NOTE

Water We Cannot See: Codifying a Progressive Public Trust to Protect Groundwater Resources from Depletion

Groundwater provides a vital water supply and plays an integral role in hydrological systems by supporting biodiversity and the overall health and functioning of surface waters. Yet, the current legal landscape in the United States premises groundwater management on outdated scientific understandings of hydrology and fails to adequately protect critical groundwater resources. Moreover, states differ significantly in their groundwater management practices despite the interstate nature of many aquifers. As climate change exacerbates stress to groundwater resources, many of the United States' largest aquifers rapidly approach depletion.

The public trust doctrine may provide a mechanism to regulate groundwater resources in the United States. While the public trust doctrine traditionally applies only to navigable surface water, this Note demonstrates that codification of public trust principles could, and should, expand the doctrine to include groundwater. This Note proposes a federal codified groundwater protection statute rooted in public trust principles. A federally codified groundwater trust would provide the necessary standards to achieve more unified groundwater management. By requiring the government to act as groundwater trustee, this Note's proposed groundwater trust would facilitate the protection of rapidly depleting groundwater resources to ensure water availability well into the future.

INTRODUCTION

We cannot see much of the globe's freshwater. Aquifers hidden beneath the Earth's surface make up the second-largest store of freshwater in the world.[1] Groundwater plays a critical role in hydrological systems by supporting biodiversity and the overall health and functioning of surface waters.[2] Modern civilization's reliance on groundwater cannot be overstated: over two billion people rely on underground aquifers as their primary water source, and groundwater sources irrigate more than half of the world's food supply.[3] Technological advances in groundwater pumping led to astronomical increases in groundwater extraction: since the 1930s, millions of wells have been drilled both in the United States and internationally to meet the demand for municipal, industrial, and agricultural water needs.[4]

Despite the global reliance on groundwater aquifers, the current legal landscape fails to adequately protect groundwater resources.[5] The existing legal schemes determining water usage and rights are

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1. *See* Alejandra Borunda, *We Pump Too Much Water Out of the Ground—and That's Killing Our Rivers*, NAT'L GEOGRAPHIC (Oct. 2, 2019), https://www.nationalgeographic.com/science/article/groundwater-pumping-killing-rivers-streams [https://perma.cc/3WAZ-YPYW] ("There's more fresh water hidden below Earth's surface in underground aquifers than any other source besides the ice sheets.").

2. BENJAMIN I. COOK, DROUGHT: AN INTERDISCIPLINARY PERSPECTIVE 162 (2019).

3. J.S. Famiglietti, *The Global Groundwater Crisis*, 4 NATURE CLIMATE CHANGE 945, 945 (2014); COOK, *supra* note 2, at 161–62; *see also* Lance Larson, *NRDC Map Demonstrates Nation's Reliance on Groundwater amid Growing Water Scarcity Crisis*, NAT. RES. DEF. COUNCIL: EXPERT BLOG (July 15, 2015), https://www.nrdc.org/experts/lance-larson/nrdc-map-demonstrates-nations-reliance-groundwater-amid-growing-water-scarcity#:~:text=A%20Depleted%20Resource&text=Groundwater%20aquifers%20across%20the%20country%20are%20stressed.&text=That%20data%20was%20from%20seven,dropped%20more%20than%20150%20feet [https://perma.cc/Y6YS-BABH] (examining the dependency on groundwater in the United States); Graham E. Fogg, *Groundwater: Unseen but Increasingly Needed*, PEW CHARITABLE TRS.: TREND MAG. (Mar. 3, 2019), https://www.pewtrusts.org/en/trend/archive/spring-2019/groundwater-the-resource-we-cant-see-but-increasingly-rely-upon [https://perma.cc/F5Z3-WHU2] (discussing how the world's reliance on groundwater prompts more sustainable management practices).

4. JOHN TRACY, JENNIFER JOHNSON, LEONARD KONIKOW, GRETCHEN MILLER, DANA OSBORNE PORTER, ZHUPING SHENG & STEVE SIBRAY, AQUIFER DEPLETION AND POTENTIAL IMPACTS ON LONG-TERM IRRIGATED AGRICULTURAL PRODUCTIVITY 4–5 (Feb. 2019), https://www.cast-science.org/wp-content/uploads/2019/02/CAST-IP63-Aquifer-Depletion.pdf [https://perma.cc/Q7MD-KEFE]; Leonard F. Konikow & Eloise Kennedy, *Groundwater Depletion: A Global Problem*, 13 HYDROGEOLOGY J. 317, 317 (2005).

5. *See* Famiglietti, *supra* note 3, at 946 (noting the failures of groundwater protection); Warigia M. Bowman, *Dustbowl Waters: Doctrinal and Legislative Solutions to Save the Ogallala Aquifer Before both Time and Water Run Out*, 91 U. COLO. L. REV. 1081, 1100 (2020) ("Current legal approaches to regulate groundwater are ill-equipped to sustainably manage groundwater supplies."); Barton H. Thompson, Jr., *Beyond Connections: Pursuing Multidimensional Conjunctive Management*, 47 IDAHO L. REV. 273, 274 (2011) ("Given the importance of groundwater, it is surprising how poorly the law of most states has protected groundwater and the surface flows and ecosystems reliant on it.").

primarily derived from common law principles that developed before science fully understood the interconnectivity of groundwater and surface water.[6] Nearly forty percent of all surface water in the United States originates as groundwater; however, groundwater and surface water are often managed disjunctively and without consideration of the connectivity of the hydrologic cycle.[7] The need for adequate groundwater protection is clear, yet current regulations are a patchwork of individual state laws offering no consistency and no workable safeguards against imminent aquifer depletion.[8]

The public trust doctrine may provide a solution to poor groundwater management practices.[9] In its simplest form, the public trust doctrine provides that specific natural resources are held in trust by the state to protect the public's interest in those resources.[10] While the public trust doctrine traditionally applies only to flowing water,[11] an analysis of some state adaptations of the doctrine suggests that a

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6. *See* Jack Tuholske, *Trusting the Public Trust: Application of the Public Trust Doctrine to Groundwater*, 9 VT. J. ENV'T L. 189, 206 (2008) (noting that much of groundwater common law is "founded upon discredited myths about groundwater"). While the law applicable to surface water is relatively well developed, both through common law and statutes, groundwater law has historically caused confusion for courts and remains relatively undeveloped. *See* Joseph W. Dellapenna, *A Primer on Groundwater Law*, 49 IDAHO L. REV. 265, 268 (2013) ("[T]he law relating to groundwater long remained relatively undeveloped and exhibited considerable confusion."). More advanced groundwater pumping technologies were first introduced in 1937; prior to that point, groundwater management law was largely unnecessary because technological capabilities significantly limited groundwater use. *Id.* at 266.

7. Famiglietti, *supra* note 3, at 947 ("[M]ost water law and policy in the developed world was written a century or more ago, when the tight interconnections between surface water and groundwater were poorly appreciated."); Dellapenna, *supra* note 6, at 268 ("Not the least of the continuing disconnects between water science and water law is the continuing application, in most states, of different bodies of law to surface waters and to groundwater even though they are all part of a single hydrologic cycle—a fact that has long been known."); Thompson, *supra* note 5, at 266, 274 ("[T]he law of most states failed to recognize the hydrologic connection between groundwater and surface water, treating them as two physically separate resources.").

8. *See* Tuholske, *supra* note 6 (analyzing state law approaches to groundwater).

9. *See id.* at 237 ("The protection of groundwater is just too precious to trust to anything less than the public trust."); James Olson, *All Aboard: Navigating the Course for Universal Adoption of the Public Trust Doctrine*, 15 VT. J. ENV'T L. 135, 139 (2014) (advocating for "applying public trust principles to the hydrologic cycle as a means to view and solve [systematic threats to the earth's water, ecosystems, and natural communities] holistically").

10. For discussions on the history of the public trust doctrine in U.S. jurisprudence, see generally Erin Ryan, *Short History of the Public Trust Doctrine and Its Intersection with Private Water Law*, 38 VA. ENV'T L.J. 135, 140–46 (2020) and J.B. Ruhl & Thomas A.J. McGinn, *The Roman Public Trust Doctrine: What Was It, and Does It Support an Atmospheric Trust?*, 47 ECOLOGY L.Q. 117, 136–39 (2020).

11. *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, 69–70 (2010) (discussing traditional iterations of the public trust).

codification of similar principles could, and should, expand the doctrine to include groundwater.[12]

This Note argues for a federal codification of public trust principles to protect vulnerable groundwater resources. Part I provides relevant background on the groundwater crisis and briefly summarizes relevant features of water law. Part I then examines the history of the public trust doctrine in United States' jurisprudence. Part II considers the relative success of state public trust doctrines in expanding their coverage to groundwater management and groundwater protection. Part III proposes a federal groundwater management statute that codifies public trust principles as its foundation.

I. BACKGROUND

A. The Groundwater Crisis

1. Groundwater Depletion

As a result of regulatory failures and excessive groundwater withdrawal, many states currently face a groundwater crisis that scientists warn will worsen.[13] Most of the major aquifers in the world's naturally driest zones—the parts of the world that rely most heavily on groundwater for sustaining civilization—currently experience rapid rates of groundwater depletion.[14] Many of these depleting aquifers lie beneath global agriculture regions and feed these regions' high agricultural productivity and crop yield. [15]

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12. For a general discussion of states' moves towards broader applications of the public trust doctrine, see *id.* at 80–84. *See, e.g.*, Env't L. Found. v. State Water Res. Control Bd., 237 Cal. Rptr. 3d 393 (Ct. App. 2018) (applying the public trust doctrine to prevent groundwater withdrawals).

13. For a discussion about the results of a study analyzing satellite data, see Jay Famiglietti, *A Map of the Future of Water*, PEW TREND MAG. (Mar. 3, 2019), https://www.pewtrusts.org/en/trend/archive/spring-2019/a-map-of-the-future-of-water [https://perma.cc/2TQY-894Q]. One of the "more startling findings" of this study demonstrates that "[o]ver half of the world's major aquifers are past sustainability tipping points, meaning that the rates at which groundwater is being withdrawn are far greater than the rates at which it is being replenished." *Id.; see also* Chelsea Harvey, *Millions of Groundwater Wells Could Run Dry*, SCI. AM. (Apr. 27, 2021), https://www.scientificamerican.com/article/millions-of-groundwater-wells-could-run-dry/ [https://perma.cc/8KQK-44R9] (discussing a recently published study that found "20% of the world's groundwater wells may be facing imminent failure, potentially depriving billions of people of fresh water").

14. Famiglietti, *supra* note 3, at 946; COOK, *supra* note 2, at 161. Examples of regions situated in arid and semi-arid zones that currently experience high rates of depletion include California's Central Valley (United States); the High Plains (United States); the Canning Basin (Australia); northwest India; and the North China Plain. Famiglietti, *supra* note 3, at 945 (analyzing the depletion of major aquifers around the globe). China, India, and the United States extract the most groundwater globally. COOK, *supra* note 2, at 162.

15. *See* Famiglietti, *supra* note 3, at 946 (noting that aquifers under many of the world's great agricultural regions "are primarily responsible for their high productivity"). For an in-depth

Climate stress exacerbates threats to the availability and sustainability of groundwater because the water cycle and climate are inextricably linked.[16] Climate change therefore affects multiple processes of the hydrologic system, including water vapor, precipitation, evapotranspiration patterns, and snow cover.[17] Because an aquifer's recharge rate depends on above-ground processes, shifts in snowfall, snowmelt, temperature, and precipitation significantly slow the circulation of water naturally recharging aquifers.[18] The warming climate diminishes snowpacks on mountains, and in turn causes less fresh water from snowmelt. Climate change also accelerates the melting and runoff of spring water.[19] Consequently, aquifers in mountainous areas face slower recharge rates than previous years.[20]

Climate change also complicates patterns of precipitation, leading to an increase in extreme drought and flooding.[21] Because wet regions of the world already experience more precipitation than drier regions of the world, climate change exacerbates such inequality in freshwater access.[22] Further, periods of drought directly increase groundwater withdrawal, thus advancing the rate of aquifer depletion as climate change increases the duration and frequency of these

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discussion on the negative impacts of groundwater depletion on agricultural productivity, see TRACY ET AL., *supra* note 4.

16. For a scientific research review of the impacts of climate change on groundwater, see Richard G. Taylor et al., *Ground Water and Climate Change*, 3 NATURE CLIMATE CHANGE 322 (2013).

17. *See* Wen-Ying Wu, Min-Hui Lo, Yoshihide Wada, James S. Famiglietti, John T. Reager, Pat J.-F. Yeh, Agnès Ducharne & Zong-Liang Yang, *Divergent Effects of Climate Change on Future Groundwater Availability in Key Mid-latitude Aquifers*, 11 NATURE COMMC'NS 1, 2 (2020) (analyzing the impacts of climate change on groundwater storage); Hervé Douville et al., *Water Cycle Changes*, *in* CLIMATE CHANGE 2021: THE PHYSICAL SCIENCE BASIS, 1055, 1057–59 (2021), https://report.ipcc.ch/ar6/wg1/IPCC_AR6_WGI_FullReport.pdf [https://perma.cc/62FJ-F5PP] (discussing future water cycle changes resulting from climate change).

18. *See* Robin Kundis Craig, *Adapting Water Law to Public Necessity: Reframing Climate Change Adaptation as Emergency Response and Preparedness*, 11 VT. J. ENV'T L. 709, 722–23 (2010) ("In the West, reductions in the amount of precipitation and winter snowpack are increasingly severe threats to already stressed water supplies.").

19. *Id.*

20. *See* Famiglietti, *supra* note 3, at 946 (noting that in certain regions, climate change causes "already limited groundwater recharge [to] decrease[ ]"). *See generally* Taylor et al., *supra* note 16 (discussing the impacts of climate change on recharge rates in different climatic zones).

21. For an in-depth discussion of how climate change exacerbates climate extremes, such as drought and flooding, see generally David Easterling et al., *Changes in Climate Extremes and Their Impacts on the Natural Physical Environment*, *in* MANAGING THE RISKS OF EXTREME EVENTS AND DISASTERS TO ADVANCE CLIMATE CHANGE ADAPTATION: A SPECIAL REPORT OF THE INTERGOVERNMENTAL PANEL ON CLIMATE CHANGE 167–190 (2012). *See also* Famiglietti, *supra* note 3, at 946 ("Changing patterns of precipitation and groundwater recharge, and increasing extremes of flooding and drought are among the most palpable impacts of global change . . . .").

22. *See* Famiglietti, *supra* note 3, at 946 ("As the wet, high- and low-latitude areas of the world become wetter, and the dry areas in between become drier (and already limited groundwater recharge decreases), the 'haves' and 'have nots' of the future water landscape are emerging.").

droughts.[23] For example, in California, recent years of severe drought resulted in the depletion of snowmelt, rivers, and lakes—water sources that all eventually feed groundwater aquifers.[24] In prior years, California used groundwater to meet only forty percent of its water needs.[25] Now, nearly sixty percent of California relies on groundwater to meet its water needs.[26]

The current human consumption of groundwater fails to account for the hydrological process or the effects of climate change on groundwater recharge rates.[27] Anthropogenic effects on groundwater resources has thus resulted in the overdraft of many aquifers.[28] Groundwater mining, also called depletion, occurs when the removal of groundwater from an aquifer exceeds the rate of natural recharge.[29] Some aquifers sit just below the surface and can therefore quickly recharge through rainwater or snowmelt; however, many aquifers are fossilized and thus recharge at considerably slower rates.[30] Fossilized

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23. *See* Wu et al., *supra* note 17, at 2 ("During drought periods, groundwater withdrawal is increased to compensate for the reduction in the surface water supply.").

24. *See* Dennis Dimick, *If You Think the Water Crisis Can't Get Worse, Wait Until the Aquifers Are Drained*, NAT'L GEOGRAPHIC (Aug. 21, 2014), https://www.nationalgeographic.com/history/article/140819-groundwater-california-drought-aquifers-hidden-crisis [https://perma.cc/AXK5-5KA2] ("A severe drought in California—now approaching four years long—has depleted snowpacks, rivers, and lakes, and groundwater use has soared to make up the shortfall."). For the last twenty-two years, the American West has experienced a megadrought. Chelsea Harvey, *Western Megadrought Is the Worst in 1,200 Years*, SCI. AM. (Feb. 15, 2022), https://www.scientificamerican.com/article/western-megadrought-is-the-worst-in-1-200-years/ [https://perma.cc/Y8MZ-77C4]. This has resulted in increased groundwater pumping, and, in turn, wells to run dry. Terry Chea, *Thousands of California Wells Dry Out amid Megadrought*, PBS NEWSHOUR (Oct. 4, 2022, 4:59 PM), https://www.pbs.org/newshour/nation/thousands-of-california-wells-dry-up-amid-megadrought [https://perma.cc/T6D2-ECY7].

25. Dimick, *supra* note 24.

26. *Id.*

27. *See generally* Marc F P Bierkens & Yoshihide Wada, *Non-Renewable Groundwater Use and Groundwater Depletion: A Review*, 14 ENV'T RSCH. LETTERS 1, 2 (2019) (discussing how changes to human use of groundwater, such as urbanization and irrigation, has resulted in "the depletion rate of groundwater resources [to] increase[ ] during the last decades"); *see also* Tuholkse, *supra* note 6, at 192 ("[W]e sanction over-drafting of aquifers in many places even while climate change may substantially alter the long-term water balance."). A recharge rate measures the relative time it may take water, through the natural hydraulic cycle, to permeate the earth's surface and supply the aquifer with more freshwater. COOK, *supra* note 2, at 5. Recharge rates vary greatly depending on the "local geology, ecology, and climate." *Id.*

28. *See* Wu et al., *supra* note 17, at 2–5 (discussing the relationship between "accelerating groundwater withdrawal" and groundwater depletion). For a discussion on human influences on groundwater recharge, see Dave Owen, *Law, Land, Use, and Groundwater Recharge*, 73 STAN. L. REV. 1163, 1174–1178 (2021).

29. *See* Tuholske, *supra* note 6, at 191–92 (noting that climate change increases periods of drought which subsequently increases the demand for groundwater). Groundwater mining can also have an exacerbating effect on climate change through groundwater uses like irrigation, which increases humidity and cools soil temperatures. COOK, *supra* note 2, at 169–180. For a detailed discussion of climate change exacerbating groundwater depletion and vice versa, see *id.*

30. *See* Bierkens & Wada, *supra* note 27, at 3–5 (defining and discussing fossilized aquifers); Dimick, *supra* note 24; COOK, *supra* note 2, at 161–63. In contrast to fossilized groundwater,

aquifers lie deep underground and contain ancient water locked within the aquifer due to geologic changes that occurred thousands of years ago.[31] Fossilized aquifers make up many of the world's most abundant sources of groundwater but are considered a nonrenewable resource because of their practically nonexistent recharge rates.[32]

In the United States, large aquifers such as California's Central Valley Aquifer and the Arizona Alluvial Aquifer rapidly approach depletion.[33] Aggressive groundwater pumping practices threaten to entirely deplete several other American aquifers within the next generation, including the Mississippi Embayment.[34]

The current depletion of the Ogallala Aquifer illustrates the significance and the magnitude of the groundwater crisis.[35] Running under the Great Plains, an area of the United States previously distressed by the Dust Bowl, the Ogallala Aquifer is one of the largest aquifers in the world and the largest in the United States.[36] Water drawn from the Ogallala irrigates millions of acres of cropland, totaling about twenty-seven percent of the nation's total irrigated area.[37] To put its size in perspective, this aquifer's water would cover the entire continental United States with nearly a foot and a half of water if pumped out.[38] The Ogallala Aquifer is the life source of the Great Plains: it furnishes the requisite water infrastructure for a massive agricultural industry[39] and provides the main source of drinking water for the region's population.[40]

"modern" groundwater refers to groundwater that is less than 50 years old. COOK, *supra* note 2, at 163. While modern groundwater is generally more susceptible to climate change and changes to the hydrologic cycle than fossilized groundwater, recharge rates for modern groundwater are higher. *Id.* Most of the world's largest groundwater sources are considered fossilized, while a relatively small amount of groundwater is classified as modern. *Id.*

31. Dimick, *supra* note 24.

32. COOK, *supra* note 2, at 163.

33. Bowman, *supra* note 5, at 1088; Tuholske, *supra* note 6, at 191; Lucas Bessire, *The Next Disaster Coming to the Great Plains*, ATLANTIC (Dec. 26, 2021), https://www.theatlantic.com/ideas/archive/2021/12/kansas-aquifer-ogallala-water-crisis-drought/621007/ [https://perma.cc/Z4RF-FECW].

34. Bowman, *supra* note 5, at 1088.

35. *See id.* at 1083–88 (discussing the history and importance of the Ogallala Aquifer); Bessire, *supra* note 33 (illustrating consequences of the Ogallala's depletion).

36. *Id.* at 1085–86; Dimick, *supra* note 24.

37. Bowman, *supra* note 5, at 1086.

38. *Id.*

39. *See id.* at 1089 ("The Ogallala is the most majestic of the American aquifers, crosses numerous state lines, and supports the most agriculture of any American aquifer.").

40. *See* Susie Whitfield, *You've Probably Never Heard of The Ogallala Aquifer, but You've Eaten Food Thanks to It—And It Is Under Severe Duress*, KAN. CITY MAG. (Jan. 21, 2022), https://kansascitymag.com/news/youve-probably-never-heard-of-the-ogallala-aquifer-but-youve-eaten-food-thanks-to-it-and-it-is-under-severe-duress/ (discussing the importance of the Ogallala). The aquifer provides 2.3 million people with eighty-two percent of their drinking water. *Id.*

Unfortunately, since its discovery seventy years ago, the Ogallala Aquifer has been mined by farmers at unsustainable rates.[41] Now, nearly ninety-seven percent of groundwater pumped from the Ogallala is used for irrigation.[42] The rate of water pumped far exceeds the rate at which it can naturally replenish, resulting in bleak predictions for the long-term viability of the aquifer if current practices continue.[43] In some areas of Texas and Kansas, for example, portions of the aquifer have been so quickly depleted that the aquifer itself is no longer usable.[44] One study predicts that if current withdrawal rates continue, around sixty-nine percent of the aquifer's volume will be depleted by 2063.[45] Other models suggest that the aquifer will be empty in the next hundred years if no action is taken.[46] Because of the Ogallala's size and importance to American agriculture, the exhaustion of its resources would be catastrophic.[47]

2. Consequences of Depletion

Failing to regulate groundwater extraction has potential repercussions that reach well beyond decreasing freshwater availability. Some of these consequences are outlined below.

Economic consequences. Groundwater depletion, if not curbed, will result in severe economic consequences.[48] As groundwater levels

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41. Bowman, *supra* note 5, at 1086. The invention and implementation of advanced pumping systems facilitated the high rates of groundwater withdrawal causing rapid rates of depletion. *See id.* at 1094 ("[A]dvancements in mechanized pumping technology have resulted in the groundwater-mining rate doubling between 1960 and 2000."); WILLIAM M. ALLEY & ROSEMARY ALLEY, HIGH AND DRY: MEETING THE CHALLENGES OF THE WORLD'S GROWING DEPENDENCE ON GROUNDWATER 8–9 (2017) (noting the impacts of irrigation systems, such as pivot irrigation and the centrifugal pump, on the High Plains Aquifer (which includes the Ogallala) over-withdrawal).

42. Bowman, *supra* note 5, at 1098.

43. *Id.* at 1087–88.

44. *See* Julene Blair, *Running Dry on the Great Plains*, N.Y. TIMES (Nov. 30, 2011), https://www.nytimes.com/2011/12/01/opinion/polluting-the-ogallala-aquifer.html [https://perma.cc/MJ2J-APX6] ("[I]n some areas of Kansas and Texas, farmers can no longer pump enough to water their crops. If current withdrawal rates continue, usable water in most areas will be gone by the end of this century.").

45. Bowman, *supra* note 5, at 1087–88.

46. *Id.* at 1086–87 ("Indeed, the Ogallala Aquifer will empty if nothing is done in the medium-to-long run (which scientists consider to be one hundred years).").

47. *See id.* at 1089 (discussing the reliance on the Ogallala for agriculture, drinking water, and municipal uses); Jane Braxton Little, *The Ogallala Aquifer: Saving a Vital U.S. Water Source*, SCI. AM. (Mar. 1, 2009), https://www.scientificamerican.com/article/the-ogallala-aquifer/ [https://perma.cc/UP63-DUGS] (discussing how the Ogallala is the "breadbasket of America").

48. *See* Famiglietti, *supra* note 3, at 948 ("Vanishing groundwater will translate into major declines in agricultural productivity and energy production, with the potential for skyrocketing food prices and profound economic and political ramifications."); Tara Moran, Janny Choy & Carolina Sanchez, *The Hidden Costs of Groundwater Overdraft*, STAN. UNIV.: WATER IN THE WEST, https://waterinthewest.stanford.edu/groundwater/overdraft/ (last updated Sept. 9, 2014)

deteriorate, wells run dry and must be dug to deeper levels.[49] Consequently, "groundwater quality decreases, and the cost of pumping water from greater depths increases."[50] In California, the economic effects are already occurring: wells in the Central Valley Aquifer that used to hit water at 500 feet must now drill down to 1,000 feet or more, costing more than $300,000 for a single well.[51] The technology required to accomplish groundwater extraction at deeper and deeper levels is extremely costly and, combined with an inevitable lower yield of usable water from wells, will likely result in diminishing returns.[52] Further, large volumes of water withdrawn from a basin or aquifer can cause land subsidence, which occurs when the land above a basin experiences an actual drop in elevation.[53] Land subsidence can have significant economic consequences on existing infrastructure by damaging roads, bridges, buildings, and pipelines.[54] For example, some areas of the San Joaquin Valley experience nearly a foot of land subsidence annually. While little data is available to quantify the current and anticipated damages of land subsidence, it is estimated

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[https://perma.cc/7LQ5-CSU7] (discussing some of the economic impacts of groundwater depletion).

49. Famiglietti, *supra* note 3, at 946.

50. *Id.*

51. Dimick, *supra* note 24.

52. *See* Moran et al., *supra* note 48 (discussing how groundwater overdraft magnifies "water quality problems").

53. *Id.* (discussing land subsidence and groundwater withdrawal); Melissa K. Scanlan, *Droughts, Floods, and Scarcity on a Climate-Disrupted Planet: Understanding the Legal Challenges and Opportunities for Groundwater Sustainability*, 37 VA. ENV'T L.J. 52, 57–58 (2019) (discussing the cause and consequences of land subsidence); Tuholske, *supra* note 6, at 197–98 (discussing subsidence in Florida as a result of groundwater pumping); Julie Schmit, *In California, Demand for Groundwater Causing Huge Swaths of Land to Sink*, NAT'L GEOGRAPHIC (Mar. 26, 2014), https://www.nationalgeographic.com/history/article/140325-california-drought-subsidence-groundwater#:~:text=JUSTIN%20SULLIVAN%2C%20GETTY-,In%20California%2C%20Demand%20for%20Groundwater%20Causing%20Huge%20Swaths%20of%20Land,farmlands%20fall%20to%20new%20lows.&text=Extensive%20groundwater%20pumping%20is%20causing,the%20U.S.%20Geological%20Survey%20reports [https://perma.cc/Y4N4-RRAD] (discussing subsidence in California); *see also* Loren Metzger, *Land Subsidence*, U.S. GEOLOGICAL SURV.: WATER SCI. SCH. (June 5, 2018), https://www.usgs.gov/special-topics/water-science-school/science/land-subsidence [https://perma.cc/9WWB-V3AW] (discussing how excessive groundwater pumping is the largest single cause of land subsidence and has resulted in permanent subsidence and related ground failures).

54. Moran et al., *supra* note 48. Subsidence does not only impact California. *See* Metzger, *supra* note 53 (explaining that subsidence is now a global issue). In the United States, subsidence has directly affected more than 17,000 square miles of land in forty-five states. *Id.* The costs associated with subsidence are difficult to measure, however, because of limited data sharing and collection between water basins and no consistent framework for examining the costs of land subsidence. *See* Moran et al., *supra* note 48 (discussing the limited data sharing and collection in many basins); Sien Kok & A.L. Costa, *Framework for Economic Cost Assessment of Land Subsidence*, 106 NAT. HAZARDS 1931, 1931 (2021) (discussing the lack of a consistent framework for assessing the economic costs of subsidence).

that subsidence caused approximately 1.3 billion dollars in damages in the San Joaquin Valley between 1955 and 1972.[55]

Deterioration of water quality. Aquifers in coastal areas often have zones of saltwater under freshwater.[56] The boundary between saltwater and freshwater remains relatively stable if the aquifer's levels are normal, but overpumping causes saltwater to shift and contaminate the freshwater supply.[57] Aquifers further inland also experience contamination when over withdrawal of its upper level, high-quality water allows lower quality water to shift up, degrading the overall water quality.[58]

Frequent groundwater pumping can also stir up contaminants that naturally occur in the aquifer.[59] For instance, a study linked the overpumping of groundwater in the San Joaquin Valley to an increased concentration of arsenic in the aquifer.[60] Groundwater provides the main source of drinking water for around one million people in the San Joaquin Valley; however, around ten percent of wells tested in the area contain arsenic above the World Health Organization's maximum acceptable level.[61]

Declining agricultural productivity. Vanishing groundwater will likely translate into major declines in agricultural productivity. Despite population growth necessitating an increase in global food supply, under current management practices, crop production will likely plateau or decline.[62] For instance, in the heavily irrigated region of the United States' central High Plains, access to groundwater is imperative

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55. Moran et al., *supra* note 48.

56. *See Groundwater Decline and Depletion*, U.S. GEOLOGICAL SURV.: WATER SCI. SCH. (June 6, 2018), https://www.usgs.gov/special-topic/water-science-school/science/groundwater-decline-and-depletion?qt-science_center_objects=0#qt-science_center_objects– [https://perma.cc/G6G4-2MLS] [hereinafter *Groundwater Decline and Depletion*] (discussing saltwater intrusion).

57. *Id.*; *see also* Tuholske, *supra* note 6, at 201–02 (discussing areas experiencing saltwater intrusion resulting from groundwater withdrawals).

58. *Groundwater Withdrawal and Depletion*, *supra* note 56.

59. *Id.*; Moran et al., *supra* note 48. Groundwater withdrawal can decrease water quality by concentrating both natural and manmade pollutants in the declined water amount. *Id.* In coastal groundwater basins, over pumping of groundwater can draw seawater into aquifers thus contaminating the freshwater supply with salt. *Id.*

60. *See* Ryan Smith, Rosemary Knight & Scott Fendorf, *Overpumping Leads to California Groundwater Arsenic Threat*, NATURE COMMC'NS 1, 2 (June 5, 2018) https://www.ncbi.nlm.nih.gov/pmc/articles/PMC5988660/ [https://perma.cc/LTS5-3FBY] (discussing research showing a link between high arsenic levels and groundwater pumping).

61. *Id.*

62. *See* Famiglietti, *supra* note 3, at 947–48 (explaining with population growth comes increased demand for food, but that diminishing groundwater will significantly decrease agricultural productivity); Kayla A. Cotterman, Anthony D. Kendall, Bruno Basso & David W. Hyndman, *Groundwater Depletion and Climate Change: Future Prospects of Crop Production in the Central High Plains Aquifer*, 146 CLIMATE CHANGE 187, 194 (2018) (analyzing future grain crop yield in the Central High Plains region and finding that "[d]eclines in irrigated acreage due to groundwater depletion dramatically impact total regional grain production").

to maintain crop yields.[63] Groundwater withdrawal, however, far exceeds recharge rates of the aquifer.[64] Consequently, the region's irrigated corn yield is projected to decrease as much as sixty percent within this century due to rising temperatures and the effects of aquifer depletion on regional production.[65] Decreased food production and increased cost in irrigation technology may also result in "skyrocketing food prices."[66]

Social and geopolitical conflict. Globally, access to groundwater exacerbates social inequality.[67] As the cost of pumping groundwater increases, the relatively wealthy can incur these new expenses while the poor cannot.[68] Social scientists also indicate that further declines in groundwater availability may trigger civil unrest and violent conflict in water-stressed regions.[69] Additionally, as access to water becomes more dire, mass migrations may result as populations from water poor regions are forced to migrate to water rich regions.[70]

B. A Brief Summary of Water Law

1. Federal Statutory Water Law: The Clean Water Act

Currently, the federal government's primary means to regulate water resources derives from the Clean Water Act ("CWA").[71] The CWA aims to address the significant water quality and pollution concerns, with its stated objective being to "restore and maintain the chemical, physical, and biological integrity of the Nation's waters."[72] To accomplish this goal, Section 301 of the CWA prohibits discharges without a permit of pollutants from a point source into "navigable

63. Cotterman et al., *supra* note 62, at 196–97 (discussing how groundwater depletion leads to less water available for irrigation, which in turn reduces crop yield).

64. *Id.* at 189 ("The region is clearly on an unsustainable path due to high rates of groundwater withdrawal along with minimal annual recharge.").

65. *Id.* at 196.

66. Famiglietti, *supra* note 3, at 946, 948.

67. *See id.* at 948 ("Further declines in groundwater availability may well trigger more civil uprising and international violent conflict in the already water-stressed regions of the world.").

68. *Id.* at 946–47. As an example of conflict arising over water resources, *some* scholars cite water as the catalyst for the uprising in Syria and Yemen associated with the Arab Spring. Nicholas S. Robins & James Fergusson, *Groundwater Scarcity and Conflict: Managing Hotspots*, 1 EARTH PERSP. 1, 1 (2014). For an in-depth discussion of the link between water and groundwater resources and social conflict, see *id.*

69. *See* Robins & Fergusson, *supra* note 68, at 2 (discussing the link between water scarcity and conflict); Famiglietti, *supra* note 3, at 948.

70. *See* Robins & Fergusson, *supra* note 68, at 2, 8 (noting that "water failure encourages migration to cities").

71. CLAUDIA COPELAND, CONG. RSCH. SERV., RL30030, CLEAN WATER ACT: SUMMARY OF THE LAW 1 (2016).

72. 33 U.S.C. § 1251(a).

waters,"[73] which the Act defines as the "waters of the United States" ("WOTUS").[74] While the CWA grants discretion to define WOTUS to the Army Corp of Engineers and the Environmental Protection Agency ("EPA"),[75] the scope of the federal government's jurisdiction granted by the CWA definition has been the subject of significant debate and controversy.[76] In *Rapanos v. United States*, the Supreme Court issued a plurality decision attempting to clarify the scope of WOTUS jurisdiction.[77] While *Rapanos* had no majority opinion, most jurisdictional determinations following *Rapanos* adhered to the concurrence's "significant nexus" test which held that WOTUS included waters that possess a significant nexus to traditionally navigable waters.[78] But, since 2015, a concrete definition of WOTUS has remained elusive and subject to regulatory change depending on the current presidential administration.[79]

The CWA illustrates a federal law implementing a cooperative federalism scheme.[80] On the federal level, the CWA grants significant authority to the EPA to set national pollution standards.[81] The CWA mandates that the EPA utilizes and issues technological standards for polluters falling under the Act's purview.[82] In addition to technology standards, the CWA also requires the implementation of water quality standards for a given waterbody.[83] While the federal government is charged with issuing technology-based standards, the primary responsibility of issuing water quality standards falls on state

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73. *See* 33 U.S.C § 1311(a) (stating that discharging pollutions is illegal unless it is done in compliance with the statutory section).

74. *See* 33 U.S.C. § 1362(7) (defining "navigable waters" as "the waters of the United States").

75. *About Waters of the United States*, U.S. ENV'T PROT. AGENCY (last updated Dec. 20, 2021), https://www.epa.gov/wotus/about-waters-united-states [https://perma.cc/VRH5-EVTG].

76. *See* Martin A. McCrory & Anjanette H. Raymond, *Navigating Murky Waters: The Rise and Fall of Clean Water Protection in the United States*, 29 S. CAL. REV. L. & SOC. JUST. 143, 165–76 (2020) (detailing the historic debate over the WOTUS definition).

77. 547 U.S. 715, 715 (2006).

78. *See id.* at 759 (Kennedy, J., concurring) (articulating the significant nexus test, which deems a water or wetland a navigable water if it "possess[es] a 'significant nexus' to waters that are or were navigable in fact or that could reasonably be so made"); McCrory & Raymond, *supra* note 76, at 169, 170, 172, 175 (discussing how a Trump Administration rule reversed the previous policy of following Kennedy's definition of WOTUS).

79. *See* McCrory & Raymond, *supra* note 76, at 171–76 (explaining how the Trump administration repealed the Obama administration's 2015 rule adopting Kennedy's "significant nexus" test in favor of a rule that instead tracked Scalia's plurality opinion in *Rapanos*).

80. *See* Alexandra Dapolito Dunn & Meghan Boian, *Postcards from the Edge: Perspectives to Reinvigorate Clean Water Act Cooperative Federalism*, 4 GEO. WASH. J. ENERGY & ENV'T L. 68, 68 (2013) (discussing the federalism structure of the CWA); McCrory & Raymond, *supra* note 76, at 163–65 (discussing the contours of state and federal jurisdiction under the CWA).

81. COPELAND, *supra* note 71, at 4.

82. *Id.* at 3, 5.

83. *Id.* at 3.

governments (subject to the EPA's approval).[84] By allowing states to retain a regulatory role, Congress aimed to "recognize, preserve, and protect the primary responsibilities and rights of States to prevent, reduce, and eliminate pollution."[85] In sum, the federal government, acting through the EPA, sets large-scale standards and an agenda to meet the pollution abatement goals of the CWA. In contrast to the federal government's role, states generally carry out day-to-day implementation and enforcement.[86]

2. Common Law Rights in Groundwater

As a general rule, no individual person or entity "owns" water.[87] Instead, either the public or the state retain title in water resources, and individuals or entities may possess the right to use the water.[88] While common law water rights in surface water have a long legal history and are relatively well-developed, common law rights in groundwater developed separately from its surface water counterpart due to a lack of scientific knowledge about the hydrology system.[89] As a result, groundwater and surface water are often managed disjunctively, and groundwater law historically "remained relatively undeveloped and

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84. *Id.* at 3–4; s*ee also* Dunn & Boian, *supra* note 80, at 72 ("The water quality standards ("WQS") program is a good example of the cooperative federalism relationship because it involves both state adoption of very detailed standards through state rulemaking and significant, and sometimes complicated, federal oversight.").

85. 33 U.S.C. § 1251(b).

86. COPELAND, *supra* note 71, at 4.

87. *See* 1 WATERS AND WATER RIGHTS § 4.01 (Robert E. Beck & Amy K. Kelley eds., 3d ed. 2023) (broadly describing the water rights regime in the United States); Scanlan, *supra* note 53, at 61 ("A majority of states view groundwater as a public resource in which private rights are usufructuary, meaning the groundwater pumper has the right to use but not own water.").

88. Scanlan, *supra* note 53, at 61. Generally, private water rights are usufructuary, which grants a right to use, in contrast with proprietary rights, which are rights of absolute ownership. *See* Shelley Ross Saxer, *The Fluid Nature of Property Rights in Water*, 21 DUKE ENV'T L. & POL'Y F. 49, 73 (2010) ("It is important to again note the difference between water ownership and real property ownership; water is a usufructuary as opposed to a possessory right." (quoting Est. of Hage v. United States (*Hage V*), 82 Fed. Cl. 202 (2008))); Russell M. McGlothlin & Scott S. Slater, *No Fictions Required: Assessing the Public Trust Doctrine in Pursuit of Balanced Water Management*, 17 U. DENV. WATER L. REV. 53, 71 (2013) ("There is well-settled accord among the states that a water right, regardless of type, is a usufructuary right; a water right only conveys a right to use water on a recurring basis.").

89. *See* Dellapenna, *supra* note 6, at 268 (noting the disconnect between ground and surface water law); Timothy R. Weston, *Harmonizing Management of Ground and Surface Water Use Under Eastern Water Law Regimes*, 11 U. DENV. WATER L. REV. 239, 242 (2008) ("Traditionally, management of water resources has focused on surface water or ground water as if they were separate entities." (quoting THOMAS C. WINTER, JUDSON W. HARVEY, O. LEHN FRANKE & WILLIAM M. ALLEY, GROUND WATER AND SURFACE WATER: A SINGLE RESOURCE, U.S. DEP'T OF THE INTERIOR (1998), https://pubs.usgs.gov/circ/1998/1139/report.pdf [https://perma.cc/KU6V-Z3UG])); Tuholske, *supra* note 6, at 204 ("[G]roundwater law traditionally was adopted on a state-by-state basis separate from laws governing surface water." (footnote omitted)).

exhibited considerable confusion."[90] Water law is primarily state law, and groundwater rights generally fall within six major systems, subject to variation: absolute capture, the reasonable use doctrine, correlative rights, the Restatement (Second) of Torts, prior appropriation, and regulated riparianism.[91]

In the few states that continue to apply absolute dominion—also known as the rule of capture—groundwater is treated as a resource subject to capture.[92] A basic tenant of common law property rights establishes that ownership of the land "extended up to the heavens and down to the inferno."[93] This absolutist understanding of land ownership eventually expanded to understanding groundwater as "part and parcel of the land in which [it is] found, and belong absolutely to the owner of such land, who may deal with [it] as he sees fit."[94] A landowner does not "own" the groundwater, however, until the landowner "controls" it, meaning until the landowner pumps the groundwater.[95] In absolute dominion jurisdictions, landowners will not be held liable for injury to others caused by groundwater use unless such injury was willful or malicious.[96] The absolute dominion rule has been abandoned in most states and only truly remains in Texas and Maine.[97]

The reasonable use rule, or American rule, allows a landowner to use the groundwater under their parcel for reasonable uses.[98] While a court's actual determination of a water user's reasonableness is a fact-intensive inquiry, the reasonable use rule is generally viewed as a rights-balancing regime because courts resolve groundwater disputes by balancing the "social utility of competing uses against each other."[99] Unlike the absolute dominion rule, however, the reasonable use rule

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90. Dellapenna, *supra* note 6, at 268.

91. *See* Tuholske, *supra* note 6, at 205–13 (outlining water rights regimes applicable to groundwater); Dellapenna, *supra* note 6, at 269 (same); Scanlan, *supra* note 53, at 61–67 (same).

92. Dellapenna, *supra* note 6, at 269; Tuholske, *supra* note 6, at 205–06; 2 WATERS AND WATER RIGHTS, *supra* note 87, § 20.04; Scanlan, *supra* note 53, at 62.

93. Dellapenna, *supra* note 6, at 272.

94. *Id.* at 273.

95. *Id.*

96. Scanlan, *supra* note 53, at 62; *see* Joseph W. Dellapenna, *The Rise and Demise of the Absolute Dominion Doctrine for Groundwater*, 35 U. ARK. LITTLE ROCK L. REV. 291, 320 (2013) (discussing limitations on the absolute capture doctrine and noting that it does "not protect a groundwater user who causes some malicious injuries").

97. Dellapenna, *supra* note 96, at 320. The doctrine has proved to be largely contradictory and unworkable in Texas, particularly given the contradiction between "ownership and rights" and legislative authorization of groundwater regulation. *See id.* at 327 ("The contradictions between the various statutes and judicial precedents invited litigation over the extent to which the absolute dominion doctrine (the rule of capture) survives in Texas.").

98. Scanlan, *supra* note 53, at 63; ROBIN KUNDIS CRAIG, ROBERT W. ADLER & NOAH D. HALL, WATER LAW 69 (2017).

99. Dellapenna, *supra* note 6, at 285.

generally does not allow a landowner to harm others' interest in groundwater by maliciously diverting water from a neighboring tract or negligently wasting groundwater.[100]

The doctrine of correlative rights as applied to groundwater is often confused with the reasonable use rule given the two doctrines' similarities.[101] Both theories require groundwater users to share the resource with others with legitimate claims to use.[102] Unlike the reasonable use rule, however, correlative rights allocate groundwater rights based on proportionality.[103] While the calculation of a groundwater user's proportionate share of the resource varies between states that apply some form of correlative rights, groundwater rights are generally allocated in proportion to the owned land above the aquifer.[104]

Prior appropriation, which originally applied to surface water in western states, adheres to the maxim "first in time, first in right."[105] Under prior appropriation regimes, water rights were granted based on the timing of a user's appropriation.[106] Priority of rights are therefore granted based on seniority, meaning whoever began using the water earliest.[107] Groundwater rights in prior appropriation states are thus obtained by users who beneficially use the water, but new junior users cannot interfere with the rights of senior users.[108]

A limited number of states rely on a torts approach to groundwater disputes by applying the Restatement (Second) of Torts § 858.[109] The Restatement approach combines aspects of tort law, correlative rights, and the reasonable use rule.[110] Landowners who

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100. *Id.* at 292; *see also* Tuholske, *supra* note 6, at 208 (discussing the scope of the reasonable use rule).

101. Scanlan, *supra* note 53, at 64 (noting the similarities between the reasonable use rule and correlative rights); WATERS AND WATER RIGHTS, *supra* note 87, § 21.01 (broadly discussing the confusion between reasonable use and correlative rights). California, the first state to articulate correlative rights, first established the principle in *Katz v. Walkinshaw*, 70 P. 663 (Cal. 1902); Scanlan, *supra* note 53, at 64.

102. Scanlan, *supra* note 53, at 64; 2 WATERS AND WATER RIGHTS, *supra* note 87, § 21.01.

103. 2 WATERS AND WATER RIGHTS, *supra* note 87, § 21.01 (discussing the role of proportionality in correlative rights regimes).

104. *Id.*

105. *See* Scanlan, *supra* note 53, at 66 (outlining prior appropriation); Tuholske, *supra* note 6, at 209–10 (analyzing applications of prior appropriation); Dellapenna, *supra* note 6, at 298–302 (discussing the history of prior appropriation and its application to groundwater).

106. Scanlan, *supra* note 53, at 66; Tuholske, *supra* note 6, at 209.

107. Tuholske, *supra* note 6, at 209.

108. *Id.* at 301.

109. *See* Tuholske, *supra* note 6, at 210–211 (discussing the application of the Restatement to groundwater disputes); Scanlan, *supra* note 53, at 64–66 (same); RESTATEMENT (SECOND) OF TORTS § 858 (AM. L. INST. 1979).

110. RESTATEMENT (SECOND) OF TORTS § 858 (AM. L. INST. 1979); *see also* Scanlan, *supra* note 53, at 64–65 (outlining the liability regime under the Restatement).

withdraw groundwater from their tract of land and use it for a beneficial purpose will not be subject to tort liability for interfering with another's use of the water unless the withdrawal: (i) causes unreasonable harm to neighboring land's groundwater, (ii) exceeds the user's proportional share, or (iii) has a direct and substantial effect on a surface watercourse which unreasonably harms a person entitled to use that surface water.[111]

Many states now apply a "regulated riparian" approach to groundwater.[112] Under this approach, groundwater rights are allocated via a state-issued permit.[113] The issuing agency considers the reasonableness of the proposed use of the water, among other factors that vary by state.[114]

The disjunctive management of groundwater and the lack of adequate protection strategies in state law approaches to groundwater rights illustrate a classic example of how limited regulation leads to a tragedy of the commons.[115] Under U.S. common law in many states, ownership or use rights in groundwater are not clearly defined.[116] Yet, flow of groundwater crosses ownership boundaries, indicating that it exists as a common pool resource.[117] Common pool resources are often difficult to sustainably manage because individuals seek to maximize their own economic benefit without considering the long-term viability of the resource.[118] Consequently, given the lack of regulation, individual exploitation of the groundwater commons for short-term gain

111. RESTATEMENT (SECOND) OF TORTS § 858 (AM. L. INST. 1979).

112. *See* 2 WATERS AND WATER RIGHTS, *supra* note 87, §§ 23.01–23.03 (discussing the move to regulated riparianism); Scanlan, *supra* note 53, at 74 ("Some states use a version of regulated riparianism that may apply to ground and surface waters."); Dellapenna, *supra* note 6, at 302–11 (outlining the history of regulated riparian regimes).

113. Scanlan, *supra* note 53, at 74; 2 WATERS AND WATER RIGHTS, *supra* note 87, § 23.02.

114. Scanlan, *supra* note 53, at 74 & n.151; 2 WATERS AND WATER RIGHTS, *supra* note 87, § 23.02.

115. *See* Dellapenna, *supra* note 6, at 317 ("These perceptual problems combine to ensure that too often the world's legal systems have been willing to leave resources like groundwater in a common-property condition that creates 'a destructive negative sum [game]'— in other words, a 'tragedy of the commons.' "); TRACY, *supra* note 4, at 8 (noting that groundwater is a common pool resource); Scanlan, *supra* note 53, at 59 ("[G]roundwater supply is prone to being mismanaged and depleted at an unsustainable rate, in part because of the common pool nature of groundwater with multiple users who can neither easily exclude others nor see the impact of their choices.").

116. *See* TRACY ET AL., *supra* note 4, at 8 ("[W]hen private ownership of a groundwater resource within an aquifer is not clearly defined, or regulations have not been developed to promote sustainable use of groundwater, there is a tendency to use groundwater in a nonsustainable manner and thereby deplete the resource.").

117. *Id.*

118. *Id.* A common pool resource is an economic term that identifies resources with characteristics that make it difficult to exclude people from benefitting from the resource's use, even if those users do not assist in supporting, managing, or sustaining the resource. *Id.*

aggregates to a depletion of the resource as a whole, with the costs spread among all beneficiaries.[119]

C. Public Trust Principles: A Brief History

In U.S. jurisprudence, the public trust doctrine is largely based in Roman civil law and British common law.[120] In its classic formulation, the public trust doctrine requires the state to hold navigable waters in trust for public use and enjoyment.[121] The Supreme Court has affirmed the public trust doctrine, at least in its most traditional form.[122] States, however, are free to adopt their own versions of the doctrine, and the development of public trust doctrine has become largely a matter of state law.[123] Many states continue to follow the traditional navigable waters public trust, while others extend principles of the public trust to apply to other natural resources.[124] Because of the doctrine's flexible nature, many activists and legal scholars advocate for an ecological trust—that is, an extension of the public trust's core principles to the broader ecological values and general environmental protection.[125]

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119. *Id.*

120. *See* Michael C. Blumm, & Zachary A. Schwartz, *The Public Trust Doctrine Fifty Years After Sax and Some Thoughts on Its Future*, 44 PUB. LAND RES. L. REV. 1, 2 (2021) ("[T]he doctrine has been implicit in sovereignty at least since the Roman Empire."); Tuholske, *supra* note 6, at 214 (discussing the public trust doctrine's Roman and British roots); Olson, *supra* note 9, at 145 (stating that public trust principles are "derived from English common law and ancient Roman law principles"); Ruhl & McGinn, *supra* note 10, at 121–22 (outlining the history and roots of the public trust doctrine).

121. *See* Olson, *supra* note 9, at 174 ("The body of the trust traditionally applied to navigable waters and their bottomland, shoreline, fish, and aquatic habitat such fish spawning areas and wetlands."). As a legal term of art, defining which water bodies qualify as navigable has been surprisingly controversial. Craig, *supra* note 11, at 64. While states adopt their own definitions of navigable waters, some commonalities include a reference to commercial navigation and use for recreational activities. *Id.* at 71–75. For a summary and discussion of the term navigable waters, see *id.*

122. Olson, *supra* note 9, at 148. *Illinois Central R.R. Co. v. Illinois* is often coined the "lodestar" of public trust law. *Id.*; Blumm & Schwartz, *supra* note 120, at 11.

123. *See* Craig, *supra* note 11, at 71 (discussing state adaptations of the public trust doctrine and noting that "the import of public trust principles is now largely a matter of state common law").

124. *See id.* (noting that some states "have used a variety of legal techniques to protect and expand public rights in the waters of each state"); Blumm & Schwartz, *supra* note 120, at 24 ("[T]he PTD has expanded considerably both in terms of the definition protected trust purposes and trust properties . . . ."); Erin Ryan, Holly Curry, & Hayes Rule, *Environmental Rights for the 21st Century: A Comprehensive Analysis of the Public Trust Doctrine and Rights of Nature Movement*, 42 CARDOZO L. REV. 2447, 2461 (2021) ("Some states apply the doctrine to only waterways, while others expand the resources protected by the trust to include wildlife, beach access, other natural and cultural resources, and perhaps even atmospheric resources.").

125. Craig, *supra* note 11, at 80–88 (defining the ecological public trust and outlining recent state pushes towards an ecological public trust). Another, more specific, iteration of the ecological trust is the atmospheric trust, which argues that the public trust doctrine extends to protect air

1. The Traditional Public Trust Doctrine in American Jurisprudence

The claim that the principles of the public trust stem from a historical pedigree is often intertwined with American applications of the public trust.[126] Scholars and courts rely on this brief passage from the Institutes of Justinian, a compilation of Roman civil law, as the founding basis for the public trust doctrine: "[T]hings uncommon to mankind by the law of nature, are the air, running water, the sea, and consequently the shores of the sea."[127]

British common law may provide a stronger foundation for the American public trust doctrine.[128] Early American jurisprudence adopted the British iteration of the public trust, which held that the sovereign holds navigable waters in trust for the public to protect navigability and promote commerce.[129] American courts historically applied the public trust doctrine to protect the public's use of navigable waters from sale or harm.[130] State courts generally followed these principles, holding that public trust resources could not be alienated by the state or owned by private parties.[131] Thus, while the scope or standards of the public trust may vary from state to state, all states recognize the doctrine's core principle: to protect the public's right to use navigable waters for its own benefit.[132]

In *Illinois Central Railroad Co. v. Illinois*, the Supreme Court entrenched the public trust doctrine in American jurisprudence.[133] The Court in *Illinois Central* applied the public trust doctrine to hold that

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resources from pollution and greenhouse gas emissions. *See* Ruhl & McGinn, *supra* note 10, at 120 (noting that "a wave of 'atmospheric trust' litigation and legal scholarship asserts that the PTD requires no less than that the federal and state governments take affirmative action to force public and private actors to reduce greenhouse gas emissions to abate climate change"); Jenna Lewis, *In Atmosphere We Trust: Atmospheric Trust Litigation and the Environmental Advocate's Toolkit*, 30 COLO. NAT. RES. ENERGY & ENV'T L. REV. 361, 366 (2019) (detailing the argument for an atmospheric public trust).

126. Blumm & Schwartz, *supra* note 120, at 6–7 (describing the history of the public trust doctrine). For an overview of the public trust doctrine's ancient roots, see generally Ruhl & McGinn, *supra* note 10.

127. Ruhl & McGinn, *supra* note 10, at 121–22.

128. James L. Huffman, *The Public Trust Doctrine: A Brief (and True) History*, 10 GEO. WASH. J. ENERGY & ENV'T. L. 15, 18 (2019).

129. Olson, *supra* note 9, at 147–48.

130. *Id.*

131. *Id.*

132. *See id.* (outlining underlying public trust principles); *see also* Tuholske, *supra* note 6, at 214–16 (explaining courts ties the public trust doctrine to a state's "sovereign duty to protect [navigable waters] for the benefit of citizens").

133. 146 U.S. 387, 452 (1892); *see also* Tuholske, *supra* note 6, at 214 ("[T]he most important nineteenth-century acknowledgment of the public trust doctrine occurred in the landmark U.S. Supreme Court case *Illinois Central Railroad Co. v. Illinois* in 1892."); Joseph D. Kearney & Thomas W. Merrill, *The Origins of the American Public Trust Doctrine: What Really Happened in* Illinois Central, 71 U. CHI. L. REV. 799 (2004) (analyzing Illinois Central).

the Illinois state legislature could not convey to a private railroad company the title to a square mile of Lake Michigan.[134] The Court reasoned that the Great Lakes, and the land beneath them, were held in a trust for the public by the states in the position of trustee.[135]

The classic permutation of the public trust doctrine embodies the characteristics discussed in *Illinois Central*: navigable waters are held in trust by the state for the benefit of the public.[136] *Illinois Central* further held that while a state's determination of what uses serve the public interest may shift over time, the government's duty to maintain waters in the interest of the public cannot be abdicated.[137] Therefore, public trust waters cannot be placed "entirely beyond the direction and control of the state."[138] *Illinois Central* thus establishes that states cannot convey public trust waters for private purposes or in a manner that impairs the right of public use.[139] Importantly, the Court implied that other resources of "a special character" may qualify for protection under the public trust doctrine, suggesting that the scope and purpose of the public trust doctrine may evolve over time.[140]

2. The Modern Expansion of Public Trust Principles

A more modern view of the public trust doctrine, followed by some states, extends the doctrine to protect other natural resources.[141] Under this iteration of the public trust, resources common to all citizens' wellbeing, like air and hydrologically connected water ecosystems, are understood to warrant the same protection under the public trust as navigable waters receive under traditional

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134. Ill. Cent. R.R. Co. v. Illinois, 146 U.S. 387, 452–53 (1892); *see* Olson, *supra* note 9, at 148 ("The Court reasoned that under the public trust doctrine it was beyond the power of the state to transfer or convey public trust waters and land for private purposes, or in a manner impairing the public trust and the public's protected right of public use."); Tuholske, *supra* note 6, at 215 (recounting the Court's reasoning: that the State's conveyance of navigable waters to private parties are limited because the "private use must benefit the public's interest").

135. *Ill. Cent. R.R.*, 146 U.S. at 452.

136. Olson, *supra* note 9, at 148.

137. 146 U.S. at 453.

138. *Id.* at 454; Olson, *supra* note 9, at 150.

139. *See* Olson, *supra* note 9, at 148, 151 ("[A] transfer or authorized use can not impair the public's interest in the trust or its trust resources."); Tuholske, *supra* note 6, at 215 (noting that a core principle of the public trust is that "governments as trustees must act in a fiduciary capacity to protect trust resources").

140. Olson, *supra* note 9, at 150; *Ill. Cent. R.R.,* 146 U.S. at 454.

141. *See* Tuholske, *supra* note 6, at 216–18 (discussing the modern view of the public trust); Craig, *supra* note 11, at 80 ("As in eastern states, most western states have expanded the protected public rights in waters beyond the three acknowledged in *Illinois Central Railroad*—navigation, fishing, and commerce—to recreation and other public uses, including, in some states, aesthetics."); Ryan et al., *supra* note 124, at 2452 (discussing how "the doctrine has evolved along multiple dimensions among the different U.S. states").

applications.[142] Courts adhering to a modern public trust doctrine focus less on the state's property interest in land and, instead, focus on the state's duty to act as a trustee for the public's interest in water as a common resource necessary for health and well-being.[143]

The expansion of the public trust doctrine began in the 1970s at the beginning of "the heyday of the modern environmental era."[144] Professor Joseph Sax is viewed as reviving and expanding the public trust with his article *The Public Trust Doctrine in Natural Resource Law: Effective Judicial Intervention*.[145] In Sax's view, the public trust doctrine could provide the "breadth and substantive content" to fill the large gaps in environmental resource management.[146] Sax noted administrative and legislative action's failure to remedy public concern about the quality of land, air, and water.[147] He argued that the doctrine could be used to initiate judicial skepticism towards "dubious government conduct."[148] If implemented correctly, Sax believed that the public trust doctrine could facilitate democratization and mitigate the poor state response to environmental harm because it instilled a public right to resources with enforceability against the government.[149]

When Sax's article was published, courts and legislatures narrowly construed the public trust doctrine as only applying to navigable waters.[150] Sax argued, however, that the doctrine should apply in "a wide range of situations in which diffuse public interests need protection against tightly organized groups . . . ."[151] In a later article, Sax analyzed the history of the public trust doctrine in the context of the "tradition of the commons in medieval Europe," where he concluded that, historically, the public trust doctrine functioned to

142. *See* Tuholske, *supra* note 6, at 215, 216 (noting that "a more modern view extends the doctrine to other natural resources"); Alexandra B. Klass, *Modern Public Trust Principles: Recognizing Rights and Integrating Standards*, 82 NOTRE DAME L. REV. 699, 706 (2006) (discussing how a more modern public trust has the "potential to become a powerful mechanism to protect the public interest in access, navigation, and recreation against state action that would attempt to privatize or limit those resources").

143. *See* Olson, *supra* note 9, at 171 (discussing how Hawaii courts "have imposed a number of duties on the state to assure that the water would be used in the public interest, not impair the public trust").

144. For an in-depth discussion on the history and the movement to expand the public trust, see Blumm & Schwartz, *supra* note 120, at 16.

145. *Id.* (citing Joseph Sax, *The Public Trust Doctrine in Natural Resource Law: Effective Judicial Intervention*, 68 MICH. L. REV. 471 (1970)).

146. *Id.* (citing Sax, *supra* note 145, at 474).

147. Tuholske, *supra* note 6, at 217.

148. Blumm & Schwartz, *supra* note 120, at 16 (citing Sax, *supra* note 145, at 491).

149. *Id.* at 16–17 (citing Sax, *supra* note 145, at 491).

150. *See* Ruhl & McGinn, *supra* note 10, at 139 (noting that prior to Sax's writings, "virtually all scholarly and judicial descriptions of the American PTD, whether relying on the Institutes or not, hewed very closely to the traditional version as the universally accepted scope").

151. Blumm & Schwartz, *supra* note 120, at 16–17, 19–20 (citing Sax, *supra* note 145, at 556).

"protect such public expectations against destabilizing changes."[152] Under this perspective, the public trust doctrine could expand the concepts of jus publicum (the right of public ownership) to a wider range of natural resource management concerns and adapt to public concern and ideologies.[153]

Following Sax's push for a more progressive public trust, some state courts and legislatures expanded the scope of the doctrine.[154] Some decisions directly cited to Sax, while others invoked Saxian public trust principles.[155] Most notably, in the 1983 case *National Audubon Society v. Superior Court* (*Mono Lake*), the California Supreme Court held that the public trust doctrine should be read as integrated into California's broader water law regime.[156] The court in *Mono Lake* held that the public trust included ecological purposes; thus, the State was required to consider principles of the public trust doctrine and ecological effects of water diversions, even from non-navigable waters.[157] The *Mono Lake* decision resulted in a broader use of the public trust doctrine in environmental advocacy.[158] Moreover, lower courts have used *Mono Lake* as precedent to hold that groundwater resources could also receive public trust protection.[159]

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152. *Id.* at 22 (citing Joseph L. Sax, *Liberating the Public Trust Doctrine from its Historical Shackles*, 14 U.C. DAVIS L. REV. 185, 188–89 (1980)).

153. *Id.* at 22 (citing Sax, *supra* note 152, at 189).

154. *See id.* at 24 ("In the years since Sax wrote, the PTD has expanded considerably both in terms of the definition protected trust purposes and trust properties."); Ryan et al., *supra* note 124, at 2461 (discussing the expansion of the public trust doctrine); Tuholske, *supra* note 6, at 215, 216 ("The move to expand the public trust doctrine began in the 1970s.").

155. For example, in *Matthews v. Bay Head Improvement Ass'n*, the New Jersey Supreme Court protected public access to dry sand beaches, rather than only public access to submerged lands. 471 A.2d 355, 363 (N.J. 1984). Similarly, in *Lake Beulah Management District v. Wisconsin Department of Natural Resources*, the Wisconsin Supreme Court held that the public trust doctrine imposes a duty on a state permitting agency to "consider whether a proposed high capacity [groundwater] well may harm waters of the state." 799 N.W.2d 73, 76 (Wis. 2011); *see also* Clean Wis., Inc. v. Wis. Dep't Nat. Res. 961 N.W.2d 611, 616 (Wis. 2021) (noting that the courts have long interpreted public trust provisions "broadly and consistent with its sweeping scope, explaining that it protects more than strictly navigable waters or related commercial navigation rights").

156. 658 P.2d 709, 719 (Cal. 1983).

157. *Id.* at 732; Erin Ryan, *From Mono Lake to the Atmospheric Trust: Navigating the Public and Private Interests in Public Trust Resource Commons*, 10 GEO. WASH. J. ENERGY & ENV'T L. 39, 56 (2019).

158. *See* Erin Ryan, *The Public Trust Doctrine, Private Water Allocation, and Mono Lake: The Historic Saga of National Audubon Society v. Superior Court*, 45 ENV'T L. 561, 622–29 (2015) (discussing moves by litigants to expand the public trust following *Mono Lake*).

159. *See id.* at 622–25 (outlining recent court decisions following a Mono Lake line of reasoning).

II. ANALYSIS

Groundwater faces inadequate legal protection both on the state and federal level. Common law doctrines applicable to groundwater disputes discourage efficiency and conservation because the doctrines fail to recognize groundwater as a finite resource.[160] Further, the evolution of groundwater law reveals an ignorance about the connections between groundwater and surface water, as most jurisdictions continue to treat groundwater and surface water as separate resources.[161] More importantly, however, the current piecemeal approach of groundwater law fails to account for the interstate nature of many of the nation's largest aquifers.[162]

Federal law also fails to protect the nation's groundwater resources, largely due to a political and historical focus on surface waters.[163] Statutes like the CWA address pollution concerns, not quantity concerns, and narrowly define the federal government's jurisdictional authority to regulate only navigable waters, or, depending on the WOTUS definition currently in force, water with a substantial nexus to navigable waters.[164] Similarly, the federal public trust doctrine is underutilized and has remained stagnant in its scope.[165] Since *Illinois Central*, the federal public trust has expanded little, if at all, from its strict application to navigable waters.[166] The

160. *See* Scanlan, *supra* note 53, at 61–67 (discussing the principles of common law groundwater doctrines and their weaknesses).

161. *See* Tuholske, *supra* note 6, at 212–13 ("The failure of states to regulate ground and surface water as a unified resource magnifies shortcomings in both surface and groundwater law.").

162. *See* 2 WATERS AND WATER RIGHTS, *supra* note 87, § 19.05 (elaborating on the law's historically fragmented approach to groundwater).

163. *See id.* § 19.01 (discussing the historic distinction between groundwater and surface water).

164. *See* COPELAND, *supra* note 71, at 1 (describing the CWA as the "principal law governing pollution of the nation's surface waters"); McCrory & Raymond, *supra* note 76, at 172 (explaining WOTUS adopted the "significant nexus test" to "reduce the case-specific analysis that could lead to inconsistent interpretations of the CWA's jurisdiction").

165. *See* Ryan, *supra* note 10, at 170 ("American case law has generally presumed that the public trust doctrine is a feature of purely state law[.]"); Matthew Schneider, *Where* Juliana *Went Wrong: Applying the Public Trust Doctrine to Climate Change Adaptation at the State Level*, 41 ENVIRONS ENV'T L. & POL'Y J. 47, 58, 60 (2017) ("Even if a federal public trust doctrine existed, the scope would be narrow and thus largely ineffective in creating measurable action on climate change.").

166. *See* Schneider, *supra* note 165, at 58, 60 (discussing the limited scope of the federal public trust). As an example of a recent suit invoking the public trust doctrine in federal court, see Juliana v. United States, 947 F.3d 1159, 1165 (9th Cir. 2020). *Juliana* ultimately shows the unwillingness of federal courts to use the public trust doctrine to protect natural resources from ecological harms. *See id.* at 1175.

stagnation of the federal public trust doctrine is likely due in large part to the evolution of the public trust doctrine as a state law tool.[167]

The federal government currently has a limited role in regulating groundwater use and management.[168] State governments, therefore, bear the primary responsibility for creating and implementing groundwater management regimes.[169] Moreover, the public trust doctrine varies between states.[170] Some states, like Texas, apply the public trust doctrine in extremely narrow terms,[171] while other states, like Hawai'i, broadly implement the common law public trust and implement its principles to other resources through statutory and constitutional mandates.[172] State variations of the public trust doctrine are best understood as two different typologies: (1) a state's common law public trust doctrine, and (2) its statutory implementation of public trust principles.

Other than a few outlier state legal landscapes, the current majority landscape of state public trust doctrines fails to adequately protect groundwater.[173] While more progressive states, like Hawai'i and California, are willing to utilize the public trust doctrine to protect some groundwater resources, the doctrine's common law basis in strictly defined navigable waters makes it difficult for courts in more conservative states to protect groundwater without a statutory expansion.[174] The limits of the common law public trust doctrine exemplify the limitations of common law more generally within the field of environmentalism: common law doctrines, while flexible, are often

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167. *See* Schneider, *supra* note 165, at 60 (2017) (arguing that the *Juliana* case made a strategic error in bringing suit in federal court because the federal public trust doctrine "would be narrow and thus largely ineffective in creating measurable action on climate change"). For an expansive summary of state public trust doctrines, see Craig, *supra* note 11 (focusing on state public trust doctrines in nineteen western states); and Robin Kundis Craig, *A Comparative Guide to the Eastern Public Trust Doctrines: Classifications of States, Property Rights, and State Summaries*, 16 PENN ST. ENV'T L. REV. 1 (2007) (focusing on state public trust doctrines in the thirty-one eastern states).

168. *See* Scanlan, *supra* note 53, at 67, 69 (discussing the role of the federal government and noting that it has been "fractured and indirect" and that "the federal role has largely been used to rescue states that have failed to sustainably manage their water supply").

169. *See id.* at 73 ("[T]he states have been the governmental entities with primary responsibility for groundwater law.").

170. *See id.* (explaining that rather than relying on permit systems founded in police power, "[s]ome states also hold groundwater in trust and have an articulated public trust doctrine that gives them not just the power, but also the trustee duty to regulate"); Craig, *supra* note 11, at 58 (explaining "the details of how public trust principles apply vary considerably from state to state").

171. Craig, *supra* note 11, at 73.

172. *Id.* at 71.

173. *See* Tuholske, *supra* note 6, at 226–31 (discussing the few applications of the public trust doctrine to groundwater).

174. *Id.; see also* Klass, *supra* note 142, at 712 (noting how very few, "if any, courts have extended the common law doctrine beyond tidal or navigable waters, thus leaving unprotected inland resources that are unconnected to navigable lakes or rivers").

slow to adapt and uncertain in application.[175] Any successful progressive public trust therefore will likely be rooted in statutes, not common law.

The successful protection of groundwater resources by the public trust largely depends on two factors: (i) the codification of public trust principles in statutes, regulations, and constitutions, and (ii) a judicial history of flexibility in applying the common law public trust doctrine. It should also be noted that common law private groundwater rights differ from state to state, leading to slight differences in the application of public trust principles.[176] State interpretations of the public trust doctrine can be understood as adhering to a traditional common law public trust doctrine, a flexible common law public trust doctrine, or a codified public trust. A court's application of the public trust doctrine therefore hinges on the history of its state's common law and the scope of the public trust as defined (or left undefined) by its state's legislature.

This Section explores the evolution and application of the public trust doctrine in Texas, California, and Hawai'i. These states are used to show the three types of state public trust doctrines. Texas adheres to the traditional public trust doctrine, California applies a flexible common law approach, and Hawai'i has enacted a codified public trust. This Section further explores the implications of these state iterations of the public trust on using public trust principles for groundwater management and protection.

A. The Traditional Common Law Public Trust Doctrine: Texas

The traditional application of the public trust doctrine follows the common law principles established in *Illinois Central*.[177] For the most part, states still applying the traditional public trust doctrine apply it only to navigable waters used for commerce and navigation, however, the exact contours of application may differ among states.[178]

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175. *See, e.g.*, Peter S. Menell, *The Limitations of Legal Institutions for Addressing Environmental Risks*, 5 J. ECON. PERSPS. 93, 102 (1991) (discussing the limitations of the toxic tort system); Marisa Martin & James Landman, *Standing: Who Can Sue to Protect the Environment*?, ABA (Oct. 9, 2020), https://www.americanbar.org/groups/public_education/publications/insights-on-law-and-society/volume-19/insights-vol—19—-issue-1/standing—who-can-sue-to-protect-the-environment-/ [https://perma.cc/3YN9-BLXA] (discussing the limitations standing doctrine can place on the success of environmental suits); Klass, *supra* note 142, at 713 (2006) (discussing the limitations of the common law as a mechanism to protect natural resources and noting that "[t]hese limitations of common law generally are exacerbated in the public trust area").

176. *See* Craig, *supra* note 11, at 57 (outlining how water law regimes influence applications of the public trust doctrine).

177. Ill. Cent. R.R. Co. v. Illinois, 146 U.S. 387, 452 (1892); *see* Ruhl & McGinn, *supra* note 10, at 121–22 (tracing the public trust doctrine to its purported Roman roots).

178. *See* Craig, *supra* note 11, at 71 (outlining differing state applications of the public trust doctrine).

In contrast to both the codified and the flexible forms of the public trust doctrine, the traditional public trust doctrine fails to recognize preservation and conservation as protected public uses.[179] Instead, the traditional public trust doctrine generally protects purposes like fishing and navigation.[180]

Texas presents a clear example of a state adhering to a strict, traditional public trust doctrine.[181] A portion of the Ogallala Aquifer lies beneath Texas, whose current groundwater management regime represents the antithesis of implementing public trust principles to water resource management.[182] Texas is the only remaining western state to follow the absolute ownership doctrine.[183] Texas further adopts the English common law rule of capture, under which, other than a few exceptions, a landowner will not be liable if his own groundwater pumping adversely affects his neighbor's groundwater.[184]

Texas does, however, designate groundwater management districts.[185] These districts are governed by locally elected boards, who are authorized to manage groundwater use.[186] Texas's groundwater conservation districts do not displace the rule of capture or absolute ownership.[187] Instead, groundwater management districts must balance any groundwater regulation with the protection of individual property rights.[188]

In 2012, the Texas Supreme Court reaffirmed private ownership of groundwater in the face of regulation in *Edwards Aquifer v. Day*.[189] The groundwater conservation district charged with regulating the Edwards Aquifer denied a landowner a permit to extract groundwater

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179. *See id.* at 69.

180. *See* Robin Kundis Craig, *Adapting to Climate Change: The Potential Role of State Common-Law Public Trust Doctrines*, 34 VT. L. REV. 781, 784 (2010) (noting that the classic American public trust doctrine charges the state "to protect the public's right to use those waters for navigation, commerce, and fishing"); Ruhl & McGinn, *supra* note 10, at 139 (discussing how the universally accepted scope of the traditional public trust protected navigation, commerce, and fishing).

181. *See, e.g.*, Natland Corp. v. Baker's Port, Inc., 865 S.W.2d 52, 59–60 (Tex. App. 1993) (noting that the public trust doctrine has "not fared well in Texas").

182. *See* Little, *supra* note 47 (discussing how the Ogallala "sprawls underneath parts of eight states from South Dakota to Texas).

183. VANESSA PUIG-WILLIAMS, ENV'T DEF. FUND, BENEATH THE SURFACE: KEY ISSUES UNDERLYING GROUNDWATER MANAGEMENT IN TEXAS 6 (2020), https://www.edf.org/sites/default/files/documents/EDF%20Beneath%20the%20Surface%20Report%20November%202020.pdf [https://perma.cc/C8CL-M7KL]; Bowman, *supra* note 5, at 1109–10.

184. PUIG-WILLIAMS, *supra* note 183, at 6; Bowman, *supra* note 5, at 1109–10.

185. PUIG-WILLIAMS, *supra* note 183, at 6.

186. *Id.*

187. *Id.*

188. *Id.*

189. *Id.* at 9; Edwards Aquifer Auth. v. Day, 369 S.W.3d 814, 817 (Tex. 2012).

below his land.[190] The landowner argued that because the state has no ownership interest in groundwater, it owed compensation for a taking under both the state and federal Takings Clause.[191] Rather than adopting a public trust approach, the *Edwards Aquifer* decision established that the state of Texas maintains no ownership or property interest in groundwater beneath a private person's land.[192] Therefore, any regulation that restricts pumping volume of groundwater beneath privately owned land is subject to the Takings Clause, and landowners could be entitled to compensation.[193]

Because Texas follows the traditional common law approach, it faces significant legal barriers to achieving adequate groundwater protection.[194] As one of the few states that continues to follow the absolute capture doctrine for groundwater rights, any push for an expansion of the common law public trust doctrine clashes with landowners' common law rights.[195] Given that the absolute capture doctrine grants ownership of the groundwater beneath one's land, the expansion of the public trust doctrine through the common law is extremely unlikely in states like Texas—even regulatory attempts to significantly minimize a landowner's pumping have resulted in successful takings claims.[196] A second issue that Texas faces is its legal distinction between groundwater and surface water, both in its water management laws and its public trust doctrine.[197] Thus, in most cases, Texas courts give little to no consideration to whether excessive groundwater pumping may affect surface water flows.[198]

B. Flexible Common Law Public Trust Doctrine: California

The flexible common law public trust finds its authority mainly in state common law evolutions rather than statutory mandates.[199] In

190. *Edwards Aquifer*, 369 S.W.3d at 821.

191. *Id.* at 833; Scanlan, *supra* note 53, at 62–63.

192. 369 S.W.3d at 831–32; Bowman, *supra* note 5, at 1110–11.

193. *Edwards Aquifer*, 369 S.W.3d at 843–44; Scanlan, *supra* note 53, at 62–63.

194. *See* Craig, *supra* note 18, at 177–78 (delineating the relevant legal provisions of Texas' public trust doctrine); PUIG-WILLIAMS, *supra* note 183, at 5–9 (discussing the legal challenges Texas faces in groundwater management); Scanlan, *supra* note 53, at 88.

195. PUIG-WILLIAMS, *supra* note 183, at 5–9 (discussing the legal challenges Texas faces in groundwater management).

196. *See, e.g.*, *Edwards Aquifer*, 369 S.W.3d at 817.

197. PUIG-WILLIAMS, *supra* note 183, at 23.

198. *See id.* at 31.

199. *See* Craig, *supra* note 11, at 92 (discussing how the willingness of some states to "raise water and other environmental issues to constitutional status and/or to incorporate broad public trust mandates into statutes has encouraged their courts to evolve water-based public trust principles into expanding ecological public trust doctrines"); Ryan et al., *supra* note 124, at 2464 ("[T]he common law trust has been flanked by related principles in constitutional and statutory

this version of the public trust, judicial decisions began explicitly defining the public trust in flexible terms at least as early as the 1970s.[200] Courts applying the flexible public trust contend that the public trust doctrine should evolve with public needs and broadly work to serve the public's interests in public trust resources.[201] The malleable nature of this framework allows courts to apply the public trust doctrine as a means to protect trust resources for ecological purposes, but its basis in the traditional common law limits the possible expansion of the doctrine to include nontraditional public trust resources.[202] The flexible common law public trust differs from the ecological public trust that many environmental advocates propose should be adopted by states, because courts will only protect a nontraditional resource if there is a showing of a tangible connection to a navigable water.[203] California is the clearest example of a state applying a flexible common law framework of the public trust, although its larger legal approach to natural resources does include some codified public trust principles.[204]

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law, but all remain robust sources of public trust protection."); Klass, *supra* note 142, at 713–14 ("[T]o the extent the common law public trust doctrine can provide support to or be supported by environmental policies in state statutes or constitutions, the doctrine will be in a position to play a more important role in state environmental protection efforts.").

200. *See* Ruhl & McGinn, *supra* note 10, at 139 (outlining the history of the public trust doctrine); Tuholske, *supra* note 6, at 216–17 ("The move to expand the public trust doctrine began in the 1970s.").

201. *See* Craig, *supra* note 11, at 83 (stating that California, Hawai'i, and other western states are "using public trust principles to expand the legally cognizable public values in the environment"); *see also, e.g.*, Marks v. Whitney, 491 P.2d 374, 380 (Cal. 1971) ("The public uses to which tidelands are subject are sufficiently flexible to encompass changing public needs."); Nat'l Audubon Soc'y v. Superior Ct., 658 P.2d 709, 712, 719 (Cal. 1983) (expanding the public trust doctrine to "waters tributary to Mono Lake and [barring parties] from claiming a vested right to divert waters once it becomes clear that such diversions harm the interests protected by the public trust").

202. *See* Ruhl & McGinn, *supra* note 10, at 141 (explaining how despite the *Mono Lake* decision, California "did not come close to a wholesale adoption of the Saxian public trust model"); Klass, *supra* note 142, at 713 (recognizing that "relying exclusively on the common law as the primary mechanism to protect natural resources and the environment (whether in the form of the public trust doctrine or in the form of more familiar doctrines such as nuisance or negligence) has always had limitations which still exist today" and these "limitations of common law generally are exacerbated in the public trust area"). Nontraditional public trust resources include nonnavigable waters, the atmosphere, marine life, and wildlife. *See* Jordan M. Ellis, *The Sky's the Limit: Applying the Public Trust Doctrine to the Atmosphere*, 86 TEMP. L. REV. 807, 812–813 (2014) (discussing examples of successful expansions of the public trust doctrine to nontraditional resources).

203. *See* Craig, *supra* note 11, at 86 ("[D]espite its reputation as the vanguard of the ecological public trust doctrine movement, California does limit the breadth of its doctrine."); *see also, e.g.*, Env't L. Found. v. State Water Res. Control Bd., 237 Cal. Rptr. 3d 393, 402–03 (Ct. App. 2018) (holding that withdrawal from a non-navigable stream violated the public trust doctrine because it adversely impacted a navigable water).

204. *See* Craig, *supra* note 11, at 84 (introducing California's broad interpretation of the public trust); Olson, *supra* note 9, at 171 (using California as an example of a state that recognizes broader public trust duties).

California broadly interprets its version of the public trust doctrine, both in its statutes and in its common law applications.[205] The California constitution embodies public trust principles through multiple provisions that place an affirmative duty on the state to protect certain water resources for the public good or welfare.[206] Notably, Article X, Section 3 prohibits the sale of tidelands "used for the purposes of navigation" to private persons or corporations unless the legislature affirmatively ensures protections of the public interest and, if a sale does occur, conditions are placed to maintain protection of said public interest.[207] Other provisions of the state constitution embody conservation-focused public trust principles, namely, the duty of the state to protect water resources for beneficial public use and public welfare.[208] It declares that general welfare requires the beneficial use of water resources, "that the waste or unreasonable use or unreasonable method of use of water be prevented," and that conservation of waters must be exercised with consideration of the interest of the people.[209]

California extends its common law public trust doctrine to preservation of the natural environment.[210] In 1971, the California Supreme Court announced in *Marks v. Whitney* that "[t]he public uses to which tidelands are subject are sufficiently flexible to encompass changing public needs."[211] While the Court did not delineate the bounds of public trust lands, subsequent cases note that lands beneath nontidal navigable waters may also qualify as public trust lands because such land constitutes "a resource which is fast disappearing in California; they are of great importance for the ecology, and for the recreational needs of the residents of the state."[212]

Recently, the court in *Environmental Law Foundation v. State Water Resources Control Board* built upon the *Mono Lake* precedent by expanding the scope of the public trust to groundwater hydrologically

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205. *See* Craig, *supra* note 11, at 104–08 (listing California's constitutional provisions and statutes especially relevant to the state's public trust doctrine); Ryan et al., *supra* note 124, at 2464 ("California has adopted public trust principles in its constitution, statutes, and regulatory law, in addition to its robust common law trust.").

206. Craig, *supra* note 11, at 104–06.

207. CAL. CONST. art. X, § 3.

208. *See* CAL. CONST. art. X, § 2 ("[T]he conservation of such waters is to be exercised with a view to the reasonable and beneficial use thereof in the interest of the people and for the public welfare.").

209. *Id.*

210. *See* Craig, *supra* note 11, at 84 ("[T]he California public trust doctrine extends to 'environmental . . . purposes.' " (quoting City of Los Angeles v. Venice Peninsula Props., 644 P.2d 792, 794 (Cal. 1982))); Ryan et al., *supra* note 124, at 2469, 2471 (discussing how California's "public trust protects ecological, scenic, and recreational uses associated with trust resources").

211. 491 P.2d 374, 380 (Cal. 1971).

212. State v. Superior Ct., 625 P.2d 239, 242 (Cal. 1981).

connected to a traditional public trust resource.[213] The court considered the issue of groundwater extraction, holding that the relevant analysis was the extent to which the groundwater extraction could affect a navigable public trust resource such as a river.[214] Ultimately, because the extractions at issue in *Environmental Law Foundation* likely affected a navigable water, the state had an affirmative duty to consider public trust principles.[215]

The California Supreme Court differentiates two distinct strands of the public trust doctrine.[216] The first is common law public trust, which traditionally applies to navigable waters and tidelands.[217] The second doctrinal strand includes statutory adaptations of public trust principles. California law thus imposes a duty on the state to consider public trust principles when mandated by statute, no matter the regulated resource.[218] For example, in *Environmental Protection Information Center v. Department of Forestry*, the court discussed the public trust duties imposed on the state by the Fish and Game Code, which directs that "fish and wildlife resources are held in trust for the people of the state . . . ."[219] In holding that the statute imposed public trust duties on the state, the court clarified that a broader, nontraditional public trust can be implemented through state legislatures.[220]

In 2014, California passed the Sustainable Groundwater Management Act ("SGMA"), the first law in California's history to regulate the use of groundwater.[221] The law incorporates some aspects of the public trust doctrine—SGMA maintains a right to groundwater access and use, but imposes conditions on its use and considers

213. 26 Cal. App. 5th 844, 859 (2018).

214. *Id.* at 859–60.

215. *Id.* at 859.

216. Craig, *supra* note 11, at 113; Env't Prot. Info. Ctr. v. Cal. Dep't of Forestry & Fire Prot., 187 P.3d 888, 926 (Cal. 2008) (quoting Nat'l Audubon Soc'y v. Superior Ct., 658 P.2d 709, 728–29 (Cal. 1983)).

217. *Env't Prot. Info. Ctr.*, 187 P.3d at 926; Blumm & Schwartz, *supra* note 120, at 28–29 (noting that the court in *Environmental Law Foundation* extended the doctrines set forth in *Mono Lake*).

218. *Env't Prot. Info. Ctr.*, 187 P.3d at 926.

219. *Id.*

220. *Id.*; Craig, *supra* note 11, at 113–14.

221. Susie Cagle, *Everything You Need to Know About California's Historic Water Law*, GUARDIAN (Feb. 27, 2020), https://www.theguardian.com/environment/2020/feb/27/california-groundwater-sgma-law-what-does-it-mean#:~:text=What%20does%20Sgma%20do%3F,Sgma%20relies%20on%20local%20oversight [https://perma.cc/9DKA-RW9U]; Lynn M. Forsythe, *A Report Card: Progress Under California's Sustainable Groundwater Management Act (SGMA)*, 21 U. DENV. WATER L. REV. 199, 202 (2018); CAL. WATER CODE §§ 100-113 (West 2022).

groundwater a shared resource.[222] Notably, the restrictions under SGMA also apply to California's agriculture industry.[223] SGMA relies on local administration by mandating local agencies' development and coordination of plans to preserve groundwater in California's 450 underground basins.[224] The law further prioritized "critically overdrafted" basins by imposing tighter time limits on the law's implementation.[225] SGMA is still in its implementation phase, so its success may not be clear for several more years. Further, it should also be noted that the court *in Environmental Law Foundation* held that SGMA did not displace the public trust doctrine or the state's duty to consider its core principles.[226]

California is one of the few states that has been willing to expand its public trust to ecological purposes and a broader range of water resources without explicit statutory authority.[227] This is likely due to California's early history of articulating a flexible common law public trust as well as the state's statutory and constitutional codifications of public trust principles, which allow courts to import the legislature's understanding of the public trust.[228] Importantly, when California courts do extend the public trust doctrine to protect other, nontraditional public trust resources, it views its authority to do so as stemming from statutes and constitutional provisions.[229] Because there are "two distinct public trust doctrines", California's statutory public trust has given courts permission to apply its principles to statutorily protected resources for environmental purposes.[230]

Although the flexible common law public trust does more to protect groundwater from excessive withdrawals, it is unlikely to

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222. Cagle, *supra* note 221.

223. *Id.*

224. *Id.*

225. Rebecca R.A. Smith, *SGMA in the Field: Early Efforts at Defining Sustainability in California's Critically Overdrafted Basins*, 52 U. PAC. L. REV. 549, 553–554 (2021).

226. Env't L. Found. v. State Water Res. Control Bd., 26 Cal. App. 5th 844, 869 (2018).

227. Craig, *supra* note 11, at 83. Wisconsin is an example of a state willing to extend the public trust doctrine to groundwater. *See, e.g.*, Lake Beulah Mgmt. Dist. v. Wis. Dep't of Nat. Res., 799 N.W.2d 73, 76 (Wis. 2011) (holding that the public trust doctrine imposes a duty on a state permitting agency to "consider whether a proposed high capacity [groundwater] well may harm waters of the state").

228. Craig, *supra* note 11 at 58 (generally noting that states have "evolved their public trust doctrines in light of the particular histories").

229. *See, e.g.*, Env't Prot. Info. Ctr. v. Cal. Dept. of Forestry & Fire Prot., 187 P.3d 888, 926 (Cal. 2008) (holding that a government agency's duty to protect "is not of some general public trust duty, but of a specific statutory obligation").

230. *Id.*

protect groundwater as a per se public trust resource.[231] California, while otherwise employing a broad public trust application, limits groundwater protection to situations where groundwater withdrawal negatively impacts a navigable water source.[232] Although many large-scale groundwater or aquifer withdrawals are indeed closely linked to surface water and likely could affect a navigable surface water source, such harm may not always be apparent.[233] As discussed in Part II, many aquifers are fossilized and the link between the aquifer and surface water is much slower to materialize.[234] Similarly, relying on a showing of harm to navigable waters may be difficult for public trust plaintiffs to prove because several environmental harms are diffuse in nature and involve future speculation.[235] These limitations of the flexible common law can probably be attributed to the lack of statutory authority necessary for a court to protect new public trust resources. California again exemplifies this pattern because no codified public trust applies to groundwater—courts are willing to apply the public trust doctrine to nontraditional resources, such as wildlife, where a statute grants such authority. Where only common-law authority exists, courts are unlikely to apply the public trust doctrine to a resource not contemplated in the traditional public trust.[236]

California's relatively new groundwater protection law, SGMA, may show promise in the incorporation of public trust principles into regulatory schemes.[237] Because this law was recently enacted, its success is still unclear; but the new law may show California inching closer to a water resources trust, similar to the system in Hawai'i.[238]

C. Codified Public Trust: Hawai'i

The codified public trust statutes implement the underlying principles of *common law* public trusts, and incorporates them into

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231. *See* Craig, *supra* note 11, at 86 (mentioning the limits of California's public trust); Klass, *supra* note 142, at 713 (discussing the limitations of relying exclusively on the common law public trust).

232. Craig, *supra* note 11, at 85–86; *see also, e.g.*, Nat'l Audubon Soc'y v. Superior Court, 658 P.2d 709, 721 (Cal. 1983) (holding only that the public trust doctrine "protects navigable waters from harm caused by diversion of nonnavigable tributaries").

233. *See* Scanlan, *supra* note 53, at 55 (["[G]round and surface waters are almost always hydrologically connected."). For a discussion on how recharge rates affect the link between ground and surface water, see COOK, *supra* note 2, at 5.

234. *See supra* Part I.A.1.

235. Martin & Landman, *supra* note 175 and accompanying text.

236. *See* Craig, *supra* note 11, at 85; Env't L. Found. v. State Water Res. Control Bd., 26 Cal. App. 5th 844, 859 (2018).

237. *See supra* note 221.

238. *See id.*

statutes, regulations, and constitutional provisions. Some of the public trust principles implemented by codified public trust statutes include the fiduciary duty of the government to protect certain resources for the public;[239] the inclusion of conservation or ecology as a public trust purpose;[240] inter-generational conservation;[241] protection of the environment for its own sake;[242] specified resources protected by the public trust;[243] and an affirmative duty for the state to consider the effects on trust resources.[244] These principles, while rooted in the common law, are substantially broader and allow for courts to apply the principles to more resources rather than only navigable waters.[245] California and Hawai'i have most clearly established codified public trusts in some resources through statutory and constitutional mandates.[246] Both states are willing to apply the public trust doctrine to protect resources for conservation and ecological purposes.[247] Hawai'i, however, implements a codified water resources trust[248] that

239. *See, e.g.*, HAW. CONST. art. XI, § 7 ("The State has an obligation to protect, control and regulate the use of Hawaii's water resources for the benefit of its people.").

240. *See, e.g.,* HAW. REV. STAT. § 174C ("Hawaiian rights, the protection and procreation of fish and wildlife, the maintenance of proper ecological balance and scenic beauty.").

241. *See, e.g.*, HAW. CONST. art. XI, § 1 ("For the benefit of present and future generations, the State and its political subdivisions shall conserve and protect Hawaii's natural beauty and all natural resources.").

242. In *Morimoto v. Board of Land & Natural Resources*, the Hawaii Supreme Court "suggested that the public trust doctrine extends to environmental and biodiversity protection" via constitutional provisions. 113 P.3d 172, 184 (Haw. 2005); HAW. CONST. art. XI, § 1; Craig, s*upra* note 11, at 124.

243. *See, e.g.*, HAW. CONST. art. XI, § 1 (including "all natural resources, including land, water, air, minerals and energy sources" in the public trust).

244. The California courts have held that citizens may sue to enforce both its statutory and common law public trust doctrine because it "places a duty upon the government to protect those resources." Ctr. for Biological Diversity, Inc. v. FPL Grp., Inc., 166 Cal. App. 4th 1349, 1365 (2008).

245. *See* Craig, *supra* note 11, at 88–91 (noting the constitutional basis for Hawai'i's broad public trust); Ryan et al., *supra* note 124, at 2468 (discussing how "states that include trust principles in statutory or constitutional law" have "expanded the trust to other resources beyond waterways"); Klass, *supra* note 142, at 744 (positing that judicial interpretations of the public trust doctrine can evolve using "policy statements and standards contained in state constitutions and environmental statutes").

246. *See* Craig, *supra* note 11, at 71 ("California and Hawai'i have most extensively developed their ecological public trust doctrines.").

247. *Id.* at 83.

248. *See* Tuholske, *supra* note 6, at 226 ("To date, the Hawaii court provides the clearest endorsement of the public trust doctrine to groundwater."); Blumm & Schwartz, *supra* note 120, at 29 ("Groundwater is subject to the PTD in Hawaii without the condition of showing an effect on navigable waters . . . ."); *In re* Water Use Permit Applications, 9 P.3d 409, 447 (Haw. 2000) [hereinafter *Waiāhole Ditch*] ("Based on the plain language of our constitution and a reasoned modern view of the sovereign reservation, we confirm that the public trust doctrine applies to all water resources, unlimited by any surface-ground distinction.").

includes groundwater, while California still relies mostly on common law when presented with water resources questions.[249]

The Hawai‘i Constitution adopts the public trust doctrine as a foundational principle of its constitutional law.[250] Hawai‘i's Constitution provides that all lands granted to the State of Hawai‘i "shall be held by the State as a public trust for native Hawaiians and the general public."[251] Some provisions specifically address access to water resources, imposing a duty on the state "to protect, control and regulate the use of Hawai‘i's water resources for the benefit of its people."[252] The broadest affirmative right to the people in the constitution states

> For the benefit of present and future generations, the State and its political subdivisions shall conserve and protect Hawaii's natural beauty and all natural resources, including land, water, air, minerals and energy sources, and shall promote the development and utilization of these resources in a manner consistent with their conservation and in furtherance of the self-sufficiency of the State. All public natural resources are held in trust by the State for the benefit of the people.[253]

The Hawai‘i Constitution thus generally reserves the power for the state to implement conservation-focused policy and commands state protection of the environment and all natural resources.[254]

Hawai‘i's constitutional public trust applies to nearly all natural resources and lands.[255] Its conservation policy, as articulated in its Constitution, demonstrates that Hawai‘i is generally indiscriminate towards the types of resources it aims to protect; instead, the state is tasked with promoting and maintaining a healthy environment, "including the prevention of any excessive demands upon the environment and the State's resources."[256] Hawai‘i's case law further illustrates the depth of public trust principles in state law.[257] The state Supreme Court notes that "the people of this state have elevated the public trust doctrine to the level of a constitutional mandate" and the

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249. *See* Craig, *supra* note 11, at 86 ("[D]espite having recognized a second, largely statutory, wildlife public trust doctrine, California maintains a connection between its ecological public trust doctrine and the traditional American source of public trust rights: state ownership of the beds and banks of navigable waters.").

250. *Id.* at 118–19.

251. HAW. CONST. art. XII, § 4.

252. HAW. CONST. art. XI, § 7.

253. HAW. CONST. art. XI, § 1.

254. *Id.*

255. *Id.*

256. HAW. CONST. art. IX, § 8.

257. *See* Craig, *supra* note 11, at 122–27 (compiling key Hawaiian public trust cases); Ana Ching, Comment, *Charting the Boundaries of Hawai'i's Extensive Public Trust Doctrine Post-*Waiāhole Ditch, 52 ENV'T L. 115, 123–124 (2022) (tracing Hawai‘i's public trust doctrine in case law).

various constitutional provisions thus "adopt the public trust doctrine as a fundamental principle of constitutional law in Hawai'i."[258]

The aggregate body of Hawaiian law, including its constitution and formal statutes, creates a "water resources trust" that is distinct from the traditional common law public trust doctrine.[259] Hawai'i's water resources trust thus originates in statutory and constitutional mandates rather than solely through common law developments.[260] Hawai'i's water resources trust is therefore a wholesale combination of its common law principles and constitutional and statutory mandates.

In the leading case on Hawai'i's public trust doctrine, In re *Water Use Permits* ("*Waiāhole Ditch*"), the court clarified the state's duties under the water resources trust.[261] It held that the trust imposes a "dual mandate of (1) protection and (2) maximum reasonable and beneficial use."[262] Thus, the water resources trust, through its implementation of public trust principles, requires the state to both "ensure the continued availability and existence of its water resources for present and future generations," and "the reasonable and beneficial use of water resources in order to maximize their social and economic benefits to the people of this state."[263] The duties imposed on the state under the water resources trust apply "to all water resources without exception or distinction," including groundwater.[264] The water resources trust is therefore significantly more protective of water resources than the traditional navigable waters public trust.[265]

Hawai'i's State Water Code integrates the public trust doctrine "wholesale" in its mandates and "does not supplant the protections of the public trust doctrine."[266] As a result, state officials implementing water law in Hawai'i are tasked with ensuring compliance with public trust principles.[267] Further, Hawai'i's courts are particularly wary of

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258. *Waiāhole Ditch*, 9 P.3d 409, 443–44 (Haw. 2000).

259. *See* Kauai Springs, Inc. v. Plan. Comm'n, 324 P.3d 951, 981–83 (Haw. 2014) (discussing the public trust doctrine as a constitutional mandate); *Waiāhole Ditch*, 9 P.3d at 409, 443–44 (discussing the same); *see also* Craig, *supra* note 11, at 118–127 (outlining relevant statutes, constitutional provisions, and cases to Hawai'i's public trust).

260. Kylie Wha Kyung Wager, *In Common Law We Trust: How Hawai'i's Public Trust Doctrine Can Support Atmospheric Trust Litigation to Address Climate Change*, 20 HASTINGS W. N.W. J. ENV'T L. & POL'Y 55, 83 (2014) ("According to the Hawai'i Supreme Court, Hawai'i's public trust doctrine has three historical bases: (1) American common law, (2) Hawai'ian Kingdom law and custom, and (3) the Hawai'i' Constitution.").

261. *Waiāhole Ditch*, 9 P.3d at 454–55; *see also* Blumm & Schwartz, *supra* note 120, at 29–32 (analyzing the *Waiāhole Ditch* case.

262. *Waiāhole Ditch*, 9 P.3d at 451.

263. *Id.*

264. *Id.* at 445.

265. *Id.*

266. *Id.* at 442, 445.

267. *Id.* at 453.

private diversions and the assertion of private water rights against the public trust goals.[268] The judiciary has repeatedly held that the water resources trust "precludes any grant or assertion of vested rights to use water to the detriment of public trust purposes."[269] Hawai'i's public trust, therefore, declines to treat private water rights as absolute—"while there indeed exist relative usufructory [sic] rights among landowners, these rights can no longer be treated as though they are absolute and exclusive interests in the waters of our state."[270]

Hawai'i's case law thus emphasizes public good over private ownership.[271] While the state commission implementing the water code may balance public and private interests in water, there is a "presumption in favor of public use."[272] Moreover, the Hawai'i courts subject any water law decisions in favor of private use to "higher scrutiny."[273] For example, in *Kauai Springs, Inc. v. Planning Commission of the County of Kaua'i*, the Hawai'i Supreme Court considered an appeal of an agency's denial of a permit to a private bottled water company wishing to harvest groundwater for its bottled water operations.[274] In affirming the agency's denial of the permit application, the court reasoned that public rights in trust resources are always superior to private interest, and as such, agencies must apply a higher level of scrutiny to proposals that request the use of a public trust resource for private commercial use.[275] Further, the water use applicant bears the burden of affirmatively proving that the proposed use will not harm a public trust resource.[276] Because the bottled water company in *Kauai Springs* failed to make an affirmative showing that its consumptive use of groundwater would not harm public trust resources, the court held that the agency's denial of the permit was not arbitrary or capricious.[277]

Hawai'i shows the promise of a statutory public trust as a means for groundwater preservation based on ecological principles.[278] Its common law public trust has long cited ecological and environmental protection as a use worth protecting, but Hawai'i courts and statutes

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268. Craig, *supra* note 11, at 126.

269. *Id.* (quoting *Waiāhole Ditch*, 9 P.3d 409, 453 (Haw. 2000)).

270. *Id.* at 87 (quoting Robinson v. Ariyoshi, 658 P.2d 287, 310–11 (Haw. 1982)).

271. *See id.*

272. *Waiāhole Ditch,* 9 P.3d at 454.

273. *Id.*; Craig, *supra* note 11, at 87.

274. 324 P.3d 951, 957 (Haw. 2014).

275. *Id.* at 983.

276. *Id.*

277. *Id.* at 991.

278. *Cf. id.*; HAW. REV. STAT. § 174C (2022); HAW. CONST. ART. XI, § 9; HAW. CONST. ART. XI, § 7.

go further and protect groundwater as a resource in and of itself, rather than only protecting it when it affects a navigable water.[279] Hawaii courts consistently hold that "the maintenance of waters in their natural state constitutes a distinct 'use' under the water resources trust."[280] This is likely due to Hawai'i's long history of resource protection as a cultural importance, and to the codification of public trust principles in the state's statutes and constitutions.[281] The codification of the public trust doctrine in Hawai'i means that "underlying every private diversion and application there is, as there always has been, a superior public interest in this natural bounty."[282] By valuing environmental protection as a distinct use, Hawaii courts possess the authority to protect groundwater from excessive withdrawals even absent a more tangible harm to a person.[283]

Hawai'i's statutory and constitutional public trust is far reaching and equally applies to surface water and groundwater.[284] This water resources trust creates significant protections against groundwater withdrawals because it affirmatively binds all state actors, including state agencies, to consider public trust principles in their decisionmaking processes.[285] Because of Hawai'i's complex and wide-reaching regulatory system, private actors must also comply with public trust principles in order to obtain water use permits.[286] Many opponents of a broader public trust voice concern about a system that disallows private use due to concerns of stifling economic productivity.[287] But, in a system like Hawai'i's, a private party may legitimize its water use if it can show that its use will not significantly harm a protected right under the public trust doctrine.[288]

Ultimately, the success of Hawai'i's water resources trust compared with states that only apply the traditional common law suggests that only relying on the courts and common law to adopt a progressive public trust doctrine is both unlikely and impractical. Courts are not policy makers, and to shift the common law public trust doctrine to protect groundwater resources understandably involves

279. *See, e.g.*, *In re* Wai'ola O Moloka'i, Inc., 83 P.3d 664, 692 (Haw. 2004).

280. *Waiāhole Ditch*, 9 P.3d 409, 448 (Haw. 2000).

281. Craig, *supra* note 11, at 86.

282. Robinson v. Ariyoshi, 658 P.2d 287, 310–12 (Haw. 1982).

283. Craig, *supra* note 11, at 88.

284. *Waiāhole Ditch*, 9 P.3d at 443; Kauai Springs, Inc. v. Plan. Comm'n, 324 P.3d 951, 957 (Haw. 2014).

285. *See Waiāhole Ditch*, 9 P.3d at 451.

286. Craig, *supra* note 11, at 87.

287. *See, e.g.*, Lloyd R. Cohen, *The Public Trust Doctrine: An Economic Perspective*, 29 CAL. W. L. REV. 239, 255 (arguing the public trust doctrine will lead to inefficient outcomes).

288. *See Waiāhole Ditch*, 9 P.3d at 451.

policy choices because a more progressive public trust including groundwater would be a stark departure from the underlying goals and tenants of the common law public trust.[289] Courts that still apply the common law public trust are also necessarily faced with the conflicting interests with other common law groundwater rights. For example, in Texas, a court ruling that the public trust doctrine protects groundwater from harmful extractions would make little sense alongside the absolute capture rule. [290]

The history and culture of a state are also inextricably intertwined with its application of the public trust.[291] States like Hawai'i and California have a longer history of environmentalism and conservation, which likely contributed to the willingness of both states' legislatures to enact codified public trust principles and for courts to read the common law public trust more progressively.[292] This inclination is contrasted with states like Texas that prioritize private ownership over environmental protection and sustainability while applying the public trust doctrine conservatively.[293] Yet, groundwater resources deplete regardless of the politics exhibited by the state they sit beneath, and ironically, states like Texas rely on groundwater for a majority of their municipal and agricultural needs.[294]

III. SOLUTION

Implementing principles of the public trust doctrine through statute, rather than relying on common law, has proven successful in states that have enacted a codified public trust.[295] While many advocates for implementing a broader public trust or an ecological trust to protect water resources for conservation purposes suggest common law as the only path forward, in practice, the most successful broad

289. *See generally* Ruhl & McGinn, *supra* note 10, at 122 (discussing the history of the public trust doctrine in relationship to the roman roots narrative).

290. *See, e.g.*, Edwards Aquifer Auth. v. Day, 369 S.W.3d 814, 817, 829 (Tex. 2012) (comparing the private interest in groundwater to ownership of oil and gas and thus holding that groundwater regulation could result in a compensable taking).

291. *See* Craig, *supra* note 11, at 58 ("[A]s with other forms of common law, states have evolved their public trust doctrines in light of the particular histories and perceived needs and problems of each state.").

292. *Id.*

293. *See* PUIG-WILLIAMS, *supra* note 183, at 6 (discussing Texas' treatment of groundwater as private property).

294. *See Groundwater*, SIERRA CLUB: LONE STAR CHAPTER, https://www.sierraclub.org/texas/groundwater (last visited Nov. 16, 2022) [https://perma.cc/3LHF-ANU2] (identifying Texas' reliance on groundwater).

295. *See* Tuholske, *supra* note 6 (describing the success of Hawai'i's public trust).

public trusts are largely based on statutory authority.[296] Relying on common law alone also faces significant roadblocks from the constitutional system. Federal courts will likely hesitate to infringe upon what has traditionally been a state common law doctrine, especially absent a statutory grant of authority from Congress.[297] Similarly, even courts at the state level usually decline to diverge from the traditional common law public trust unless they are applying a codified public trust statute.[298] Therefore, a stronger federal statutory public trust may provide the means for broader judicial interpretations of public trust principles.

Federal law already addresses some aspects of water quality and quantity in statutes like the CWA, demonstrating that federal regulation of water clearly falls within Congress's constitutional authority to regulate under the Commerce Clause.[299] In *Sporhase v. Nebraska*, the Supreme Court explicitly acknowledged Congress's authority to enact legislation that regulates groundwater withdrawals under its Commerce Clause authority, holding that "[g]round water overdraft is a national problem and Congress has the power to deal with it on that scale."[300]

To combat the significant concern of groundwater depletion, this Note proposes a federal groundwater management statute based in public trust principles. The proposed statute would function similarly to Hawai'i's water resources trust, in which the public trust doctrine serves as a guiding principle to water-permitting decisions made by the state agency.[301] With public trust principles as its foundation, the

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296. *See* Craig, *supra* note 11 (describing courts' applications of statutory public trusts in western states).

297. *See, e.g.*, Erie R.R. Co. v. Tompkins, 304 U.S. 64, 78 (1938) (establishing the *Erie* doctrine which holds that "[e]xcept in matters governed by the Federal Constitution or by Acts of Congress, the law to be applied in any case is the law of the State"); Patterson v. McClean Credit Union, 491 U.S. 164, 183 (1989) ("Although we must do so when Congress plainly directs, as a rule we should be and are 'reluctant to federalize' matters traditionally covered by state common law." (quoting *S*anta Fe Industries, Inc. v. Green, 430 U.S. 462, 479 (1977))).

298. *See* Klass, *supra* note 142, at 712 (discussing how common law public trusts are limited in their ability to expand to a broader resource base).

299. *See* JAY AUSTIN & BRUCE MYERS, ANCHORING THE CLEAN WATER ACT: CONGRESS'S CONSTITUTIONAL SOURCES OF POWER TO PROTECT THE NATION'S WATERS, ENV'T L. INST ii (2007) ("The Supreme Court has long acknowledged Congress's power to protect the natural environment from these activities that substantially affect commerce.").

300. 458 U.S. 941, 954 (1982). The *Sporhase* Court further noted a "significant federal interest in conservation as well as in fair allocation of this diminishing resource." *Id.* at 953. Groundwater disputes have increasingly reached the Supreme Court, such as the recent case of *Mississippi v. Tennessee*. 142 S. Ct. 31, 39–40 (2021). While a full discussion of interstate water disputes is outside the scope of this Note, the court in *Mississippi v. Tennessee* again affirmed that groundwater could qualify as an interstate resource provided the aquifer met certain requirements. *Id.*

301. *See* Craig, *supra* note 11, at 118–27 (discussing Hawai'i's water resources trust).

proposed statute recommends delegating authority to the EPA to regulate groundwater withdrawals from interstate aquifers. Additionally, as a compromise to maintain some state authority in the realm of groundwater management, the proposed statute would mirror the cooperative federalism scheme implemented in the CWA.[302] The major principles and provisions of the proposed statute are outlined below.

A. A Groundwater Trust as Underlying Statutory Principles

Hawai‘i's successful codification of public trust principles into statutes shows promise of success if implemented on a wider scale. Like in Hawai‘i's water resources trust, public trust principles could act as a foundational basis for a federal groundwater law. In Hawai‘i, the codified water resources trust implements public trust principles as a basis for its water management decisions, including in its approval process [ ] for any projects that implicate public trust resources.[303] It does not, however, replace all common law water rights; instead, the codification of public trust principles acts to limit poor water management based on the foundational principle that water is a public right.[304] A federal codified public trust would thus act as a backstop to limit excessive groundwater withdrawals while also continuing to balance private rights with the conservation of water for the public good.[305] The core public trust principles incorporated in the proposed federal statute are public ownership, clear jurisdictional definitions, and ecological conservation as public trust purposes.

1. Public Ownership

A true codification of the public trust doctrine must declare that all water resources be held in a trust by the state where the public at large is the beneficiary.[306] Such a proposition may seem ambitious, but state ownership of water resources for public use does little to affect the current state of common law water rights.[307] At common law, at least in

302. *See* COPELAND, *supra* note 71, at 4 (outlining the state and federal roles in implementing the CWA); Dunn & Boian, *supra* note 80, at 68 (discussing the CWA's cooperative federalism scheme).

303. *See, e.g.*, *In re* Wai‘ola O Moloka‘i, Inc., 83 P.3d 664,692–94 (Haw. 2004) (discussing the weighing of private interests and "public rights" under the water resources trust).

304. *See, e.g.*, Kauai Springs, Inc., v. Plan. Comm'n, 324 P.3d 951, 171–74 (Haw. 2014).

305. *Id.* at 982 (noting that the balancing of public and private rights is determined on a case-by-case basis, but the public trust is an "outer limit" of permissible government action).

306. *See* Craig, *supra* note 11, at 76–80 (discussing public ownership and rights in water).

307. *See* 1 WATERS AND WATER RIGHTS, *supra* note 87, § 4.01 (discussing the difference between actual ownership of water and ownership of the right to use); Scanlan, *supra* note 53, at

most states, no private person possesses absolute ownership of water.[308] Instead, an individual may possess rights to *use* the water.[309] Even for groundwater resources, most states apply the same underlying assumption that the state technically owns the water and people simply "own" rights to use it, subject to state limitations.[310] A declaration of groundwater resources as falling within a public trust would, however, allow for a shift in the standards and priorities considered in groundwater management.[311] Similarly, an underlying principle of the state ownership and the public trust can act as a shield for the government against takings claims.[312] If the state owns the water, and people only own the right to use it, no taking of a private property will occur.[313]

In order to implement public ownership as a fundamental goal of the proposed statute, the following language should appear in a section outlining the statute's purpose and goals: "Interstate groundwater resources are held for the benefit of the citizens of the United States. The People are beneficiaries and have a right to have groundwater resources protected for their use."[314] This language both establishes public rights in water resources and places an affirmative duty on the state to protect water resources for public use.[315]

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61 ("A majority of states view groundwater as a public resource in which private rights are usufructuary, meaning the groundwater pumper has the right to use but not own water.").

308. Scanlan, *supra* note 53, at 61*;* Dellapenna, *supra* note 6, at 269.

309. *See* Scanlan, *supra* note 53, at 61 (discussing usufructuary rights to use groundwater).

310. *Id.*

311. *See* Tuholske, *supra* note 6, at 236 ("Adoption of the public trust to protect water resources provides an important statement that can shift public views in favor of protecting public resources.").

312. *See* John D. Echeverria, *The Public Trust Doctrine as a Background Defense in Takings Litigation*, 45 U.C. DAVIS L. REV. 931, 933 (2012). Although Texas is an outlier in its common law treatment of groundwater, its decision in *Edwards Aquifer Auth. v. Day* shows the difficulty in regulating "private" property and thus the potential benefits of retaining title in the public. 369 S.W.3d 814, 817 (Tex. 2012); PUIG-WILLIAMS, *supra* note 183, at 5 (outlining the challenges Texas' absolute capture framework places on groundwater regulation); Klass, *supra* note 142, at 738–42 (discussing the use of the public trust doctrine as a defense against takings claims).

313. Of course, takings litigation is significantly more complicated than this, but as a general rule, a prerequisite to any takings claim requires a showing of private ownership. Klass, *supra* note 142, at 738–39. For a more in-depth discussion of the relationship between takings claims and the public trust doctrine, see *id.* at 738–42.

314. This language is based off similar language in section 174C-2 of the Hawaii code. HAW. REV. STAT. § 174C-2.

315. *See In re* Wai'ola O Moloka'i, Inc., 83 P.3d 664, 693 (Haw. 2004) (interpreting language similar to the proposed language as placing an affirmative duty on the state to protect public trust resources).

2. A Clear Definition of Jurisdiction Over Groundwater

Any federal legislation must clearly delineate the water resources protected to explicitly include groundwater resources, especially given the long legal history of only defining "[w]aters of the United States" as surface water.[316] Because of the significant debate surrounding the scope of the WOTUS definition, it is more practical to avoid the WOTUS language altogether. Thus, to clarify the scope of the proposed groundwater management statute, it should define its jurisdictional scope as applying to "interstate groundwater resources."[317] Such a definition is the most politically prudent avenue because the statute would only apply to aquifers that are interstate, thus leaving significant jurisdiction to states to regulate intrastate aquifers. Similarly, a clear definition of applicability to interstate aquifers avoids the WOTUS debate.

3. Ecological and Conservation Principles

For a codified public trust to successfully protect groundwater from overwithdrawal, a statute must explicitly include principles of ecology and conservation.[318] Conservation principles are particularly important when it comes to groundwater because the traditional common law public trust only protects resources for uses like boating, swimming, and fishing, but groundwater is relatively inaccessible without technological assistance.[319]

The stated goal of the proposed statute is explicitly clear in implementing ecological and conservation goals:

> This Act aims to recognize the hydrologic connection in water resources; sustainably manage groundwater use for continued and future access; maintain proper ecological balance of all waterbodies covered under the Act; and preserve the nation's groundwater resources for current and future municipal uses, public recreation, agriculture, public water supply, and the greater public good.[320]

316. *See* McCrory & Raymond, *supra* note 76, at 172 (outlining the historic debate over the WOTUS definition).

317. For a discussion by the Supreme Court about what qualities qualify an aquifer as "interstate," see *Mississippi v. Tennessee*. 142 S. Ct. 31, 39–40 (2021). Relevant factors included the natural flow of groundwater across state boundaries and the ability of more than one state to pump from the same aquifer. *Id.*

318. *See* Craig, *supra* note 180, at 829 (discussing the connection between public trust principles and conservation).

319. *See* Scanlan, *supra* note 53, at 60 (noting that the vulnerabilities particular to groundwater "underscore[ ] the need" for groundwater conservation).

320. This language is modeled off similar language in section 174C-2 of the Hawai'i code. HAW. REV. STAT. § 174C-2.

B. Cooperative Federalism

For both political and administrative feasibility, the proposed groundwater management statute recommends utilizing principles of cooperative federalism.[321] On the federal level, the proposed statute delegates regulatory authority to the EPA pursuant to the goals of the statute. With public trust principles in mind, the EPA would have the authority to set overall groundwater conservation, use, and quantity policy; implement a permitting system for groundwater withdrawals of interstate aquifers; and review permitting decisions to ensure compliance with the public trust principles outlined above. Much like the CWA, this Note's proposed groundwater management act would require the EPA to implement technology standards for any groundwater withdrawal to ensure the use of sustainable pumping technology.[322] Similarly, water withdrawal permits should identify the maximum allowable withdrawal from a given aquifer to ensure that the withdrawal rate does not exceed the recharge rate.

The CWA models a workable framework for groundwater legislation because states still have the authority to regulate their water resources more stringently if they find it necessary.[323] Under the CWA, much of the statute's implementation is left to the states, subject to EPA approval.[324] The proposed groundwater management act would operate in much the same way—a federal law regulating groundwater would require a minimum level of groundwater management from states via EPA regulation.

While the contours of the federal-state governance relationship and the principles of the regulatory scheme are not within the scope of this Note, some state level groundwater management systems could act as models for the state's role in implementing federal standards. For instance, California's new sustainable groundwater management law could exemplify a workable state-level implementation scheme.[325] The California law upholds the private right to withdraw and use groundwater but considers it a shared resource and thus limits its use.[326] By relying on local oversight and the implementation plans of local groundwater boards, SGMA aims to respond to the needs of

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321. *See* Dunn & Boian, *supra* note 80, at 68 (defining cooperative federalism as "the collaboration between the federal and state governments to achieve a common goal").

322. *See* COPELAND, *supra* note 71, at 2 (discussing the means through which the CWA became a "technology-forcing statute").

323. *See id.* at 4.

324. *Id.*

325. Cagle, *supra* note 221; Forsythe, *supra* note 221; CAL. WATER CODE §§ 100-113 (West 2018).

326. Cagle, *supra* note 221; CAL. WATER CODE §§ 100-113.

localities to impose groundwater use limitations.[327] The instituted limits are still ecological because withdrawal rates cannot exceed recharge rates. On the national scale, appointing local groundwater management boards to implement national standards rooted in public trust principles may better allow for response to local needs.

C. Limitations of a Federal Codified Water Resources Trust

An obvious drawback of any proposal for federal legislation is the harsh political climate that makes it difficult to pass new laws.[328] While obtaining the political capital to pass a bill is always a formidable task, the urgency of the groundwater crisis requires federal action. There are, however, several compromises that could make the passage of a codified groundwater public trust more likely. For one, an emphasis on the balance between public and private rights in groundwater could help sway more conservative political actors. Even in states like Hawai‘i, which undeniably apply the most liberal public trust, the maintenance of private rights in groundwater use is balanced with the broader public interest.[329]

This Note does not suggest that statutory public trust principles are a panacea in solving the groundwater crisis. Nor does the proposed public trust statute aim to use the public trust doctrine as the only means of protection for groundwater resources. Instead, this Note suggests that implementing public trust principles as underlying statutory values will promote sustainable groundwater management. Any successful groundwater statute must include other, more classic forms of command-and-control regulation. A law based on public trust principles can ground predicate groundwater management with an underlying assumption that groundwater resources are public goods. As a result, a comprehensive groundwater statute can facilitate stronger government oversight in the hopes of quelling the possibility that groundwater becomes a tragedy of the commons.

CONCLUSION

Because of the disjunctive management of groundwater resources between states (and the transstate nature of groundwater depletion), a federal codification of a water resources trust is likely the

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327. Cagle, *supra* note 221.

328. *See* Elaine Kamarck, *The Challenging Politics of Climate Change*, BROOKINGS INST. (Sept. 23, 2019), https://www.brookings.edu/research/the-challenging-politics-of-climate-change/ [https://perma.cc/ZA9K-8YHE] (discussing the political challenges in addressing climate change).

329. Craig, *supra* note 11, at 126.

best long-term solution to aquifer depletion. The possibility that the nation's largest aquifers may become depleted or completely over-withdrawn affects the entire country, and the harms of aquifer depletion are not confined by state boundaries.[330] For instance, a hypothetical exhaustion of the Ogallala would affect the key region for United States' agricultural productivity.[331] If drained, natural processes would take about six thousand years to refill the aquifer. Clearly, the current state-by-state management of the Ogallala has done little to slow down its rapid withdrawal.[332] The Ogallala is not alone in its worrisome fate. Aquifers across the nation are at risk of complete depletion within the next century. Given the breadth of potential consequences that would affect the entire nation, a federal law could provide uniform management across the country.[333]

In the United States, groundwater law is often premised on outdated scientific understandings of hydrology, resulting in little protection for groundwater as compared to its surface water counterpart. Furthermore, individual states differ significantly in their groundwater management practices even though aquifers often cross state borders. A federal codified groundwater protection statute rooted in public trust principles may provide the necessary standards for more unified groundwater management. Pursuing federal legislation that codifies a water resources trust would implement ecological and public rights-based principles for more sustainable groundwater management. Protecting groundwater through public trust principles would also place an affirmative duty on the government to protect scarce water resources so society can continue to use these aquifers for its benefit well into the future.

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330. Bowman, *supra* note 5, at 1143.

331. Little, *supra* note 47.

332. *See* Bowman, *supra* note 5, at 1101 (discussing the failures in current management of the Ogallala).

333. *Cf. Groundwater Decline and Depletion*, *supra* note 56 (describing the consequences and effects of groundwater depletion).

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