health implications of climate change and suggesting that in the face of climate-induced famine from droughts and deaths from deadly floods, "[t]he weak[] [will] drop[] like flies" (citation omitted)).

[162] *See* Larson, *Reconciling Energy*, *supra* note 13, at 937.

[163] *See generally* Frank H. Easterbrook, *Cyberspace and the Law of the Horse*, 1996 U. CHI. LEGAL F. 207 (1996) (arguing against the study of many areas of law impacting a certain industry or even object (such as a horse), rather than the study of general principles of law, because the former approach leads to a shallow understanding of essential principles of law).

[164] Larson, *Reconciling Energy*, *supra* note 13, at 950–51.

1. Virtual Water[165]

Nearly everything humans do, for better and for worse, can be expressed in terms of quantity of water. Water is embedded in virtually all products, a concept called *virtual water*, with significant virtual water embedded in energy and food.[166] The production of a single kilogram of wheat, for example, requires approximately 1,000 liters of water.[167] Water is similarly embedded in energy, whether as a reactor coolant; steam to turn turbines; for growth of biofuel crops; in the mining of coal, oil, or natural gas; or in the components of solar and wind energy sources.[168]

To complicate matters, virtual energy is similarly embedded in the treatment and distribution of water.[169] If we move water security to the forefront in our discussions about sustainability, we will integrate climate change concerns with the problems associated with increasing global consumption patterns. That is because we will account for water throughout the chain of production in agriculture and energy.[170] Of course, the monitoring and reporting of carbon footprints across the chain of food or energy production provides important information on climate change impacts from greenhouse gas emissions.[171] The monitoring, measuring, and reporting of carbon footprints has thus become an important policy tool in assessing and mitigating anthropogenic greenhouse gas emissions, with the reduction of carbon footprints representing "the sine qua non of good environmental stewardship."[172] This focus on carbon footprints creates incentives to deploy low- or no-carbon energy sources, like nuclear, solar, wind, and hydroelectric energy.

The climate change paradigm's focus on greenhouse gas emissions and carbon footprints fails to account for environmental impacts from these

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[165] The following discussion of virtual water borrows heavily from my prior writing on the subject. *See id.* at 932–35, 952–55.

[166] *See* Allan, *Virtual Water*, *supra* note 30, at 5–6.

[167] WORLD WATER COUNCIL, E-CONFERENCE SYNTHESIS: VIRTUAL WATER TRADE – CONSCIOUS CHOICES 3 (2004), http://www.worldwatercouncil.org/fileadmin/wwc/Programs/Virtual_Water/virtual_water_final_synthesis.pdf [https://perma.cc/E3LU-V284]; *see also* A. Y. Hoekstra & A. K. Chapagain, *Water Footprints of Nations: Water Use by People as a Function of Their Consumption Pattern*, 21 WATER RESOURCES MGMT. 35, 39 (2007) (finding the virtual water content of wheat to be 1,334 cubic meters per ton).

[168] Larson, *Reconciling Energy*, *supra* note 13, at 933.

[169] *Id.* at 934 ("The energy required to run a faucet for five minutes is equivalent to the energy used to power a 60-watt light bulb for fourteen hours.").

[170] *Id.* at 954.

[171] *See* Dave Owen, *Climate Change and Environmental Assessment Law*, 33 COLUM. J. ENVTL. L. 57, 112–13 (2008).

[172] Larson, *Reconciling Energy*, *supra* note 13, at 952.

so-called "green" or "clean" energy sources.[173] Carbon footprint measurements do not account for other environmental concerns associated with these low-carbon energy sources, because the production and transmission of energy affects water consumption and contamination.[174] The effects of extractive industries—coal mining, oil and gas exploration and extraction, and fracking, among others—on water security are not fully integrated in carbon footprint analysis.[175] "Carbon footprints also fail to include the environmental impacts of climate change mitigation measures . . . ."[176] For example, geologic carbon sequestration can cause groundwater pollution, while green building codes, smart grids, and hybrid cars can require higher uses of copper and other mined elements.[177]

A jurisdiction could lower its carbon footprint by enacting such building codes, encouraging carbon sequestration, and developing renewable energy sources like wind, solar, and hydroelectric energy, all connected to a smart grid intended to lower energy demands.[178] As I wrote before, "[t]hese efforts would likely significantly reduce the state's carbon footprint,"[179] and so they would advance the climate change paradigm.

At the same time, these activities require "the mining of silicon, copper, gold, tungsten, and other minerals to build the components of solar cells, wind turbines, 'green' buildings, hybrid cars, or smart grids."[180] Carbon footprint analysis would not account for the increased water needed to cool the nuclear reactors, to grow the biofuels, to replace that lost to evaporation behind the dam, or to supply the fracking operations that recover natural gas.[181] Neither would it account for the water pollution from

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[173] *Id.* at 952–53.

[174] *Id.* at 952 (citing Alexis Laurent et al., *Limitations of Carbon Footprint as Indicator of Environmental Sustainability*, 46 ENVTL. SCI. & TECH. 4100, 4105–06 (2012)).

[175] *Id.* (citing Laurent et al., *supra* note 174, at 4105–06).

[176] *Id.* at 952–53.

[177] *Id.*; *see also* AM. PUBLIC POWER ASS'N, CARBON CAPTURE AND STORAGE: ANALYSIS OF POTENTIAL LIABILITIES ASSOCIATED WITH GROUNDWATER CONTAMINATION DUE TO GEOLOGICAL SEQUESTRATION OPERATIONS 5 (2008), http://www.publicpower.org/files/PDFs/APPA%20CCS%20white%20paper%20Waters%20of%20the%20US.pdf [https://perma.cc/43L6-RGU9] (discussing potential groundwater contamination from geologic sequestration of carbon); RESNICK INST. OF TECH., CRITICAL MATERIALS FOR SUSTAINABLE ENERGY APPLICATIONS 4 (Neil Fromer et al. eds., 2011), http://resnick.caltech.edu/docs/R_Critical.pdf [https://perma.cc/Y3DZ-U3CR] (discussing increased demand for copper and other metals from green building codes and smart technologies).

[178] For a similar but more detailed hypothetical, see Larson, *Reconciling Energy*, *supra* note 13, at 953.

[179] *Id.*

[180] *Id.*

[181] *Id.* For further discussion, see P.W. Gerbens-Leenes et al., *The Water Footprint of Energy from Biomass: A Quantitative Assessment and Consequences of an Increasing Share of Bio-Energy in*

nuclear waste disposal, fracking, geologic sequestration, or hydroelectric dams.[182] In short, the monitoring and reporting regime of the climate change paradigm is incomplete and provides an inadequate assessment of sustainable and environmentally responsible practices.[183]

A water footprint is similar to a carbon footprint, in that just as a carbon footprint reflects carbon emissions associated with a product or activity, a water footprint reflects water consumption associated with a product or activity.[184] A water footprint metric addresses fossil fuel energy production like a carbon footprint because it would account for the water used in that energy production.[185] Water footprints would also integrate the impacts of pollution and water consumptions from across the entire chain of production of no- or low-carbon energy sources such as nuclear energy, hydroelectric, natural gas, biofuels, wind, and solar.[186] Water footprints would also account for impacts to water quality from pollution.[187] Additionally, "water footprint[s] . . . provide necessary information on sustainability issues arising from increased consumption attributable to population growth and economic development."[188]

Furthermore, water footprints would provide a better understanding of how countries could face water insecurity through virtual water exports. Consider the following example:

> Fracking fluid frequently contains an emulsifier produced from the seed of the guar plant. The rapid [global] expansion of fracking . . . has resulted in a rising

Energy Supply, 68 ECOLOGICAL ECON. 1052, 1058 (2009) (comparing the water footprints of "the most important primary energy carriers"—"crude oil, coal, natural gas, uranium, electricity from hydropower, solar energy and wind" (citation omitted)); Benjamin K Sovacool & Alex Gilbert, *Developing Adaptive and Integrated Strategies for Managing the Electricity-Water Nexus*, 48 U. RICH. L. REV. 997, 1000 (2014).

[182] *See* Alex Funk & Benjamin K. Sovacool, *Wasted Opportunities: Resolving the Impasse in United States Nuclear Waste Policy*, 34 ENERGY L.J. 113, 121–23, 135 (2013) (noting the risk of groundwater contamination from nuclear waste); P.W. Gerbens-Leenes et al., *supra* note 181.

[183] *See* Larson, *Reconciling Energy*, *supra* note 13, at 950–55.

[184] *See* Lidija Čuček et al., *A Review of Footprint Analysis Tools for Monitoring Impacts on Sustainability*, 34 J. CLEANER PRODUCTION 9, 11 (2012); *see also, e.g.*, Daniel A. Farber, *Sustainable Consumption, Energy Policy, and Individual Well-Being*, 65 VAND. L. REV. 1479, 1509–10 (2012) (giving the water footprints of several different foods).

[185] *See, e.g.*, Corinne D. Scown et al., *Water Footprint of U.S. Transportation Fuels*, 45 ENVTL. SCI. & TECH. 2541 (2011) (providing an example of how water footprints can be used to measure impacts from the combustion, consumption, and production of fossil fuels).

[186] Larson, *Reconciling Energy*, *supra* note 13, at 952–55.

[187] *Id.* at 954. "[W]ater footprint[s] would also provide necessary information on sustainability issues arising from increased consumption attributable to population growth and economic development." *Id.* at 955.

[188] *Id.* (citing A. Ertug Ercin & Arjen Y. Hoekstra, *Water Footprint Scenarios for 2050: A Global Analysis*, 64 ENV'T INT'L 71, 71–72 (2014)).

> demand for guar, with the international price of guar seed rising from $4 per kilogram to $30 per kilogram in an eighteen-month period. Thousands of acres of crops formerly used for food production have been converted to the production of guar in India and Pakistan . . . . [G]uar may be a less drought-resilient and more water-intensive crop than many of the food crops it replaces.[189]

This replacement of food crops with increased guar production has the potential to raise food prices.[190]

Guar production may facilitate a shift to cleaner natural gas in some nations with fracking operations but increase water insecurity in nations replacing food crops with guar.[191] A shift to a water footprint metric will capture the impacts of these kinds of policies as virtual water moves around the world in global trade, determining "whether guar exports have the net effect of achieving water security in one nation at the expense of water security in another."[192]

2. Accessibility

Psychological research suggests that as temporal and spatial distance increases, "mental representations become . . . more abstract" and mental prioritization less likely.[193] In other words, people are unlikely to understand or prioritize sustainability issues unless they immediately hit home. That is especially problematic for climate change, as the general public often perceives climate change's impacts to be uncertain, temporally and spatially attenuated, and "not personally relevant."[194] Even if citizens accept climate change as relevant and important, "it [still] must compete with other[, more salient] issues for priority."[195]

To more effectively convey sustainability concerns to the general public, these concerns must be framed in ways that are proximal in both time and space.[196] And the message of climate change that hits most

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[189] *Id.* at 944–45 (footnotes omitted).

[190] *Id.* at 945.

[191] *Id.*

[192] *Id.* at 955.

[193] Leila Scannell & Robert Gifford, *Personally Relevant Climate Change: The Role of Place Attachment and Local Versus Global Message Framing in Engagement*, 45 ENV'T & BEHAV. 60, 62 (2013).

[194] *Id.* at 61.

[195] *Id.* at 61–62.

[196] *Id.* at 63; *see also* Anthony Leiserowitz, *Communicating the Risks of Global Warming: American Risk Perceptions, Affective Images, and Interpretive Communities*, *in* CREATING A CLIMATE FOR CHANGE: COMMUNICATING CLIMATE CHANGE AND FACILITATING SOCIAL CHANGE 44, 53–54 (Susanne C. Moser & Lisa Dilling eds., 2007) (suggesting that in order to effectively communicate the risk of global warming, it is necessary to communicate that threats are local and immediate).

immediately and closest to home is a message of water variability and extreme weather events like droughts and floods.[197] The water security paradigm speaks directly in these terms and, indeed, will reform laws to govern on the more local and regional level, rather than the hierarchical-governance model of the climate change paradigm. Ultimately, any person can intuitively understand water waste and water pollution, and the challenge of water scarcity. But the concepts of carbon emissions, greenhouse gases, and their impacts on global climate patterns are far from intuitive, accessible, or even spatially and temporally proximal to most people. The water footprint metric focuses sustainability on the intuitive concept of water waste. Furthermore, a water footprint metric can be tailored to be understood and monitored within the specific geographic and cultural context in which it is used, by factoring in scarcity, cultural and recreational values, and ecological concerns. Climate change's reliance on carbon footprints requires broader monitoring of sources and impacts divorced from geographic or cultural context.

C. Governance Under the Water Security Paradigm[198]

The shift from the climate change paradigm to the water security paradigm is in many ways about governance. Indeed, it addresses the "Goldilocks governance challenge"—governance must be scaled so that jurisdiction is neither too big nor too small.[199] The scope of governance "must be just right to rein in transaction costs and limit externalities."[200] If the scope of jurisdiction is too big, there will be too many stakeholders who are too remote from one another and unfamiliar with local conditions, thus unnecessarily increasing transaction costs.[201] If the scope of jurisdiction is

[197] *See* Scannell & Gifford, *supra* note 193, at 63.

[198] For a more detailed discussion of the role of appropriate jurisdictional boundaries in creating effective water policy, see Larson, *Interstitial Federalism*, *supra* note 32, from which I have borrowed extensively for this Section.

[199] *Id.* at 910–11.

[200] *Id.* at 910 (citing R. H. Coase, *The Problem of Social Cost*, 3 J.L. & ECON. 1 (1960) (noting the relationship between transaction costs and externalities)); Daniel C. Esty, *Revitalizing Environmental Federalism*, 95 MICH. L. REV. 570, 584–85 (1996); Christine A. Klein, *On Integrity: Some Considerations for Water Law*, 56 ALA. L. REV. 1009, 1010–11 (2005)).

[201] *Id.* at 910–11 (citing Village of Euclid v. Ambler Realty Co., 272 U.S. 365, 387 (1926); Robert D. Cooter & Neil S. Siegel, *Collective Action Federalism: A General Theory of Article I, Section 8*, 63 STAN. L. REV. 115 (2010) (for a general discussion of the role of transaction costs on intergovernmental cooperation and federalism)).

too small, it will produce negative externalities to neighboring jurisdictions.[202] Consider the following example:

> [I]f two [jurisdictions] share a river and the jurisdictional boundaries [do not correspond to the watershed], one [jurisdiction] can dam or pollute the river and externalize the costs of water scarcity or water contamination to its neighbor. If those [jurisdictions] share a river and the [boundaries incorporate many basins at a national or supra-national level], water management will be inefficient because stakeholders will be attenuated from management decisions and managers will be less familiar with the unique regional conditions associated with the river.[203]

The Goldilocks governance challenge partially explains the failures of previous natural resource policy paradigms. The pollution occurring as a function of the industrial paradigm occurred in part because industries operated in, and were largely regulated by, one jurisdiction while externalizing the costs of contamination to downstream and downwind neighboring jurisdictions.[204] Hierarchists continue to advance a top-down, global governance approach in the climate change paradigm, but this approach has advanced slowly in large part because the transaction costs of negotiating with so many diverse counties are simply too high.[205]

As the previous section shows, both policies and messaging should take into account local considerations. Thus, determinations of the optimal quantity and quality should be made at the river-basin level, where unique cultural characteristics and physical conditions of each basin can be considered.[206] The water security paradigm should not be led by entrepreneurs, ethicists, or hierarchists like previous natural resource policy paradigms.[207] Top-down, hierarchical governance approaches are frequently ineffective because they depend on "thin simplifications" of complex systems.[208] Though hierarchists encourage reliance on expertise and policy integration, they are too far removed from the locus of most actual policy implementation and thus frequently fail to understand how communities

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[202] *Id.* at 911 (citing Esty, *supra* note 200, at 601–02; Charles Fried, *Federalism—Why Should We Care?*, 6 HARV. J.L. & PUB. POL'Y 1 (1982) (for a general discussion of the role of externalities on intergovernmental cooperation and federalism)).

[203] *Id.* (footnotes omitted).

[204] *See generally* Larson, *Interstitial Federalism*, *supra* note 32 (discussing the role of jurisdictional scaling in exacerbating externalities like air and water pollution).

[205] Shi-Ling Hsu, *A Game-Theoretic Model of International Climate Change Negotiations*, 19 N.Y.U. ENVTL. L.J. 14, 24 (2011).

[206] Larson, *Interstitial Federalism*, *supra* note 32, at 911–12.

[207] *See supra* Section I.A.

[208] JAMES C. SCOTT, SEEING LIKE A STATE: HOW CERTAIN SCHEMES TO IMPROVE THE HUMAN CONDITIONS HAVE FAILED 309–12 (1998).

organize themselves and respond to social problems.[209] Entrepreneurs encourage development and investment but externalize costs. Ethicists encourage cost internalization and grassroots engagement but lack expertise and an integrated, holistic agenda.

Rather, the water security paradigm should be led by regionalists—advocates embedded within the river basin and familiar with the unique sociocultural, economic, hydrologic, and climatologic characteristics of that geographic unit, defined by the limits of the watershed.[210] An illustration from my earlier work on jurisdiction may help clarify my meaning:

> For purposes of water management, the world is like a golf ball—a sphere pocked with dimples. Each dimple is a river basin, or catchment, and the boundaries between those dimples are watersheds. All water within a basin drains to a common point . . . . [and thus] . . . naturally internalizes the costs associated with water scarcity and quality.[211]

The regionalist governance of water security, using water footprints as its tool for monitoring and measuring, would provide a more nuanced and understandable governance approach than the hierarchical climate change paradigm.

With this regionalist approach in mind, the water security paradigm should be grounded geographically at the basin level for two reasons. First, those most familiar with the unique climate, geology, hydrology, economy, and culture of water should be those who advance the water security paradigm. The chemistry, ecology, and uses of water vary not only from one river to another but even between stretches of the same river.[212] Water changes in its ecologic and economic character as it flows from mountains, valleys, deserts, and deltas and through farms, cities, and indigenous communities. Water also has an important cultural meaning that is distinct from other natural resources. No one playfully squirts oil or throws lumps of coal at each other, and you never hear of people being baptized in uranium. Water is different from other resources—not only because of its cultural, aesthetic, and religious significance—but because that significance changes as water flows through different communities, from one that sees the river as perennial, a source of fish, and sacred in highlands, and then

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[209] *See* Larson, *Interstitial Federalism*, *supra* note 32, at 924.

[210] *See id.*

[211] *Id.* at 911–12 (footnotes omitted).

[212] K.J. Gregory, *The Human Role in Changing River Channels*, 79 GEOMORPHOLOGY 172, 175–80 (2006); Luis Filipe Gomes Lopes et al., *Hydrodynamics and Water Quality Modelling in a Regulated River Segment: Application on the Instream Flow Definition*, 173 ECOLOGICAL MODELLING 197, 198–201 (2004).

through another where the river flow is intermittent and largely a source of seasonal recreation. Regionalists are best situated to appreciate these nuances, because top-down planners will be unable to capture the dispersed knowledge of individual communities.[213]

Second, water is a spillover common pool resource, meaning that it often crosses jurisdictional boundaries.[214] Under the "internalization prescription" for spillover commons:

> [J]urisdiction [should] be assigned over spillover commons at the smallest scale that internalizes the effects of management decisions. In the case of spillover commons, jurisdictional boundaries must be redrawn, wherever possible, to conform to the geographic contours of the resource . . . . The watershed is thus the natural jurisdictional boundary, and the [drainage basin] the appropriate scale of jurisdiction . . . .[215]

By basing governance boundaries on the watershed, the costs of water management will be internalized.[216] Unfortunately, governance institutions have historically taken the opposite approach, using rivers as political boundaries to frustrating, and sometimes disastrous, results.[217]

The water security paradigm's focus on basin-level governance helps limit transactions costs by narrowing the field of stakeholders to those most familiar with and interested in the shared commons.[218] Basin-level governance facilitates cost internalization and avoids negative externalities by redrawing jurisdictional boundaries to correspond to the geographic contours of the spillover commons—the basin.[219] The water security paradigm's focus on basin-level governance by regionalists thus strikes the right balance in the Goldilocks governance challenge by making the scope of jurisdiction just the right size to limit transaction costs while avoiding externalities.[220]

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[213] *See generally* F. A. Hayek, *The Use of Knowledge in Society*, 35 AM. ECON. REV. 519 (1945) (arguing that centralized top-down planning will not achieve the efficiencies of an open market in part because the knowledge of a single agent will not equal the accumulated and specialized knowledge of diverse and dispersed agents).

[214] Larson, *Interstitial Federalism*, *supra* note 32, at 910.

[215] *Id.* at 911–12 (footnotes omitted).

[216] *See* ROBERT D. COOTER, THE STRATEGIC CONSTITUTION 106–10 (2000) (explaining, but also criticizing, the "conventional economic prescription" that the best jurisdiction to provide spillover goods like water is a "special district" that "encompass[es] the natural region affected by pollution").

[217] *See* Larson, *Interstitial Federalism*, *supra* note 32, at 917 (discussing the example of the Colorado River as a boundary between three states creating long-term legal disputes over the shared resource).

[218] *Id.* at 926–27.

[219] *See id.* at 927–28; *see also* COOTER, *supra* note 216, at 105–07.

[220] *See* Larson, *Interstitial Federalism*, *supra* note 32, at 927–28.

Of course, most jurisdictional boundaries do not correspond to the geographic contours of basins. Indeed, in 1868, explorer John Wesley Powell recommended to Congress that state boundaries in the western territories of the U.S. be based on river basins.[221] Congress ignored his recommendations and, in some instances, even made the river itself the state boundary.[222] Indeed, the great irony of Powell's legacy is that, despite his revolutionary prescriptions regarding rivers, the reservoir that bears his name, Lake Powell, sits astride the Arizona–Utah border.[223] And what has resulted has either been high transaction costs associated with federal control of water resources (such as with the Clean Water Act[224]) or the externalities associated with state control of water resources (such as water rights disputes over shared rivers).[225] But sovereignty concerns make redrawing the boundaries to correspond to the basin politically problematic, if not impossible.[226] Yet certain legal reforms can help to facilitate basin-level, interjurisdictional governance. At the international level, river treaties often establish international river basin commissions.[227] At the domestic level, in the United States, interstate compacts can establish interstate river basin commissions.[228]

Often, these transboundary river commissions lack meaningful regulatory authority, or even sufficient resources to facilitate cooperation and information exchange, in part because member jurisdictions fear turning over sovereignty to the commission.[229] To alleviate this concern,

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[221] *Id.* at 916–17; *see generally* J.W. POWELL, THE EXPLORATION OF THE COLORADO RIVER AND ITS CANYONS (Dover Publications Inc. 1961) (1895) (recommending, in a report to Congress, that watersheds serve as jurisdictional boundaries for western states).

[222] For a brief collection of recent scholarship reviewing Powell's arguments, see Larson, *Interstitial Federalism*, *supra* note 32, at 917 n.41.

[223] *Id.* at 916–17.

[224] *See* Brandon Hofmeister, *Roles for State Energy Regulators in Climate Change Mitigation*, 2 MICH. J. ENVTL. & ADMIN. L. 67, 79 (2012); Martin A. McCrory, *Standing in the Ever-Changing Stream: The Clean Water Act, Article III Standing, and Post-Compliance Adjudication*, 20 STAN. ENVTL. L.J. 73, 77 (2001) (noting that ambiguity involving Clean Water Act jurisdiction has resulted in uncertainties that raise transaction costs associated with permitting projects that may discharge to jurisdictional waters).

[225] *See, e.g.*, Arizona v. California, 373 U.S. 546 (1963) (illustrating the prolonged and complex litigation involved in interstate water disputes).

[226] *See* Larson, *Interstitial Federalism*, *supra* note 32, at 962.

[227] "For example, the International Borders and Water Commission (IBWC) manages the Colorado River under the 1944 Rivers Treaty between the U.S. and Mexico." Rhett Larson, *Augmented Water Law*, 48 TEX. TECH L. REV. 757, 768 (2016) [hereinafter Larson, *Augmented Water Law*].

[228] *See, e.g.*, Delaware River Basin Compact, Pub. L. No. 87-328, 75 Stat. 688, 691 (1961) ("The Delaware River Basin Commission is hereby created as a body politic and corporate . . . . The commission shall consist of the Governors of the signatory states, ex officio, and one commissioner to be appointed by the President of the United States . . . .").

[229] *See* Larson, *Interstitial Federalism*, *supra* note 32, at 952–54.

such commissions "should be subject to a judicially enforceable fiduciary duty" embodied in the organic instrument (whether compact or treaty) "to manage spillover commons for the benefit of all . . . jurisdictions" sharing the water.[230] This would help avoid one jurisdiction co-opting the commission to its sole benefit and ensure adequate legal leverage for individual commission members to influence the commission and ensure that they have not sacrificed sovereignty, while still empowering the commission to avoid negative externalities and minimize transaction costs.[231] Such leverage can be based on a disgorgement remedy for any breach of the commission's fiduciary duty, as specified in the compact or treaty. Commission membership should also reflect the major industries, ethnic groups, utilities, and municipalities in the basin, thereby ensuring that transboundary commissions are led by regionalists in an effort to achieve water security.[232]

Regionalists frequently have knowledge about social norms adapted over generations to unique regional conditions, including norms critical to natural resource development like cooperation and dispute resolution, that will not be captured by a hierarchist paradigm like climate change.[233] Rivers like the Ganges or the Jordan have unique religious significance best understood by regionalists.[234] Rivers with headwaters located in developed countries, like the Colorado River, may have more than a 1,000 days of reservoir storage to serve their populations, but 1,000 days of reservoir storage to serve the population relying on the Brahmaputra River would flood an area the size of Pakistan.[235] Top-down, attenuated, supranational management tends toward the one-size-fits-all approach to governance, and that approach is inappropriate when rivers require solutions tailor-made to their unique geographies.[236] Interstate compacts and regional international

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[230] *Id.* at 915. For a similar argument relating to implementation of a human right to water, see Larson, *The New Right*, *supra* note 26, at 2257–58.

[231] *See* Larson, *Interstitial Federalism*, *supra* note 32, at 952–54.

[232] *See id.*

[233] *See generally* ROBERT C. ELLICKSON, ORDER WITHOUT LAW: HOW NEIGHBORS SETTLE DISPUTES (1991) (demonstrating how local resource users develop effective management regimes through intimate knowledge of unique resources and familiarity with norms that evolve over time).

[234] Rhett B. Larson, *Holy Water and Human Rights: Indigenous Peoples' Religious-Rights Claims to Water Resources*, 2 ARIZ. J. ENVTL. L. & POL'Y 81, 109 (2011) [hereinafter Larson, *Holy Water*].

[235] Larson, *Reconciling Energy*, *supra* note 13, at 956 (comparing storage capacity in Colorado and other basins); Margaret A. Palmer et al., *Climate Change and the World's River Basins: Anticipating Management Options*, 6 FRONTIERS ECOLOGY & ENV'T 81 (2008) (noting the challenges of land loss associated with storage).

[236] *Cf.* A. Dan Tarlock, *Federalism Without Preemption: A Case Study in Bioregionalism*, 27 PAC. L.J. 1629, 1634–36 (1996) (explaining that state and local cooperation has been necessary for federal biodiversity regulation to have its intended effect).

treaties should effectively redraw jurisdictional boundaries to correspond to the geographic contours of river basins.[237] Interbasin jurisdiction will be too remote from such adapted social norms, so treaties and compacts, granting basin-level jurisdiction to commissions, should redraw jurisdictional boundaries to empower regionalists. While political obstacles, in particular concerns of sovereignty, will be significant, these obstacles may erode in the face of the realities of water insecurity caused by growing populations, economic development, natural resources conflicts, plagues, and droughts and floods brought on by climate change.

III. WATER SECURITY AND THE LAW

A shift to the water security paradigm will have broad implications for natural resource law. As detailed above, the most obvious of these implications include the use of water footprints as a reporting and monitoring tool and the leadership of regionalists at the river basin level. These legal reforms will help ensure that the water security paradigm predominates. Other legal reforms will be essential to redirect natural resource policy toward achieving an acceptable quantity and quality of water at acceptable costs and risks.

This Section proposes three legal reforms to advance global water security: (A) the recognition of a sustainable human right to water, (B) the integration of the Green Agenda (water quality) and the Blue Agenda (water supply) with what this Article calls the Red Agenda (disease vector habitat) in water law, and (C) the establishment of legal incentives for investment in water technology innovation and water infrastructure, including desalination and responsible dam development. These reforms not only will serve to advance water security but also would reflect legal innovations that are more likely to be implemented successfully under a water security paradigm than the current climate change paradigm.

A. Recognizing a Sustainable Human Right to Water

"There are only two kinds of people on earth—people with enough [clean] water to stay alive and dead people."[238] Water is often understandably referred to as a human right, and forty-one nations incorporate it as an express right in their constitutions.[239] A growing chorus of voices has been calling for recognition of an international human right to

[237] Larson, *Interstitial Federalism*, supra note 32 (arguing for spillover commons to be regulated based on their geographic contours).

[238] Larson, *Reconciling Energy*, *supra* note 13, at 958.

[239] Larson, *The New Right*, *supra* note 26, at 2184.

water.[240] In the United States, California has recently enacted its own "Human Right to Water Bill,"[241] and water shutoffs in Detroit have increased calls to recognize the human right to water domestically.[242] Recognizing the right to water is an important part of advancing water security. The rhetorical force of recognizing a human right would raise the "lexical priority" of water issues and help to reorient policy toward the water security paradigm.[243] An enforceable human right to water effectively puts first things first—what good are other rights to someone dying of cholera or thirst?[244] Additionally, an enforceable human right provides legal leverage to disadvantaged or marginalized groups to secure environmental justice.[245] However, the formulation 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 necessary to satisfy such a right.[246]

Put simply, the right must be enforceable and not merely aspirational. If recognizing a right to water is to help achieve water security by more appropriately prioritizing water and providing leverage for disadvantaged communities to access this critical resource, then the right to water must be formulated and implemented in ways that are achievable, sustainable, and enforceable.[247] It is insufficient to simply state that a human right to water guarantees provision of water of adequate quantity and quality to keep people alive.

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[240] *See* G.A. Res. 64/292, ¶¶ 5, 8 (July 28, 2010) (acknowledging that access to drinking water is an "integral component" of expanding human rights); *see also* Peter H. Gleick, *The Human Right to Water*, 1 WATER POL'Y 487, 489 (1999) ("This paper . . . concludes that international law, international agreements and evidence from the practice of States strongly and broadly support the human right to a basic water requirement."); Stephen C. McCaffrey, *A Human Right to Water: Domestic and International Implications*, 5 GEO. INT'L ENVTL. L. REV. 1, 7 (1992) ("Access to adequate amounts of safe, useable fresh water should be recognized as a human right.").

[241] CAL. WATER CODE § 106.3(a) (West 2013); *see generally* ANGÉLICA SALCEDA ET AL., INT'L HUMAN RIGHTS LAW CLINIC, UNIV. OF CAL., BERKELEY, SCHOOL OF LAW, THE HUMAN RIGHT TO WATER BILL IN CALIFORNIA: AN IMPLEMENTATION FRAMEWORK FOR STATE AGENCIES (2013), https://www.law.berkeley.edu/files/Water_Report_2013_Interactive_FINAL.pdf [https://perma.cc/YGX2-C2P2] (providing background and evaluation of California's Human Right to Water Bill). For a more detailed discussion of this California statute, see Larson, *Adapting Human Rights*, *supra* note 33, at 4–5.

[242] *See* Larson, *Adapting Human Rights*, *supra* note 33, at 3–4; *see also* Alisa Priddle & Matt Helms, *Bankruptcy Judge Tells Detroit to Address Water Shutoffs*, USA TODAY (July 16, 2014, 1:27 PM), https://www.usatoday.com/story/news/nation/2014/07/16/detroit-bankruptcy-water/12734925/ [https://perma.cc/63H5-WFJC?type=image].

[243] *See* Larson, *The New Right*, *supra* note 26, at 2209.

[244] *See id.* at 2198.

[245] *Id.* at 2244.

[246] Larson, *Adapting Human Rights*, *supra* note 33, at 20–22.

[247] *Id.*

For example, the Republic of Ecuador recognized the right to water under its constitution in 2008.[248] Article 3 states that a prime duty of the government is to guarantee water for all citizens.[249] Article 12 provides that the human right to water is fundamental and nonwaivable.[250] Article 66 provides that the right to drinking water is recognized and guaranteed to all people.[251] And Article 318 states: "Water is a strategic national resource for public use and the State's control over water is inalienable and non-waivable, and water constitutes a vital element for nature and the existence of human beings. All forms of water privatization are prohibited."[252] Despite the strong rhetoric, the constitutional right to water in Ecuador fails to clarify the quantity, quality, and price of water. Prohibitions on water privatization in Ecuador may limit the water sector's access to credit and capital, making questions of water costs and pricing all the more difficult to answer. In part, because these questions typically remain unanswered when a constitutional right is formulated, such rights do not lead to better water provision.[253]

India also has a "provision right" to water, one it has inferred from Article 21 of its Constitution.[254] India's Supreme Court has stated that "the right to access to clean drinking water is fundamental to life and there is a duty on the State under Article 21 to provide clean drinking water to its citizens."[255] Despite the recognition of this right, 17% of the population of India does not have access to tapped, treated water, including 38% of urban residents.[256]

Clearly, when we speak of a human right to water we are talking not only about life but about a certain standard of living. That standard raises questions about cost, access, quality, and consistency of service making it necessary that a human right to water be accompanied by certain legal reforms to answer those questions.

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[248] CONSTITUCION POLITICA DE LA REPUBLICA DEL ECUADOR [C.P.].

[249] *Id.* art. 3, § 1.

[250] *Id.* art. 12.

[251] *Id.* art. 66, § 2.

[252] *Id.* art. 318 (author's translation).

[253] *See* David Zetland, Water Rights and Human Rights: The Poor Will Not Need Our Charity if We Need Their Water 5–7 (Aug. 11, 2011) (unpublished manuscript), https://papers.ssrn.com/sol3/papers.cfm?abstract_id=1549570 [https://perma.cc/4EMN-6TJT].

[254] *See* INDIA CONST. art. 21 ("No person shall be deprived of his life or personal liberty except according to procedure established by law."); Larson, *The New Right*, *supra* note 26, at 2188.

[255] Larson, *The New Right*, *supra* note 26, at 2188 (citing A.P. Pollution Control Bd. II v. Naidu, 2000 Supp. 5 S.C.R. 249).

[256] Erik B. Bluemel, *The Implications of Formulating a Human Right to Water*, 31 ECOLOGY L.Q. 957, 981 (2004).

One possible reform to make a right to water more easily enforceable is to reimagine the right to water as a "participation right" rather than a "provision right."[257] As shown by the constitution of Ecuador, a provision right would impose an obligation upon the state to provide water to its citizens and is the typical formulation of the right to water.[258] In contrast, a participation right does not guarantee water provision but instead guarantees a citizen's right to be free from discrimination or cruel treatment in water provision, to receive adequate notice of water cutoffs or rate increases, and to participate in the transparent development of water policy through stakeholder meetings.[259]

Two court decisions in southern Africa illustrate the potential advantages of a participation right over a provision right in promoting water security. South Africa was one of the first countries to recognize a constitutional right to water and formulated it as a provision right.[260] The right proved economically and ecologically unsustainable[261] because South Africa implemented the right in a way that made cost recovery difficult.[262] Without effective water pricing, consumers had little incentive to conserve water, and water utilities would not invest in improving and maintaining infrastructure.[263] Disputes over water pricing led to extensive litigation, with the South African Constitutional Court ultimately deferring to the water utility's decision to require prepayment of water services beyond the provision of a free basic quantity of water.[264]

In contrast, litigation in Botswana provides an example of how a participation right may be more easily enforceable.[265] In the years prior to

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[257] *See* Larson, *The New Right*, *supra* note 26, at 2186.

[258] *Id.* at 2187.

[259] *See id.* at 2186.

[260] *Id.* at 2210; *see* S. AFR. CONST., 1996 § 27(1) ("Everyone has the right to have access to . . . sufficient food and water . . . .").

[261] Larson, *The New Right*, *supra* note 26, at 2211–13. Under the flat-fee approach, South Africa lost over 600 billion liters a year as a result of nonrevenue water, at an annual total cost of R 3.259 billion or approximately $390 million. Nonrevenue water includes water delivered to legal connections but without payment and water delivered to illegal water connections. *SA Losing 600bn Litres of Water*, NEWS 24 (Feb. 15, 2007, 1:36 PM), http://www.news24.com/SouthAfrica/News/SA-losing-600bn-litres-of-water-20070215 [https://perma.cc/7WSH-LDL5]. Phiri had the highest levels of nonrevenue water in the city of Johannesburg. Larson, *The New Right*, *supra* note 26, at 2253.

[262] *See id.* at 2211–12.

[263] *Id.* at 2210–25 (providing an overview of the facts and underlying circumstances of the Mazibuko case and the water supply and provision challenges in South Africa).

[264] *Mazibuko v. City of Johannesburg* 2010 (4) SA 1 (CC) at 65 para. 124 (S. Afr.), http://www.saflii.org/za/cases/ZACC/2009/28.pdf [https://perma.cc/A9NZ-E7VQ]; Larson, *The New Right*, *supra* note 26, at 2212–13.

[265] *Mosetlhanyane v. Attorney General*, No. CACLB-074-10 (BwCA Jan. 27, 2011) (Bots.), https://www.internationalwaterlaw.org/cases/Domestic-HR_to_Water/Bushmen-Water-Appeal-

the case in question, the Botswanan government had sought to remove the indigenous Basarwa community from a government-created game preserve in the Kalahari Desert.[266] In an effort to force the Basarwa to leave, the government decommissioned the community's wells.[267] Ultimately**,** in a lawsuit brought by the community, the court restored the community's rights based on a claim that depriving them of their water violated the community's right to be free from inhuman or degrading treatment under Section 7(1) of the Constitution of Botswana.[268] Such a prohibition against government restraint on personal liberty falls within the meaning of a participation right because such a right is fundamentally about the freedom to engage in the political process without fear of state retaliation.

The success of the Basarwa in Botswana in enforcing a participation right to water, compared to the failure to enforce a provision right in South Africa, suggests that the participation right may be a preferable formulation of the right to water.[269] A participation right does not require water provision at low or no cost and thus does not raise the same sustainability concerns as a provision right. Additionally, participation rights tend to be more jurisprudentially mature than the relatively recent innovation of constitutional provision rights and thus more easily enforced in court.[270]

Even if a state does seek to create and implement a provision right, certain reforms can ensure that such a right does not give rise to unsustainable water practices.[271] First, courts with unique expertise in water law, science, and policy should adjudicate questions and disputes involving water law.[272] One of the reasons the South African Constitutional Court upheld water cutoffs and prepaid rates was that the court lacked the institutional competency to evaluate the public water utility's technical opinions on water sustainability and pricing.[273]

Judgement-Jan_2011.pdf [https://perma.cc/4MCT-6X2K]. For further discussion of the *Matsipane* case, see Larson, *The New Right*, *supra* note 26, at 2237–39.

266 *Mosetlhanyane*, No. CACLB-074-10, ¶¶ 5–8.

267 *Id.* ¶¶ 6–7.

268 *Id.* ¶¶ 20–21, 25 (citing BOTS. CONST. § 7(1), http://www.wipo.int/edocs/lexdocs/laws/en/bw/bw008en.pdf [https://perma.cc/3GQA-6MZQ]).

269 Larson, *The New Right*, *supra* note 26, at 2237.

270 *See id.* at 2243–44.

271 *See generally* Larson, *Adapting Human Rights*, *supra* note 33 (suggesting reforms for the effective and sustainable implementation of a human right to water).

272 *Cf.* Margaret G. Farrell, *Coping with Scientific Evidence: The Use of Special Masters*, 43 EMORY L.J. 927, 952–53 (1994) (noting the role of special masters to enhance a court's institutional competence in highly technical fields).

273 *See* Larson, *Adapting Human Rights*, *supra* note 33, at 38–39 (also noting the need for specialized tribunals in states seeking to implement a positive right to public utilities).

Second, jurisdictions should implement block rates for water pricing with directed subsidies—in the form of "water stamps"—provided to poor households that cannot afford to pay the full cost of basic water provision.[274] With block rates, a basic amount of water for domestic use would be priced well below cost.[275] With each additional block of water consumed, the rate increases so that the largest water consumers (energy and agriculture, typically) pay the highest rates, higher than the full cost of provision.[276] Those higher rates would encourage water conservation in the industries best placed to achieve water savings.[277] Those higher rates would then be used to subsidize water stamps. Poor individuals or families would pay what they could for their basic water block, based on an "ability-to-pay determination" made by the municipal government, with the difference made up by water stamps.[278] In this way, everyone pays for water and internalizes the costs of water consumption, but economically disadvantaged people have those costs partially offset by direct subsidies funded by rates paid by the largest water consumers.[279]

The danger in this approach is that the cost of higher water rates will be passed on to poor communities through higher food and energy prices.[280] Additional support would be necessary to ensure a minimum standard of living, including directed food subsidies to economically disadvantaged households and electricity rates at the household level set at affordable rates in poorer communities. Despite the challenge in implementing block rates, prioritizing equitable and sustainable water provision represents a potential starting point and an emphasis that would move the world toward water security.[281]

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[274] *Id.* at 42; *see generally* Pablo Serra, *Subsidies in Chilean Public Utilities* (World Bank Inst., Working Paper No. 2445, 2000), http://documents.worldbank.org/curated/en/850051468768861504/pdf/multi-page.pdf [https://perma.cc/28PE-RMGV] (describing a similar directed subsidy approach in water provision to poor communities in Chilean municipalities).

[275] Larson, *Adapting Human Rights*, *supra* note 33, at 41–42. *But see* JOHN J. BOLAND & DALE WHITTINGTON, WATER TARIFF DESIGN IN DEVELOPING COUNTRIES: DISADVANTAGES OF INCREASING BLOCK TARIFFS (IBTS) AND ADVANTAGES OF UNIFORM PRICE WITH REBATE (UPR) DESIGNS (The Environment for Development Initiative) ((2000), http://www.efdinitiative.org/sites/default/files/071f_water20tariff20design.pdf [https://perma.cc/TH2M-AMPJ] (criticizing the use of block tariff regimes in developing countries).

[276] Larson, *Adapting Human Rights*, *supra* note 33, at 41.

[277] *Id.*

[278] *Id.* at 42.

[279] *Id.* at 42–43.

[280] *Id.* at 43 ("The embedded nature of water and energy – virtual water and virtual energy – make[s] it difficult to establish equitable pricing of these utility services [and food] without any increased block rates being reflected in the costs of other goods and services.").

[281] *Id.*

B. Integrating Public Health Concerns into Water Law[282]

Perhaps no element of water policy threatens security more than the potential for water-related disease outbreaks. As noted above, water represents both a pathway of transmission and a critical component in prevention of pathogens.[283] One of the most important ways in which the connection between water and disease has been framed is in the classification of diseases by how they are transmitted through water—a system called the Bradley Classifications in epidemiology.[284] The system classifies a host of various diseases into four categories based on mode of transmission.[285]

In my previous work, I have described the importance of the Bradley Classification system in illustrating the importance of water management in the prevention and mitigation of disease outbreaks and noted how the classification system demonstrates the sheer number of major diseases associated with water management.[286] The first class includes waterborne infections, such as cholera or typhoid, which are transmitted directly through ingestion of water tainted with the disease-causing microbial pathogen.[287] These diseases can be prevented through improved sanitation infrastructure to prevent fecal contamination and improved treatment of drinking water, including disinfection by chlorine or ultraviolet light.[288] The second class includes water-washed infections, such as trachoma or scabies, which arise because of inadequate water for hygiene.[289] Indeed, one

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[282] For a lengthy discussion of the need for integration of the Blue, Green, and Red Agendas, see Larson, *Time of Cholera*, *supra* note 35, from which the following Section borrows extensively.

[283] *Id.* at 1274; *see also supra* Section II.A.

[284] *See also* C.L. Moe, *What are the Criteria for Determining Whether a Disease Is Zoonotic and Water Related?*, *in* WATERBORNE ZOONOSES: IDENTIFICATION, CAUSES AND CONTROL 27, 31–34 (J.A. Cotruvo et al. eds., 2004**)** (summarizing the Bradley Classifications and providing examples and background for each category). *See generally* GILBERT F. WHITE ET AL., DRAWERS OF WATER: DOMESTIC WATER USE IN EAST AFRICA (1972) (a longitudinal study of water use in Ugandan villages that represents the initial research upon which the Bradley Classifications are based and the earliest articulation of the classifications).

[285] Moe, *supra* note 284, at 31–34; *see also* D. D. Mara & R. G. A. Feachem, *Water- and Excreta-Related Diseases: Unitary Environmental Classification*, 125 J. ENVTL. ENGINEERING 334, 334 (1999) (providing a table summary of the Bradley Classifications).

[286] Larson, *Time of Cholera*, *supra* note 35, at 1291–96.

[287] Moe, *supra* note 284, at 32.

[288] *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, 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. I. A Case Study in Rural North-East Thailand*, 105 EPIDEMIOLOGY & INFECTION 363, 374 (1990); Mark A. Shannon et al., *Science and Technology for Water Purification in the Coming Decades*, 452 NATURE 301, 302 (2008).

[289] Mara & Feachem, *supra* note 285, at 334–35.

of the keys to long-term control of water-related diseases is simply ensuring a sufficient quantity and quality of water to allow for basic hygiene.[290] The third class includes water-based infections such as guinea worm and schistosomiasis, where the pathogen spends part of its life inside vectors whose primary habitat is aquatic, such as snails or water fleas.[291] The fourth class includes water-related infections where the disease vector breeds in water, such as mosquitoes, but the diseases spread via other means, such as insect bites.[292] These water-related infections include malaria, Zika, West Nile virus, Dengue fever, yellow fever, and chikungunya.[293] They collectively represent one of the greatest threats to human life,[294] with malaria alone killing an estimated 584,000 people in 2013.[295]

Despite the significant role water plays in epidemiology, water law itself often fails to address public health concerns.[296] The Red, Green, and Blue Agendas of water law interact in many ways. Water law typically focuses on the Blue Agenda and the Green Agenda but fails to fully integrate the Red Agenda.[297] The water security paradigm must more fully integrate the Red Agenda in water law and policy.[298] The Venn diagram below, drawn from my previous work, provides an illustration upon which a discussion of these interactions can be based.

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[290] *See id.* at 338.

[291] Moe, *supra* note 284, at 32–33; *see also* Bruno Gryseels et al., *Human Schistosomiasis*, 368 LANCET 1106, 1113 (2006) (reporting that schistosomiasis affects 200 million people worldwide, with as many as 280,000 deaths annually in sub-Saharan Africa alone).

[292] Mara & Feachem, *supra* note 285, at 335.

[293] *Id.* at 336 (noting malaria and Dengue fever as examples); Larson, *Time of Cholera*, *supra* note 35, at 1295.

[294] Duane J. Gubler, *Resurgent Vector-Borne Diseases as a Global Health Problem*, 4 EMERGING INFECTIOUS DISEASES 442 (1998) (noting the severity and scope of water-related disease epidemics); Atul A. Khasnis & Mary D. Nettleman, *Global Warming and Infectious Disease*, 36 ARCHIVES MED. RES. 689 (2005) (noting the potential for increased mortality rates associated with water-related diseases expanding as a result of climate change).

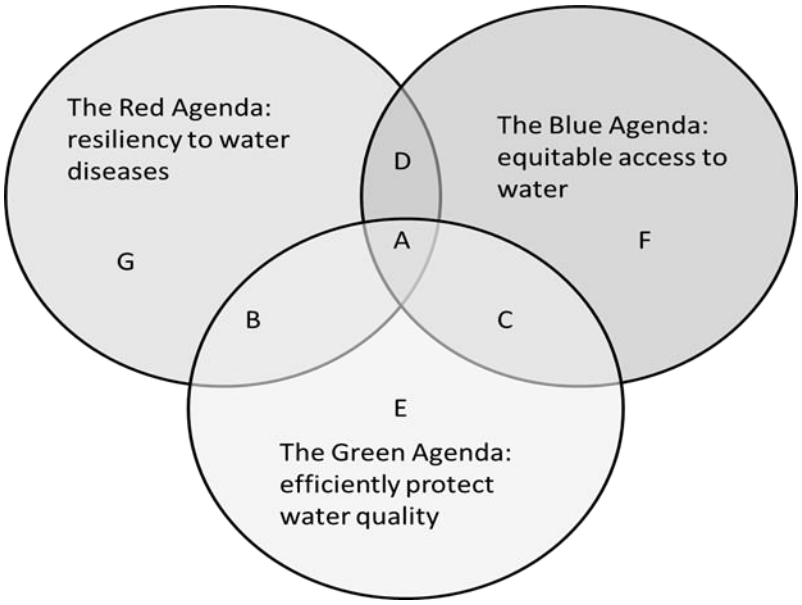
[295] WORLD HEALTH ORG., WORLD MALARIA REPORT 2014, at 38 (2014), http://www.who.int/malaria/publications/world_malaria_report_2014/wmr-2014-no-profiles.pdf [https://perma.cc/F5T8-XSBJ].

[296] *See* Larson, *Time of Cholera*, *supra* note 35, at 1291–98.

[297] *Id.* at 1276.

[298] *Id.* at 1290.

Figure 1: Venn Diagram of the Three Water Law Agendas[299]



I have previously described this diagram as follows:

> [I]n Area A of the diagram, all three agendas are integrated. An example of a water law that integrates all three agendas might include legal incentives for water efficiency, like . . . 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 [human use], thus advancing the Blue Agenda. And more water is available for hygiene and sanitation, thus preventing water-washed and waterborne diseases and advancing the Red Agenda.[300]

Unfortunately, water law and policy is frequently implemented in ways where these agendas conflict or are ignored. For example, a nation may invest in building dams, reservoirs, and irrigation systems in the name of advancing the Blue Agenda, but by doing so, it brings disease vector habitats closer to human communities.[301] Or a nation may prohibit the discharge of pesticides in rivers and lakes to protect water quality in the name of the Green Agenda, but that would make it more difficult to

[299] *Id.* at 1298.

[300] *Id.* at 1298–99.

[301] S. Sow et al., *Water-Related Disease Patterns Before and After the Construction of the Diama Dam in Northern Senegal*, 96 ANNALS TROPICAL MED. & PARASITOLOGY 575, 579 (2002) (describing the rise of malaria and schistosomiasis in the wake of the construction of the Diama Dam and related infrastructure in Senegal).

respond to disease outbreaks because pesticides help to kill disease vectors like mosquito larvae.[302]

As I have written elsewhere, "[t]he . . . water crisis in Flint, Michigan, can [also] be better understood through this [diagram's] framework."[303] To address water supply issues, "Flint ceased purchasing water from Detroit and instead shifted its primary water source to the [less costly] Flint River."[304] This shift to a closer and cheaper water supply is textbook Blue Agenda thinking, but it resulted in a major public health crisis, including lead contamination and an outbreak of the waterborne Legionnaires' Disease.[305] Had water planners integrated the Red and Green Agendas into their analysis, they may have considered the potential for waterborne pathogen outbreaks and chloride contamination of the river that resulted in lead leaching from pipes.[306]

The fundamental importance of the three-agendas framework is to encourage an integrated water policy to achieve water security. Integrating the Red Agenda advances water security by mitigating the costs and risks associated with water disease epidemics. But current water law fails to integrate the Red Agenda due to the siloed thinking of water rights and water quality lawyers, who work in a vacuum and do not frequently interact or collaborate with public health professionals.[307] Certain legal reforms, such as requiring Health Impact Assessments (HIAs) in connection with water resource development projects, could help to better integrate the Red Agenda into water and policy.[308] An HIA would be similar to the

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[302] Nat'l Cotton Council v. EPA, 553 F.3d 927, 940 (6th Cir. 2009) (holding that discharge of pesticides into rivers and lakes required a Clean Water Act permit).

[303] Larson, *Time of Cholera*, *supra* note 35 at 1299. Specifically, I argued that "[t]he crisis in Flint is arguably an example of pure Blue thinking, lodged in Area F . . . and failing to adequately integrate the other agendas." *Id.* at 1300.

[304] *Id.* at 1299.

[305] *Id.*; *see also* Suzannah Gonzales, *Legionnaires' Spike in Michigan County Dealing with Water Crisis*, REUTERS (Jan. 13, 2016, 5:49 PM), http://www.reuters.com/article/us-michigan-water-idUSKCN0UR23120160113 [https://perma.cc/5KNG-4PUK]).

[306] Larson, *Time of Cholera*, *supra* note 35, at 1299; *see also* Stephen Rodrick, *Who Poisoned Flint, Michigan?*, ROLLING STONE (Jan. 22, 2016), http://www.rollingstone.com/politics/news/who-poisoned-flint-michigan-20160122 [https://perma.cc/LZ7R-GAHK]).

[307] *See* Larson, *Time of Cholera*, *supra* note 35, at 1311–13; *see also* Robert L. Glicksman & Richard E. Levy, *Agency-Specific Precedents*, 89 TEX. L. REV. 499, 511–15 (2011) (describing costs associated with the silo effect in agency rulemaking and adjudication, and the efforts of the Office of Information and Regulatory Affairs in the U.S. federal government to overcome silo effects).

[308] *See* Larson, *Time of Cholera*, *supra* note 35, at 1315–16; *see also*, *e.g.*, *Health Impact Assessment: Main Concepts and Suggested Approach* (European Ctr. for Health Policy, Gothenburg Consensus Paper, 1999), http://www.healthedpartners.org/ceu/hia/hia01/01_02_gothenburg_paper_on_hia_1999.pdf [https://perma.cc/YY3F-NYU6] [hereinafter Gothenburg Consensus] (describing approaches for the effective implementation of health impact assessments).

Environmental Impact Statements prepared under the National Environmental Protection Act, under which projects undertaken, permitted, or funded by the U.S. federal government are required to evaluate environmental impacts and potential alternatives that could avoid those impacts.[309] The approach of the HIA policy would be similar, under which legislation, treaties, or the internal rules of international development banks would require the evaluation of the impacts of a water development project on disease vector habitat and the possible alternatives to avoid any public health challenges associated with such water projects.

Some have criticized assessment requirements as "toothless procedural hoops with little to no [substantive] impact."[310] This need not be so, however. These procedural requirements can have substantive components when agencies and collaborating organizations agree to enforceable obligations incorporated into the assessment process.[311] Further, requiring assessments can improve project planning through mandatory consideration of public health concerns that may otherwise be ignored, and the public release of the assessment report would improve transparency.[312] These assessments and the potential for associated substantive requirements would integrate the Red Agenda into water law and policy and move that policy closer to achieving water security.

C. Encouraging Investment in Water Innovation and Infrastructure

The reforms I have proposed thus far will advance global water security. However, additional reforms are necessary to encourage greater investment in the technology and infrastructure. Billions of dollars are needed globally simply to maintain existing water infrastructure.[313] Leaking pipes have resulted in wasted water all over the world, without recovery of

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[309] *See, e.g.*, Gothenburg Consensus, *supra* note 308 (setting forth recommendations for conducting health impact assessments and comparing them to environmental impact assessments); 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).

[310] Larson, *Time of Cholera*, *supra* note 35, at 1316 & n.312 (cataloging examples of such scholarly critiques).

[311] Jody Freeman & Jim Rossi, *Agency Coordination in Shared Regulatory Space*, 125 HARV. L. REV. 1131, 1164 (2012) (noting how agreements within the NEPA Record of Decision may impose substantive requirements on agencies and regulated parties).

[312] Larson, *Time of Cholera*, *supra* note 35, at 1316; *see also* 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).

[313] *See, e.g.*, 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, 130 (2013) ("For example, over the next twenty to thirty years, it is estimated that the United States will need to invest $140–250 billion in water infrastructure."); Camille Pannu, *Drinking Water and Exclusion: A Case Study from California's Central Valley*, 100 CALIF. L. REV. 223, 268 & n.235 (2012).

costs.[314] Investments and innovations in irrigation technology and more efficient industrial and domestic appliances and equipment are critical to improved water conservation.[315] In some parts of the world, conservation alone will be inadequate, and water augmentation technology, such as cloud seeding or desalination, may be required.[316] And in many instances, greater investment in dams is necessary to increase flood and drought resiliency by capturing flood waters and by increasing storage capacity.[317]

1. Shared Benefits

"The concept of shared benefits is derived from welfare economics, noting that water is a . . . commodity with [variable accessibility and] multiple possible alternative uses . . . ."[318] Under this concept, the most access to and effective use of water often depends on geography.[319] To facilitate development of dams, the concept of shared benefits should be recognized as a binding principle of domestic and international water law.[320] As I have noted previously, though "[e]ach [riparian] jurisdiction could attempt to capture the full panoply of [potential] water uses , . . . that would mean inefficient attempts to implement uses [of water in ways] that may be a poor geographic or economic fit."[321] Rather than attempt to share the raw water of the river, jurisdictions should share all of the benefits of that water use based on their comparative geographic and economic advantages.

For example, an upstream mountainous jurisdiction should develop dams and share the benefits of storage, flood control, and hydroelectricity with a lowland, downstream jurisdiction with greater capacity to grow

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[314] *See* Andrew F. Colombo & Bryan W. Karney, *Energy and Costs of Leaky Pipes: Toward Comprehensive Picture*, 128 J. WATER RESOURCES PLANNING & MGMT. 441, 441 (2002) ("That leaks are costly in terms of money and resources is a well-established idea . . . . Leakage is the dominant component of UFW [unaccounted for water].").

[315] *See* Craig Anthony (Tony) Arnold, *Water Privatization Trends in the United States: Human Rights, National Security, and Public Stewardship*, 33 WM. & MARY ENVTL. L. & POL'Y REV. 785, 844–45 (2009); Ronald A. Kaiser, *Texas Water Marketing in the Next Millennium: A Conceptual and Legal Analysis*, 27 TEX. TECH L. REV. 181, 194 (1996).

[316] *See* Larson, *Augmented Water Law*, *supra* note 227, at 773–78.

[317] *See* Larson, *Interstitial Federalism*, *supra* note 32, at 957–58.

[318] *Id.* at 957.

[319] *Id.*

[320] A. Dan Tarlock & Patricia Wouters, *Are Shared Benefits of International Waters an Equitable Apportionment?*, 18 COLO. J. INT'L ENVTL. L. & POL'Y, 523, 533 (2007) (citing Claudia W. Sadoff & David Grey, *Beyond the River: The Benefits of Cooperation on International Rivers*, 4 WATER POL'Y 389 (2002)).

[321] Larson, *Interstitial Federalism*, *supra* note 32 at 957.

food. The benefits of the food in turn can be shared with its upstream neighbor.[322]

The 1961 Columbia River Treaty illustrates how a shared-benefits regime can be implemented.[323] The treaty allows Canada and the U.S. to manage the river cooperatively, with Canada developing flood-control measures and the U.S. providing storage and hydroelectric energy.[324]

Shared-benefits governance is not a concept limited only to dam development because it can be applied in other water infrastructure contexts. The Arizona Water Banking Authority (AWBA) in the Colorado River basin uses a shared-benefits approach for groundwater management.[325] "Arizona created the AWBA in 1996 as a means of storing [part of] Arizona's unused allocation of Colorado River water"[326] through artificial groundwater-recharge facilities,[327] which Arizona's geology permits.[328] Arizona expanded its use of the AWBA and now also stores Colorado River water for Nevada, which pays for the storage.[329] Arizona thus makes use of its comparative geographic and geologic advantage and shares the benefits of that use with its coriparian state, thereby monetizing water efficiency.[330] As this example shows, "[b]enefit sharing need not be limited solely to water quantity."[331]

2. Technology Investments

Additional reforms can facilitate investment in water conservation technologies. For example, in the western United States, prior-appropriation water rights regimes typically include the concept of forfeiture—a "use it or lose it" rule where a water rights holder forfeits its water right if it fails to use the water for a period of time.[332] The doctrine of forfeiture discourages implementation of water-efficient irrigation technology like center-pivot or drip irrigation. Even if a farmer could get the same productivity out of less water, the farmer will use the same

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[322] *Id.* at 914.

[323] Treaty Relating to Cooperative Development of the Water Resources of the Columbia River Basin, Can.–U.S., Sep. 16, 1964, 15 U.S.T. 1555.

[324] Larson, *Interstitial Federalism*, *supra* note 32, at 957.

[325] *Id.* at 958.

[326] *Id.*

[327] Jon Kyl & Ryan A. Smith, *Foreword to the Symposium on Water Law and Policy Conference*, 49 ARIZ. L. REV. 209, 213 (2007).

[328] Larson, *Interstitial Federalism*, *supra* note 32, at 958.

[329] *Id.*

[330] *Id.*

[331] *Id.*

[332] *See, e.g.*, John C. Peck & Constance Crittenden Owen, *Loss of Kansas Water Rights for Non-Use*, 43 U. KAN. L. REV. 801, 802 (1995).

amount of water to avoid forfeiture.[333] States could implement water escrows, where water users could place unused water rights achieved through conservation into trust with the state.[334] While held in trust, those rights would be shielded from forfeiture.[335] The trust could then act as a clearinghouse for the sale of water rights achieved through conservation and connect potential sellers with potential buyers.[336] In some instances, where financing is needed to implement water conservation technology, lenders could make loans secured by the rights to the conserved water. This would allow farmers and developers to access credit needed to invest in water conservation technologies, and for financiers to encourage the use of the most advanced and efficient water appliances and irrigation methods.

Other reforms can facilitate the necessary investment in water augmentation technology.[337] Water law in the western United States, for example, distinguishes between developed water and salvaged water.[338] Developed water—such as desalinated sea water or bulk water imports—is imported into the basin by tanker or pipeline.[339] Salvaged water is part of the basin but made accessible by technological means, such as drilling for and desalinating otherwise inaccessible and brackish groundwater or removing invasive scrub brush for forests to increase stream flow.[340] Developed water lies outside the scope of the state's water rights regime and is owned by the developing party.[341] In contrast, salvaged water remains part of the water rights regime, with the salvaging party having no right to the augmented water created.[342] In the water escrow example from above, a portion of the water moving through the escrow could be held back from each transaction to build up a fund of available water rights.[343]

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[333] *See* Dan Tarlock, *How Well Can Water Law Adapt to the Potential Stresses of Global Climate Change?*, 14 U. DENV. WATER L. REV. 1, 24 (2010).

[334] Rhett Larson & Kelly Kennedy, *Bankrupt Rivers*, 49 U.C. DAVIS L. REV. 1335, 1378 (2016).

[335] *Id.*

[336] *Id.*

[337] *See* Rhett B. Larson, *Innovation and International Commons: The Case of Desalination Under International Law*, 2012 UTAH L. REV. 759, 764–67 (2012); Larson, *Augmented Water Law*, *supra* note 227, at 767 (discussing examples of the opportunities and obstacles associated with investment in water augmentation technologies).

[338] Larson, *Augmented Water Law*, *supra* note 227, at 766–67.

[339] *Id.* at 766.

[340] *Id.*

[341] Se. Colo. Water Conservancy Dist. v. Shelton Farms, Inc., 529 P.2d 1321, 1324–25 (Colo. 1974) (holding that a party that invested in the removal of invasive species along a river—resulting in increased stream flow—did not secure any special right to that increased water supply because such waters are salvaged and not developed).

[342] *Id.*

[343] Larson & Kennedy, *supra* note 334, at 1379.

These water rights could create a discounted source of water rights available to those who invest in salvaged water technologies or processes, such as desalination, forestry management practices, or arguably even cloud seeding.[344] Access to discounted water rights markets would create incentives that do not currently exist in water law for parties to invest in water augmentation, at least in the context of salvaged water.[345]

IV. THE PROMISE AND CHALLENGES OF THE WATER SECURITY PARADIGM

Two related ideas lie at the very heart of a water security paradigm and are illustrated in a statement made by Bruce Lee regarding his theory of martial arts: "Be formless, shapeless, like water. You put water into a cup, it becomes the cup. You put water into a bottle, it becomes the bottle. Water can flow or it can crash. Be water, my friend."[346]

The two ideas contained in Lee's theory of martial arts represent the core related ideas of water security jurisprudence. First, adaptive capacity is essential in laws and policies formulated under the water security paradigm. Water laws must be like water: they must be effectively adapted to respond to changing circumstances.[347] Second, natural resource laws and policies must no longer seek to manage a "normal" natural system; instead they must recognize that these systems both flow and crash—they are creative and destructive. This is perhaps the most important contribution of the climate change paradigm—that there is no "normal" in natural resources. This must inform the water security paradigm. Natural resource policies should depend upon data, models, and assumptions regarding water extremes like droughts, floods, epidemics, and water conflicts.[348] Laws and policies should seek to manage those extremes rather than seek to achieve some illusion of the "normal" status of water quality and quantity. The natural world changes, new technologies evolve, populations grow, and consumption patterns alter according to economic conditions. Laws must be able to adapt to manage the extreme conditions brought on by these dynamic systems.

Laws must, therefore, integrate an "adaptive management" approach. Adaptive management is "a systematic process for continually improving management policies and practices by learning from the outcomes of

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[344] *Id.* at 1378.

[345] *Id.*

[346] BRUCE LEE, WORDS FROM A MASTER (John R. Little ed., 1999).

[347] For a general discussion of adaptive management in natural resource law, see J.B. Ruhl & Robert L. Fischman, *Adaptive Management in the Courts*, 95 MINN. L. REV. 424 (2010).

[348] For a general discussion on management of extremes and avoiding assumptions about the stationarity of natural systems, see Craig, *supra* note 82.

implemented management strategies."[349] Because the ability to predict future events is inherently limited, legal institutions must periodically evaluate management decisions and adapt to respond to new information or changing circumstances or else develop a system that automatically responds to changing conditions. Water rights regimes should thus allocate rights based on a percentage of available stream flow rather than a raw quantity of water.[350] Such a regime automatically adapts to available resources and avoids the conflicts associated with rigid raw water allocations.

The advantages of an adaptive approach can be seen by comparing the approaches of the upper basin states of the Colorado River basin (which allocate water based on percentage of available flows) and those of the lower basin states (which allocate based on raw water amounts).[351] The lower basin states—Arizona, Nevada, and California—deal with this perpetual problem because the allocations established by law have a built-in structural deficit.[352] The Colorado River Compact allocates 7.5 million acre-feet per year to the upper basin states and 7.5 million acre-feet per year to the lower basin states.[353] The 1944 Rivers Treaty with Mexico allocated 1.5 million acre-feet per year to Mexico.[354] And the system loses 1.5 million acre-feet each year to evapotranspiration. That adds up to an assumed 18 million acre-feet available in the river system each year. But tree ring analysis demonstrates that the river more typically contains around 13.5 million acre-feet per year.[355] The upper basin allocates its 7.5 million acre-feet based on a percentage of available stream flow, thereby

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[349] Claudia Paul-Wostl, *Transitions Towards Adaptive Management of Water Facing Climate and Global Change*, 21 WATER RESOURCES MGMT. 49, 51 (2007). "Adaptive management [is a decision process that] promotes flexible decisionmaking that can be adjusted in the face of uncertainties as outcomes from management actions and other events become better understood . . . . It is not a 'trial and error' process, but rather emphasizes learning while doing." BRYON K WILLIAMS ET AL., ADAPTIVE MANAGEMENT 4 (2009), https://www2.usgs.gov/sdc/doc/DOI-%20Adaptive%20ManagementTechGuide.pdf [https://perma.cc/9EST-GL6E].

[350] *See, e.g.*, Lawrence J. MacDonnell, *Out-of-Priority Water Use: Adding Flexibility to the Water Appropriation System*, 83 NEB. L. REV. 485, 522 (2004).

[351] *See* Gregory J. Hobbs, Jr., *Colorado River Compact Entitlements, Clearing Up Misconceptions*, 28 J. LAND RESOURCES & ENVTL. L. 83, 85–87 (2008) (describing the history of the law of the Colorado River, including the different approaches taken by the Upper Basin, relying on percentage of streamflow to allocate water, and the Lower Basin, relying on raw water allocations).

[352] Neillie Fields, *The Colorado River System: Perspectives from the Lower Basin*, 19 U. DENV. WATER L. REV. 333, 335 (2016).

[353] Arizona v. California, 373 U.S. 546, 632 (1963); 70 CONG. REC. 325 (1928).

[354] Treaty Respecting Utilization of Waters of the Colorado and Tijuana Rivers and of the Rio Grande, art. 10, Mex.–U.S., Feb. 3, 1944, 59 Stat. 1219.

[355] Eric L. Garner & Michelle Ouellette, *Future Shock? The Law of the Colorado River in the Twenty-First Century*, 27 ARIZ. ST. L.J. 469, 472 (1995).

accounting automatically for the structural deficit and adapting to the ever-changing conditions of the river.[356] The lower basin, on the other hand, allocates raw water amounts to each state and is in a perpetual state of negotiation over how to respond to the shortage. This rigid system cannot survive as an effective means of water allocation in a dynamic world.[357] Water security requires adaption to water reality and resilience to water extremes.

Adaptive management has become a central feature of climate change policy debates,[358] as policymakers must respond to changing climatic conditions and ever-improving climate modeling.[359] The question of sustainable development encompasses not just maintaining and improving human life but also maintaining and improving human life under changing environmental and technological conditions. As such, natural resource law needs to "do development differently" through adaptive management.[360] However, technology and consumption patterns change even more rapidly than the climate, and thus adaptive management must play an even more critical role in environmental and natural resource law under the water security paradigm.

Adaptive capacity in water security is important in part because no paradigm in any policy field is perfect, and the water security paradigm is no exception.[361] Other previous natural resource paradigms should influence its development. The climate change paradigm's emphasis on renewable energy will reduce water consumption, the green paradigm's

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[356] *See* Douglas L. Grant, *Interstate Water Allocation Compacts: When the Virtue of Permanence Becomes the Vice of Inflexibility*, 74 U. COLO. L. REV. 105, 118 (2003) (discussing the difficulties inherent in inflexible raw water allocations in the lower basin of the Colorado River).

[357] *See id.* at 120.

[358] *See, e.g.*, Craig, *supra* note 82.

[359] The developmental question is no longer limited to "what can be done to advance humanity?" but rather now encompasses "how can we maintain and ensure human lives under changing environmental conditions?" This is true in both the developed and developing world, but is an especially harsh reality for peoples and nations who lack the resources and abilities to formulate appropriate adaptive strategies. Gabriel Eckstein, *Water Scarcity, Conflict, and Security in a Climate Change World: Challenges and Opportunities for International Law and Policy*, 27 WIS. INT'L L.J. 409, 456 (2009). This requires governments to incorporate strategies into all their development activities that facilitate adaptation.

[360] *Id.* at 457 (citing UNITED NATIONS DEV. PROGRAMME (UNDP), UNDP'S STRATEGY FOR ADAPTATION TO CLIMATE CHANGE 1, https://www.undp-aap.org/sites/undp-aap.org/files/UNDP_Adaptation_Strategy.pdf [https://perma.cc/V7F8-FTXX]) (using the "do development differently" language)).

[361] *See, e.g.*, Robert Alexy, *Jürgen Habermas's Theory of Legal Discourse*, 17 CARDOZO L. REV. 1027, 1032 (1996); Rebecca Hollander-Blumoff, *Crime, Punishment, and the Psychology of Self-Control*, 61 EMORY L.J. 501, 553 (2012); Tom C.W. Lin, *The New Investor*, 60 UCLA L. REV. 678, 696 (2013) (all illustrating that all policy paradigms have limitations, and noting criticisms of dominant paradigms in criminal law, the philosophy of law, and investment law and policy).

emphasis on pollution prevention and remediation will help integrate the Red and Green Agendas with the Blue Agenda, and the industrial paradigm will promote market-based incentives to encourage investment in water infrastructure. Where the water security paradigm is insufficient, previous or new paradigms can and should supplement the new dominant paradigm where necessary. In some instances, a national or supranational approach to policy leadership will be necessary because some water issues require governance that extends beyond the basin, including virtual water, desalination, and cloud seeding.[362] Nevertheless, just as the industrial paradigm gave way to the green paradigm and the green paradigm then receded in influence as the climate change paradigm rose to prominence, so should we deemphasize climate change in order to promote a more resonant and integrated water security approach.

Some supporters of the current climate change paradigm may argue that we lose too much with a shift to water security. For example, some may argue that momentum toward reducing greenhouse gas emissions will be lost if we shift our focus to water footprints rather than carbon footprints. However, renewable energies are typically more water efficient than nonrenewable sources, and fossil fuel combustion energy sources depend on enormous amounts of water.[363] Thus, a reduction in water footprints will result in a reduction in carbon footprints.[364] Furthermore, the water footprint framework will also account for water consumed in deforestation, thus accounting not only for increased carbon emissions but also the loss of carbon sinks.[365]

Given the potential for water conflict, some climate change supporters could also point out that water can prove divisive.[366] While it is true that water scarcity can result in disputes and even conflict, water is just as frequently a source of cooperation and often has a unifying effect.[367] Furthermore, while water security has the potential to focus policy aims on a contentious resource in some cases, climate change can hardly be pointed

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[362] Rhett B. Larson, *Inter-State Water Law in the United States of America: What Lessons for International Water Law?*, 2 BRILL RES. PERSP. INT'L WATER L. 1, 18 (2017) (noting that governance regimes in water law and policy may sometimes require jurisdiction that is broader than the river basin in instances where water policy has interbasin implications, as in the case of desalination or cloud seeding).

[363] Felix Mormann, *Clean Energy Federalism*, 67 FLA. L. REV. 1621, 1640 (2015).

[364] Jeff B. Kray, *Climate Change and Water Resources*, *in* WATERS AND WATER RIGHTS § 4A.01(b) (Robert E. Beck & Amy K. Kelley eds., 3d ed. 2010).

[365] Larson, *Reconciling Energy*, *supra* note 13, at 954.

[366] *See, e.g.*, George William Sherk, *The Management of Interstate Water Conflicts in the Twenty-First Century: Is it Time to Call Uncle?*, 12 N.Y.U. ENVTL. L.J. 764 (2005).

[367] Larson, *Holy Water*, *supra* note 234, at 109.

to as an example of a nondivisive, unifying, conflict-free policy paradigm.[368]

Still, there are other criticisms of the water security paradigm, and it will require further research either to integrate these concerns fully or to accommodate them in better, alternative paradigms in the future. For example, the water security paradigm could be implemented in ways that overemphasize the Blue Agenda, encouraging water uses that are either unsustainable or that impact aquatic or riparian habitats. The water security paradigm's anthropocentric focus should not be so narrow as to exclude necessary considerations of biodiversity. Additionally, careful consideration should be given to how the water security paradigm best addresses issues of salt water. It has obvious implications for desalination as a source of drinking water. But if the water security paradigm is viewed too narrowly, it will not integrate important issues of displacement associated with sea level rise or ocean acidification.[369]

Ultimately, rising sea levels present a real threat of water insecurity that should be integrated within the water security paradigm because water security should include flood resilience as well as protection of freshwater aquifers from saline intrusion. The water security paradigm's approach to ocean acidification is somewhat attenuated—improved water efficiency and lowered global water footprints will cause reduced carbon emissions, which should mitigate some issues of ocean acidification. But there is no question that the water security paradigm has its limits. This Article is not arguing for a perfect paradigm—simply a better one that will also need to be supplemented by complementary policies to address problems it fails to integrate.

Finally, perhaps the most significant criticism of the water security paradigm that will require additional research questions the degree to which water is more successful at spurring collective action to address sustainability challenges. As is evident in the climate change paradigm, behavioral psychology will be instructive here.[370] Empirical research is necessary to compare how people respond to advocacy based on the

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[368] *See, e.g.*, Shi-Ling Hsu, *A Realistic Evaluation of Climate Change Litigation Through the Lens of a Hypothetical Lawsuit*, 79 U. COLO. L. REV. 701 (2008); Anna Spain, *Beyond Adjudication: Resolving International Resource Disputes in an Era of Climate Change*, 30 STAN. ENVTL. L.J. 343 (2011).

[369] *See generally* Sumudu Atapattu, *Climate Change, Human Rights, and Forced Migration: Implications for International Law*, 27 WIS. INT'L L.J. 607 (2009) (analyzing legal issues surrounding displacement associated with sea level rise); Robin Kundis Craig, *Dealing with Ocean Acidification: The Problem, the Clean Water Act, and State and Regional Approaches*, 6 WASH. J. ENVTL. L. & POL'Y 387 (2016) (analyzing legal challenges associated with ocean acidification).

[370] *See supra* notes 229–46 and accompanying text.

climate change paradigm as compared to advocacy based on the water security paradigm. Perhaps behavioral psychology issues such as compassion fatigue or optimism bias would prevent effective transmission of the water security approach.[371] But even these questions will necessarily be impacted by typical concerns of bounded rationality, including the availability heuristic and recency bias,[372] so that people in places prone to water-related disasters may respond better to a water security approach, while those in coastal areas or living near poles or glaciers respond better to a discourse based on climate change.

Despite this need for careful tailoring and continued research, the water security paradigm represents a better approach to understanding and communicating natural resource policy. It speaks directly in terms of water, rather than indirectly in terms of carbon, and it addresses issues of population growth and economic development while sacrificing little of the important focus of climate change on weather variability. And at its core, the water security paradigm is about resilience of human communities to water variability and its implications.

CONCLUSION

The shift from climate change to water security is fundamentally about how the world should talk about sustainability challenges. Water is not part of the climate change problem. Rather, climate change is a component of the water problem. Scholarship and policy papers in natural resource management should not have to answer questions like, "What does this have to do with climate change?" Rather, scholarship and advocacy in natural resource and environmental law and policy should seek to answer the question, "What does this have to do with water security?" This shift in dialogue is perhaps all the more important with the new Trump administration's hostility to climate change-framed policy discussions.[373]

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[371] For a description and analysis of compassion fatigue—the decrease in individual or public support of initiatives to alleviate human suffering due to stagnation of progress on the issue and a sense of hopelessness in finding a solution—see generally Nancy A. Millich, *Compassion Fatigue and the First Amendment: Are the Homeless Constitutional Castaways?*, 27 U.C. DAVIS L. REV. 255 (1994). Optimism bias is the "tendency of individuals to believe that they are less likely to experience negative events . . . than the average person, and more likely to experience positive events." Tom Baker & Peter Siegelman, *Tontines for the Invincibles: Enticing Low Risks into the Health-Insurance Pool with an Idea from Insurance History and Behavioral Economics*, 2010 WIS. L. REV. 79, 95.

[372] *See, e.g.*, Erik F. Gerding, *Code, Crash, and Open Source: The Outsourcing of Financial Regulation to Risk Models and the Global Financial Crisis*, 84 WASH. L. REV. 127, 176 (2009).

[373] For a summary of some of the Trump administration's initial efforts to deemphasize climate change, see Dan Merica, *What Trump's Climate Change Order Accomplishes — and What It Doesn't*, CNN (Mar. 29, 2017, 6:11 AM), http://www.cnn.com/2017/03/28/politics/donald-trump-climate-change-executive-order/ [https://perma.cc/9ATX-AXUK].

The old climate change paradigm could now be politicized into silence. To avoid this and engage those who, for whatever reason, refuge to engage in the climate change conversation, the dialogue must change.

But the water security paradigm is not only a matter of changing the dialogue surrounding sustainability. The legal reforms proposed in this Article will reorient our focus toward water-related disasters and water-related economic impacts, such as food prices, which represent the threats of climate change most accessible and relevant to the general public. People naturally care most about the implications of climate change for themselves, their families, and their communities. And these implications revolve around water security. Ultimately, the only reason this blue planet matters so much is because it is blue. Our policy paradigm, therefore, should focus on what matters and resonates most. The sooner scientists and policymakers accept that reality and refocus efforts around something everyone can understand—water security—the sooner we will start effectively addressing our looming global sustainability crisis. Until we stop talking about climate change and instead concentrate on water security, we are just blowing hot air. And once we reframe our discussions about sustainability around water security, we will finally be talking about the actual problem and its primary solution. Our laws and our policies will "be water"—adaptable to a dynamic natural world and aimed at mitigating, or being resilient to, extreme water conditions.