LSU Journal of Energy Law and Resources

Volume 5 | Issue 2
Journal of Energy Law & Resources -- Spring 2017

A Watershed Agreement: Fixing the Wild West of Water Usage

Jane M. Daily

A Watershed Agreement: Fixing the Wild West of Water Usage

"Whiskey is for drinking; water is worth fighting over."
- Mark Twain[1]

INTRODUCTION

In coming decades, population increases coupled with anticipated climate change will create a massive water shortage. Twenty years ago, United Nations Secretary General Boutros Boutros-Ghali boldly predicted that the next great war would be fought over securing resources, noting that "water will be more important than oil this century."[2] The United Nations (UN) estimates that by 2025, as many as 1.8 billion people will live in countries or regions facing water scarcity.[3] Further, two out of three people will be facing water stress—a lack of life sustaining water.[4] With the upcoming challenges to secure water quickly approaching, water wars may be looming.[5] Similar to how oil security and sustainability sharply defined the twentieth century, countries with water wealth will visibly shape the twenty-first century.[6]

The Western United States is currently experiencing its fourth consecutive year of drought.[7] A new study conducted by NASA, Columbia, and Cornell University, projects that under the current trajectory, there is an 80% chance that the Southwest and Great Plains regions will experience a "megadrought"—a drought exceeding thirty-five

---

1. Jim Robbins, *Range War in Rosebud Valley*, N.Y. TIMES MAGAZINE, May 6, 1984, at 82–89.

2. Interview by Lyse Doucet, BBC News, with Dr. Boutros Boutros-Ghali, former United Nations Sec'y Gen., in London, England (June 10, 2003).

3. THE UNITED NATIONS, International Decade for Action 'Water for Life' 2005–2015, un.org/waterforlifedecade/scarcity.shtml [https://perma.cc/Z6XX-RMVB] (last visited Feb. 13, 2017); Peter Schulte, *Defining Water Scarcity, Water Stress, and Water Risk: It's Not Just Semantics*, PACIFIC INSTITUTE INSIGHTS, (Feb. 4, 2014), pacinst.org/water-definitions [pacinst.org/water-definitions] (defining the terms water scarcity and water stress).

4. THE UNITED NATIONS, *supra* note 3; Schulte, *supra* note 3.

5. Chris Arsenault, *Risk of Water Wars Rises with Scarcity*, ALJAZEERA, Aug. 26, 2012, aljazeera.com/indepth/features/2011/06/201162219314723165 3.html [https://perma.cc/KS2D-PMDF].

6. Nelson D. Schwartz, *Investors Are Mining for Water, the Next Hot Commodity*, N.Y. TIMES, Sept. 24, 2015, nytimes.com/2015/09/25/business/energy-environment/private-water-projects-lure-investors-preferably-patient-ones.html?_r=0 [https://perma.cc/5E2K-HFQQ].

7. Sam Stebbins et al., *8 States Running Out of Water*, 24/7 WALL ST, Sept. 3, 2015, 247wallst.com/special-report/2015/09/03/8-states-running-out-of-water [https://perma.cc/Q7ZF-8C6V].

years—by the year 2100.[8] Droughts have devastating impacts on the environment, infrastructure, and human life. However, amidst perpetual drought and water stress, people scramble to secure life-sustaining water, which leads to a boom in uncontrolled groundwater drilling.[9] An unregulated race for groundwater is unsustainable and will have dire environmental consequences for the Southwestern U.S. and Mexico.[10] Until now, Americans have taken water for granted; however, reliable access is no longer guaranteed.[11] The National Intelligence Strategy of the United States of America (NIS) provides the roadmap that will drive the national intelligence communities' priorities for the next four years.[12] Its 2014 report provides, for the second consecutive time, that competition for natural resources and overcoming water scarcity will be an increasingly prevalent global issue.[13] To combat shortages, the U.S. must cooperate with Mexico to secure all transboundary water aquifers.[14] Otherwise, both nations will forgo the opportunity to remain self-reliant and will have to resort to importing water.

While transboundary water agreements are rare, two Middle Eastern countries signed a notable pact over a shared water source in early 2015. Jordan and Saudi Arabia shattered global silence on transboundary aquifer management—one that had spanned decades. This agreement could serve as the tipping point in international water law, as it likely provides the requisite momentum for other countries to negotiate. Specifically, the ratification of a water-sharing agreement between the U.S. and Mexico, mirroring that between Jordan and Saudi Arabia, would signal the first important step towards a global shift in successful water policy. Sharing research, setting extraction limits, and enforcing environmentally friendly methods are the necessary cornerstones of a useful water agreement. Such

---

8. B. I. Cook, T. R. Ault & J. E. Smerdon, *Unprecedented 21st Century Drought Risk in the American Southwest and Central Plains*, 1 SCI. ADVANCES e1400082, Feb. 12, 2015, 4, 7. advances.sciencemag.org/content/1/1/e1400082.full.pdf+html [https://perma.cc/DGP6-A4AS].

9. Brian Howard & Spencer Millsap, *California Drought Spurs Groundwater Drilling Boom in Central Valley*, NAT'L GEOGRAPHIC, Aug. 16, 2014, news.nationalgeographic.com/news/2014/08/140815-central-valley-california-drilling-boom-groundwater-drought-wells [https://perma.cc/HY2G-NUW5].

10. *Id.*

11. Schwartz, *supra* note 5.

12. Shane Harris, *Water Wars*, FOREIGN POLICY, Sept. 18, 2014, foreignpolicy.com/2014/09/18/water-wars/ [https://perma.cc/T3RT-ZJVA].

13. THE NAT'L INTELLIGENCE STRATEGY OF THE UNITED STATES OF AMERICA, OFFICE OF THE DIRECTOR OF NAT'L INTELLIGENCE (2014), dni.gov/files/documents/2014_NIS_Publication.pdf [https://perma.cc/3XW7-4FYD].

14. An aquifer is "a relatively permeable geologic formation (in something like sand or gravel)" through which water can flow. C.W. FETTER, APPLIED HYDROGEOLOGY 95 (Pearson, 4th ed. 2000).

an arrangement between the U.S. and Mexico would cost very little political capital and would create huge resource dividends.

This Comment explores, and ultimately recommends, that the U.S. and Mexico create a formal agreement on the management of their shared groundwater resources that follows in the vein of the recent Middle Eastern treaty. Part I will examine the importance of transboundary aquifer systems and will explore the basic components of the water cycle. Part II will discuss the origins of America's general water management policy and how environmental and population changes have impacted it. Part III will delve into the issues facing the U.S. and Mexico as a result of their required cooperation over shared water. Further, it will highlight the specific Middle Eastern influences that shaped and made an agreement between Saudi Arabia and Jordan possible. Part IV highlights the Saudi-Jordanian agreement, which was the first of its kind, and advocates U.S. and Mexican adoption of a similar treaty. Ultimately, it argues that Mexico and the U.S. should include the basic tenants of shared data, joint management, creation of a buffer zone, and putting numeric limitations in a future agreement. Implementing an international agreement that addresses transboundary aquifers will foster greater cooperation between the U.S. and Mexico. Using key aspects of the Saudi-Jordanian pact as a guide will not only help the U.S. and Mexico preserve valuable water, but will also help circumvent future conflict.

I. WATER POLICY

Groundwater is the most underappreciated natural resource.[15] The water existing under the earth's surface accounts for nearly 22.4% of all fresh water.[16] Almost 2 billion people worldwide depend on the extraction of water, which is accessed through approximately 300 transboundary aquifer systems.[17] With continued climate change and lengthy droughts, surface water will not be able to keep up with the growing fresh water demand.[18] However, while hundreds of treaties govern transboundary rivers and lakes, only one international agreement directly addresses a

15. *See* Dave Owen, *Taking Groundwater*, 91 WASH. U. L. REV. 253, 254 (2013).

16. Julio Barberis, *The Development of International Law of Transboundary Groundwater*, 31 NAT. RESOURCES J. 167, 167 (1991).

17. NAT'L GROUNDWATER ASS'N, FACTS ABOUT GLOBAL GROUNDWATER USAGE, ngwa.org/Fundamentals/Documents/global-groundwater-use-fact-sheet.pdf [https://perma.cc/PKW2-FF5R] (last visited Sept. 24, 2015).

18. Schulte, *supra* note 3.

transboundary aquifer.[19] This treaty, the Franco-Swiss Genevese, governs groundwater resources in the Lake Geneva Basin[20] and provides a pragmatic approach to water regulation based on yearly technical water extraction and recharge data.[21]

Because groundwater is out of sight, it is consequently out of mind. Generally, people have a highly inaccurate or vague understanding of groundwater, where it comes from, and how it moves and is replenished.[22] Groundwater's subversive nature triggers alarming overuse; since the source is out of sight, states tend to overdraw and overtax the resource. States with growing water demands are pumping many of their aquifers at unsustainable rates.[23] Historically, international water law has been applied to cross-jurisdictional disputes concerning *surface* water crossing international borders. On the contrary, transboundary *groundwater* resources have been traditionally determined on an *ad hoc* basis or according to regional custom.[24] Simply relying on custom and piecemeal legislation is not enough to protect this vital resource. When states only address problems as they arise (i.e., who can drill from a particular place and how much can they take) the resulting rules and regulations only apply

---

19. "Transboundary aquifer" or "transboundary aquifer system" refers to, respectively, an aquifer or aquifer system, parts of which are situated in different States. Yoram Eckstein & Gabriel E. Eckstein, *A Hydrogeological Approach to Transboundary Groundwater Resources and International Law*, 19 AM. U. INT'L L. REV. 201, 205 n.17 (2003).

20. *See* Arrangement on the Protection, Utilization, and Recharge of the Franko-Swiss Genevese Aquifer, Fr.-Switz., Sept. 1977 (agreeing on the management of the Genevese aquifer "in order to protect this natural resource and to preserve the quality of its waters"), internationalwaterlaw.org/documents/regionaldocs/franko-swiss-aquifer.html [https://perma.cc/X9HR-8HGT] (last visited Feb. 22, 2017); *see also* Bernard J. Wohlwend, Workshop on Harmonization of Diverging Interests in the Use of Shared Water Res., An Overview of Groundwater in International Law, A Case Study: The Franco-Swiss Genevese Aquifer Dec. 17–19, 2002 (analyzing the Franco-Swiss Aquifer under international law), bjwconsult.com/The%20Genevese%20Aquifer.pdf [https://perma.cc/QS94-4PTW].

21. ELLI LOUKA, INTERNATIONAL ENVIRONMENTAL LAW: FAIRNESS, EFFECTIVENESS, AND WORLD ORDER (Cambridge Univ. Press, 2006).

22. *See* Daniel L. Dickerson et al., *Groundwater in Science Education*, 18 J. SCI. TCHR. EDUC. 45, 46 (2007) ("Few students or science educators hold complete and appropriate understandings regarding the concept and apparently do not learn anything about it after high school."); *see also* DAVID KEITH TODD & LARRY W. MAYS, GROUNDWATER HYDROLOGY 3–4 (3d ed. 2005) (describing inaccurate theories that philosophers from Aristotle to Descartes offered to explain the origins of groundwater).

23. *See* U.S. GEOLOGICAL SURVEY, GROUND-WATER DEPLETION ACROSS THE NATION (2003), pubs.usgs.gov/fs/fs-103-03/ [https://perma.cc/SNW5-EYN9].

24. Gabriel Eckstein & Yoram Eckstein, *International Law, Ground Water Resources, and the Danube Dam Case*, SSRN (2005), papers.ssrn.com/sol3/papers.cfm?abstract_id=772072 https://perma.cc/9AVN-AMLE].

on a micro scale. However, the macro problem also needs to be addressed. By looking at groundwater as a single entity, rather than divisible by state lines, governments will be able to plan and create an overarching strategy to protect and economically utilize the water. Yet, aquifers worldwide are being depleted because they are pumped at a rate greater than recharge[25]—by an estimated 145 cubic kilometers annually—a rate high enough to measurably contribute to a rising sea level.[26] Thus, definitive standards and regulations must be established to help dispel future conflicts.

A. Water Basics

To better understand the need for a more regulated transboundary water regime, the basic mechanics of water must be explored. The hydrologic cycle, or water cycle, is the system between which water—solid, liquid, gas, or vapor—travels from the atmosphere to the Earth and back again in a constant cycle of renewal.[27] Water evaporates from the ocean, precipitates over the land, and flows through streams and rivers back into the ocean, supporting human and ecological systems along the way. Much of this cycle happens underground.[28] In undeveloped landscapes, most precipitation evaporates, is transpired by plants, or infiltrates through the ground surface.[29] Only a small percentage of water travels to surface waterways as overland flow.[30] Next, water infiltrating the surface percolates downward until it hits the water table.[31] Below the water table, groundwater tends to flow laterally, and much of that water will eventually discharge into surface waterways.[32] The rates of flow may be very slow—and water passing through clay or non-porous rock may

25. Aquifer recharge is when water is added to an aquifer. For example, when rainwater seeps into the ground. Recharge may occur artificially through injection wells or by spreading water over groundwater reservoirs. N.Y. STATE DEP'T OF ENVTL. CONSERVATION, *Groundwater Definitions* (2015), dec.ny.gov/lands/76322.html [https://perma.cc/3CT7-F4CF] (last visited Feb. 13, 2017).

26. *See* Leonard F. Konikow, *Contribution of Global Groundwater Depletion Since 1900 to Sea-Level Rise*, 38 GEOPHYSICAL RES. LETTERS 17401, 17401 (2011).

27. Eckstein & Eckstein, *supra* note 18, at 207.

28. *See* U.S. GEOLOGICAL SURVEY, *The Water Cycle for Kids*, ga.water.usgs.gov/edu/watercycle-kids.html [https://perma.cc/5RDA-B5PP] (last visited Feb. 13, 2017).

29. FETTER, *supra* note 13 at 4.

30. *See* COMM. ON REDUCING STORMWATER DISCHARGE CONTRIBUTIONS TO WATER POLLUTION, NAT'L RES. COUNCIL, URBAN STORMWATER MGMT. IN THE UNITED STATES 156 (2009).

31. The water table is the level below which all of the pore space in the soil or rock is saturated with water. FETTER, *supra* note 13, at 4–5, 37–42.

32. *Id.* at 5.

barely move at all.[33] An "aquifer" is a saturated and relatively permeable subsurface layer through which water moves more quickly, and from which it can readily be pumped.[34]

Aquifers contain a surprising percentage of freshwater resources. Globally, most freshwater is frozen in glaciers and icecaps.[35] Of the remaining freshwater resources, 98% lies beneath the ground.[36] Some of that groundwater exists far below the surface and thus is difficult for humans to access. This water plays little role in sustaining surface water ecosystems.[37] Yet, even at near-surface levels, the aggregate quantity of groundwater in many areas greatly exceeds the quantity in surface lakes, rivers, and streams.[38] Groundwater levels, however, remain relatively steady, unless an aquifer is being pumped faster than its rate of recharge.[39] According to the United States Geological Survey, in 2005, the U.S. used approximately 82.6 billion gallons of groundwater per day.[40]

Although the physical nature of groundwater presents certain advantages for human users, it also creates challenges. Perhaps the largest challenge lies in the fact that aquifers typically span property boundaries. Because groundwater moves in response to pumping,[41] wells on one property, if pumped vigorously enough, can suck in or "steal" water from adjacent lands, lowering the water table beneath those lands in the process.[42] On an international scale, aggressive groundwater pumping can interfere with or limit another country's ability to access its own resources.[43]

Additionally, groundwater is typically more vulnerable to pollution and contamination than surface water because it flows at a much slower rate.[44] Slower flow rates also reduce an aquifer's natural recuperative

---

33. *Id.* at 85.
34. For comparison, hydrogeologists consider a meter per day to be a relatively fast flow rate. *Id.* at 95.
35. *Id.* at 4.
36. *Id.*
37. THOMAS C. WINTER ET AL., GROUNDWATER AND SURFACE WATER: A SINGLE RESOURCE 445 (1998).
38. FETTER, *supra* note 13 at 263.
39. Mark Giordano, *Global Groundwater? Issues and Solutions*, 34 ANN. REV. ENVTL. RES. 153, 155 (2009).
40. Joan F. Kenny et al.,U.S. GEOLOGICAL SURVEY, *Estimated Use of Water in the United States in 2005* 19 (2009).
41. ELINOR OSTROM, GOVERNING THE COMMONS: THE EVOLUTION OF INSTITUTIONS FOR COLLECTIVE ACTION 107 (1990).
42. WINTER ET AL., *supra* note 36 at 454.
43. FETTER, *supra* note 13, at 267; MARQ DE VILLIERS, WATER: THE FATE OF OUR MOST PRECIOUS RESOURCE 200–03 (2000).
44. Ludwick A. Teclaff & Eileen Teclaff, *Transboundary Ground Water Pollution: Survey and Trends in Treaty Law*, 19 NAT. RES. J. 629, 632 (1979).

abilities.[45] To compound the problem, not only are underground aquifers more likely to be contaminated, but the cleaning, or reclamation, of a polluted aquifer is extremely difficult and expensive, assuming it is possible at all.[46] The process can render the aquifer unusable for years, decades, or even longer.[47] Moreover, due to its physical location, groundwater is relatively more challenging and costly to monitor than surface water.[48]

Traditionally, perceptions related to groundwater were based on the imagination, or even mythology, rather than on scientific observation.[49] The average person often misguidedly perceives aquifers and groundwater to exist as underground lakes or rivers; however, it is more accurate to describe groundwater as being stored and flowing through aquifers rather than an underground lagoon.[50] Groundwater in an aquifer resides in pore spaces, similar to water in a sponge filling up the small holes. Yet, there exists one distinction: a sponge material is more elastic and pliable than the materials in a geological formation.[51] Thus, the flow of groundwater does not occur in the form of underground rivers or veins, but rather in the form of seeping water, similar to water moving through a sponge.[52] Only in recent decades has attention been paid to the role that groundwater plays in the water cycle on a global and national scale. Unfortunately this greater understanding has not resulted in a comprehensive system of ownership or management.[53]

B. American Water Policy

American water law, or riparian principles were established when there was relatively low conflict over water usage by the population.[54] The

45. *Id.*
46. *Id.*
47. *Id.*
48. *Id.*
49. JEAN MARGAT & JAC VAN DER GUN, GROUNDWATER AROUND THE WORLD: A GEOGRAPHIC SYNOPSIS 2 (2013).
50. Robin Clarke et al., *Groundwater: A Threatened Resource* 7 (UNEP Environment Library No. 15, 1996).
51. *See* Julio A. Barberis, *International Ground Water Resources Law*, in 40 FOOD AND AGRICULTURAL ORGANIZATION LEGISLATIVE STUDY NO. 36, 2-4 (1986).
52. *Id.*
53. MARGAT & VAN DER GUN, *supra* note 48 at 5.
54. *See* JOSEPH W. DELLAPENNA, *Global Climate Disruption and Water Law Reform,* 15 WIDENER L. REV. 409, 413 (2010).

original thirteen colonies adopted Britain's riparian rights approach[55]—the landowner acquires water rights to adjacent water.[56] Water was deemed to be common property; something that people could use, but not own.[57] In the context of riparian rights, ownership of a mere right indicates only the right to use water as it passes over or lies upon one's land.[58] One does not have the right to seriously impair the similar rights of others to use the water and to receive its fruits as it passes over or lies upon their land.[59] More than a century ago, the Supreme Court of California summarized this point by stating, "the right of the riparian proprietor to the flow of the stream is inseparably annexed to the soil, and passes with it, not as an easement or appurtenant, but as a parcel. Use does not create the right, and disuse cannot destroy or suspend it."[60]

The earliest expressions of modern riparian theory stated the three basic rights of every riparian land owner: (1) a right to receive the water in its natural condition; (2) equal rights as against every other riparian; and (3) a right to make a reasonable use of the water as it flowed across, or by, or lay upon the land.[61] However, the U.S. Constitution did not adopt these expressions and contains no explicit provision allotting powers over water.

---

55. The term "riparian rights" derives from the Latin word *ripa*, meaning the bank of a stream. Johnson v. McCowen, 348 So. 2d 357, 360 n. 3 (Fla. Ct. App. 1977). Worton Creek Marina, LLC v. Claggett, 381 Md. 499, 508, 850 A.2d 1169, 1174 (Md. 2004); Little v. Kin, 249 Mich. App. 502, 504 n.2, 644 N.W.2d 375, 377 n.2 (2002), *aff'd mem.*, 468 Mich. 699, 664 N.W.2d 749 (2003); Secretary of State v. Gunn, 75 So.3d 1015, 1018 n.7 (Miss. 2011); Panetta v. Equity One, Inc., 190 N.J. 307, 318, 920 A.2d 638, 644–45 (2007) (citing to 6 Waters and Water Rights 1290 (Robert E. Beck, ed., 1991, repl. vol. 2005)).

56. DAVID H. GETCHES, WATER LAW IN A NUTSHELL 16–17 (4th ed. 2008).

57. SAMUEL WEIL, *Theories of Water Law,* 27 HARV. L. REV. 530, 530 (1941).

58. T.E. Lauer, *The Common Law Background of the Riparian Doctrine*, 28 MO. L. REV. 61, 104 (1963).

59. *Id.*

60. Lux v. Haggin, 69 Cal. 255, 391, 10 P. 674, 753 (1886) (emphasis in the original). *See also* Koch v. Aupperle, 274 Neb. 52, 64, 737 N.W.2d 869, 878–79 (2007), *appeal after remand on other grounds*, 277 Neb. 560, 763 N.W.2d 415 (2009); Kinross Copper Corp. v. State, 160 Or. App. 513, 520–21, 981 P.2d 833, 838 (citing to 7 Waters and Water Rights § 1.01 (Amy K. Kelley, ed., 3rd ed. LexisNexis/Matthew Bender 2015)), *aff'd on rehearing*, 163 Or. App. 357, 988 P.2d 400 (1999), *rev. denied*, 330 Or. 71, 994 P.2d 133 (2000), *cert. denied*, 531 U.S. 960 (2000).

61. *See, e.g.*, Tyler v. Wilkinson, 24 Fed. Cas. 472, 474 (No. 14,312) (D.R.I. 1827), quoted *supra* at note 52; Merritt v. Parker, 1 N.J.L. App. 460, 463 (1795), quoted *supra* at note 23. Some courts still express the rights of riparian owners in terms of these three interests; although the idea of reasonable use predominates *See, e.g.*, Weight v. USAA Cas. Ins. Co., 782 F. Supp. 2d 1114, 1125 (D. Haw. 2011); L&S Water Power, Inc. v. Piedmont Triad Regional Water Auth'y, N.C. App., 712 S.E.2d 146, 150 (2011), rev. allowed, N.C., 724 S.E.2d 518 (2012); Cummins v. Travis Cty. Water Control Dist. No. 17, 175 S.W.3d 34, 47 (Tex. Ct. App. 2005), *rev. denied*.

Instead, it allows each individual state to regulate and manage their own water resources as they see fit.[62]

Courts in the eastern states began to adopt the old riparian scheme, which came to be called the "reasonable use" theory of riparian rights.[63] Under this theory, each owner of riparian land may use water in a water body, regardless of the effect the use has on the natural flow. This is true, so long as each user does not trample the equal rights of other riparian owners to use the water.[64] The second and third of the originally posited rights are thus seen as corollaries of one another and form the core of modern riparian theory.[65]

In the Western U.S., water scarcity has driven the development of a different water rights doctrine—the system of appropriative rights.[66] Prior appropriation severs water rights from land rights.[67] It serves to protect the beneficial use of the person who first diverts and appropriates water from its natural course.[68] However, because water constitutes a public good, the state retains ownership. Therefore, satisfying the elements of prior

---

62. Idaho v. Coeur d'Alene Tribe of Idaho, 521 U.S. 261, 283 (1997).

63. Peter N. Davis, *The Riparian Right of Streamflow Protection in the Eastern States*, 36 ARK. L. REV. 47, 49 (1982); Waters and Water Rights § 1.01 (Amy K. Kelley, ed., 3rd ed. LexisNexis/Matthew Bender 2015) §§ 6.01(b), 7.01(b). *See also* Bradford Bowman, *Instream Flow Regulation: Plugging the Holes in Maine' Water Law*, 54 ME. L. REV. 287, 297–99 (2002). In an amendment adopted in 2008, Ohio enshrined the reasonable use theory in its constitution. OHIO CONST., art. 1, § 19b (D).

64. North Gualala Water Co. v. State Water Resources Control Bd., 139 Cal. App. 4th 1577, 43 Cal. Rptr. 3d 821 (2006), *rev. denied*, Dumont v. Kellogg, 29 Mich. 420, 423 (1874); Michigan Citizens for Water Conserv. v. Nestlé Waters N. Am., Inc., 269 Mich. App. 25, 54–56, 709 N.W.2d 174, 194–95 (2005), *rev'd on other grounds*, 479 Mich. 280, 737 N.W.2d 447 (2007); Koch v. Aupperle, 274 Neb. 52, 63–65, 737 N.W.2d 869, 878–79 (2007), *appeal after remand on other grounds,* 277 Neb. 560, 763 N.W.2d 415 (2009); Coastal Plains Utilities, Inc. v. New Hanover Cty., 166 N.C. App. 333, 351, 601 S.E.2d 915, 927 (2004); Cummins v. Travis Cty. Water Control Dist. No. 17, 175 S.W.3d 34, 47 (Tex. Ct. App. 2005), *rev. denied*; Pion v. Bean, 176 Vt. 1, 9, 833 A.2d 1248, 1256 (2003); Wilson v. Dressler, 52 Va. Cir. 410, 413 (2000), 2000 Va. Cir. LEXIS 305; RESTATEMENT (SECOND) OF TORTS § 850 (1977). *See also* Joseph W. Dellapenna, *The Evolution of Riparianism in the United States*, 95 MARQ. L. REV. 53, 81–85 (2011); John L. Fortuna, *Water Rights, Public Resources, and Private Commodities: Examining the Current and Future Law Governing the Allocation of Georgia Water*, 38 GA. L. REV. 1009, 1023 (2004) (citing to Jeremy Nathan Jungreis, "*Permit" Me Another Drink: A Proposal for Safeguarding the Water Rights of Federal Lands in the Regulated Riparian East*, 29 HARV. ENVTL. L. REV. 369, 373–75 (2005)).

65. *Id.*

66. WATERS AND WATER RIGHTS §§ 1.01, 8.01, 8.02(b), and chs. 11–17 (Amy K. Kelley, ed., 3rd ed. LexisNexis/Matthew Bender 2016).

67. DAVID H. GETCHES, WATER LAW IN A NUTSHELL 77–78 (4th ed. 2008).

68. *Id.*

appropriation gives the holder only a usufructuary right, or a right to use—not own—the water.[69] While this law still governs Texas,[70] many states have replaced the rule of capture[71] with the reasonable use doctrine, which modifies the rule of capture by taking into account the rights of others to the same water source.[72]

The doctrine of prior appropriation has led to almost all of the water in the Western United States being claimed and appropriated.[73] The only real restriction on the water use by any one riparian lies in the prohibition on use that inflicts "substantial harm"[74] or, as contemporary courts more often say, an "unreasonable injury" to another riparian user.[75]

It is easier to envision how non-riparian rights might be applied in accordance with the maxim, "your right to swing your arms ends just where the other man's nose begins."[76] However, when it comes to water, extracting the resource can have harmful consequences. The water cycle is a contained unit, and any outside influences will impact further extraction down the line. The pumping of an aquifer by one landowner could introduce pollutants into the entirety of the basin, thus affecting every landowner with access thereto. The delicate nature of groundwater means there is limited room to extend your arm before hitting your neighbor in the nose.

---

69. DAN TARLOCK, LAW OF WATER RIGHTS AND RESOURCES, § 3:3 (2016).

70. Edwards Aquifer Auth. v. Day, 369 S.W.3d 814, 831–32 (Tex. 2012).

71. "Groundwater is governed by the rule of capture, which grants landowners the right to capture the water beneath their property. The landowners do not own the water but have a right only to pump and capture whatever water is available, regardless of the effects of that pumping on neighboring wells." TEXAS A&M UNIV., TEXAS WATER LAW (2015), texaswater.tamu.edu/water-law [https://perma.cc/HSK7-NPE2] (last visited Feb. 13, 2017).

72. TARLOCK, *supra* note 68, at § 4:7 (2016).

73. Owen L. Anderson et al., 1 WATERS AND WATER RIGHTS § 14.01(b)(1) (Amy K. Kelley, ed., 3rd ed. LexisNexis/Matthew Bender 2016).

74. *See, e.g.*, Mason v. Hoyle, 14 A. 786 (Conn. 1888); Elliott v. Fitchburg, 64 Mass. (10 Cush.) 191 (1852); Dumont v. Kellogg, 29 Mich. 420 (1874); Dyer v. Cranston Print-Works, 22 R.I. 506, 48 A. 791 (1901).

75. *See, e.g.*, Beaunit Corp. v. Alabama Power Co., 370 F. Supp. 1044 (N.D. Ala. 1973); Harris v. Brooks, 225 Ark. 436, 283 S.W.2d 129 (1955); Pyle v. Gilbert, 245 Ga. 403, 265 S.E.2d 584 (1980). *See generally* Albert C. Lin, *The Unifying Role of Harm in Environmental Law*, 2006 WIS. L. REV. 897; Michael Paradis, *Just Reasonable: Can Linguistic Analysis Help Us Know What It Is to Be Reasonable?*, 47 JURIMETRICS 169 (2007); Shelley Ross Saxer, *The Fluid Nature of Property Rights in Water*, 21 DUKE ENVTL. L. & POL'Y F. 49, 62 (2010).

76. Zechariah Chafee, *Freedom of Speech in War Time*, 32 HARV. L. REV. 932 (1919).

II. U.S. AND MEXICO'S BORDER WATER POLICY

The U.S. and Mexico are two diverse and fiercely independent countries that carry the burden of supporting growing populations with limited and shared resources. The nearly 2,000 mile-long border between Mexico and the U.S. is hot and dry,[77] with few rivers crossing the arid expanse.[78] This parched environment ranges from semi-arid steppe along the Rio Grande in the east to dry desert in the west.[79] Despite more than forty years of lip service and promises, neither Mexico nor the U.S. has made any serious diplomatic efforts to effectuate a border-wide pact coordinating management of the border region's transboundary groundwater resources.

Unfortunately, policymakers often perceive groundwater negotiations to be politically sensitive and of little diplomatic significance in the grand scheme of Mexico-U.S. relations. However, both federal governments have been more vocal about regulating other issues such as illegal immigration, drug violence, and economic trade.[80] Groundwater management has not been a platform for either federal government.

In an era characterized by a growing appreciation of and dependence on groundwater, the safeguarding of this resource remains poor.[81] The populations that depend on water to continue their way of life have allowed the sanitation and preservation to falter into the realm of neglect or even disregard.[82] Groundwater resources along the Mexico-U.S. border display significant signs of stress from overexploitation, contamination, and mismanagement.[83] Nevertheless, the lack of information about the region's aquifers has not prevented the border from booming. Between

---

77. Gabriel Eckstein, *Rethinking Transboundary Ground Water Resources Management: A Local Approach along the Mexico-U.S. Border*, 25 GEO. INT'L ENVTL. L. REV. 95, 96 (2013).

78. *Id.*

79. *See* Diana M. Liverman, et. al., *Environmental Issues Along the United States-Mexico Border: Drivers of Change and Responses of Citizens and Institutions*, ANN. REV. ENERGY & ENV'T 607, 610 (1999), dianaliverman.files.wordpress.com /2014/12/liverman-et-al-1999-us-mexico-border-envt-in-arer.pdf [https://perma.cc /BF4T-6R8Y].

80. Maria Rosa Garcia-Acevedo & Helen Ingram, *Conflict in the Borderlands*, NACLA REPORTING ON THE AMERICAS (2004), nacla.org/article/conflict-borderlands [https://perma.cc/ZYZ7-54DZ] (last visited Feb. 13, 2017).

81. Stephen P. Mumme, *Advancing Binational Cooperation in Transboundary Aquifer Management on the U.S.-Mexico Border*, 16 COLO. J. INT'L ENVTL. L. & POL'Y 77, 89 (2005).

82. *Id.*

83. *See* GOOD NEIGHBOR ENVTL. BD., WATER RESOURCES MANAGEMENT ON THE U.S.-MEXICO BORDER: THIRTEENTH REPORT TO THE PRESIDENT AND CONGRESS OF THE UNITED STATES 24 (Jun. 2010).

2000 and 2010, the region's population grew by 16% to 14.4 million.[84] The combined border population is expected to increase by 40% by 2020; however, water resources are not booming.[85]

The aquifers that crisscross the border serve as the only or primary source of fresh water for most of the region's communities.[86] The Hueco Bolson Aquifer, for example, supplies nearly all of the fresh water used by Ciudad Juarez's residents.[87] More than one-quarter of that is used by El Paso's residents.[88] Even though groundwater resources play a significant role along the border, little is known about their geographic range, volume, flow direction, quality, and renewability.[89] In fact, the location and actual number of all of the aquifers traversing the frontier has yet to be formally determined.[90]

Numerous wells dot the landscape, and millions of people on both sides of the border rely heavily on the region's groundwater resources. A "tragedy of the commons"[91] situation is developing, with each state viewing the other as competition for a finite resource.[92] In 2005, California, Texas, Arizona, and New Mexico ranked first, second, seventh, and thirteenth, respectively, for the volume of fresh groundwater

84. *Id.* (suggesting that the combined border population may grow from 14.4 million people in 2010 to around 20 million in 2020).

85. *Id.* at 1.

86. Eckstein, *supra* note 76, at 96.

87. Charles E. Heywood & Richard M. Yager, U.S. GEOLOGICAL SURVEY, *Simulated Ground-Water Flow in the Hueco Bolson, An Alluvial-Basin Acquifer System Near El Paso, Texas* 1 (2003), www.twdb.texas.gov/groundwater/models/gam/hmbl/WRIR02-4108.pdf [https://perma.cc/GJ2T-SFDV] (stating that at the turn of the 20th century, Ciudad Juarez had a resident population of about 2 million and El Paso had a resident population of 680,000). Zhuping Sheng & Jeff Devere, *Understanding and Managing the Stressed Mexico-USA Transboundary Hueco Bolson Aquifer in the El Paso del Norte Region as a Complex System*, 13 HYDROGEOLOGY J. 813, 814 (2005).

88. Heywood & Yager, *supra* note 87. Sheng & Devere, *supra* note 87.

89. Eckstein, *supra* note 76, at 100.

90. *Id.*

91. A "tragedy of the commons" is an economic problem in which every individual tries to reap the greatest benefit from a given resource. As the demand for the resource overwhelms the supply, every individual who consumes an additional unit directly harms others who can no longer enjoy the benefits. Generally, the resource of interest is easily available to all individuals. Elinor Ostrom, *Tragedy of the Commons*, THE NEW PALGRAVE DICTIONARY OF ECONOMICS, 360–63 (2008).

92. Garrett Hardin, *The Tragedy of the Commons*, 162 SCI. 1243, 1243–44 (1968).

withdrawn nationally.[93] In Arizona and Sonora, Mexico, projections show municipal demand for water doubling over the next ten to twenty years.[94] Despite the importance of and a growing dependency on water, there are no regulations or safeguards protecting this resource. Leaking septic tanks and underground fuel and chemical storage containers, agricultural run-off, industrial activities, and intrusion from saline aquifers all contribute to the degradation of aquifers along the border.[95]

Finding a solution to the access problem may be more involved than placing arbitrary limitations and guidelines on extraction. Neither country is completely aware of the actual water volume or of the number of aquifers that traverse the border. Scientists sometimes suffer from "blank map syndrome," whereby a transboundary aquifer mapped by an American entity lacking access to Mexican data omits the portion of the aquifer south of the border shows a completely blank expanse (the same problem plagues Mexican researchers).[96] While data sharing would seem fundamental to a global and civilized scientific community, there are still obstacles that inhibit data distribution. Somewhere between eight to twenty aquifers are estimated to lie beneath the border. It will remain impossible to pinpoint the exact quantity of underground water until accurate mapping is available. The withholding of valuable planning and management data is a readily fixable scientific problem.

As a result, the coming years will likely bring increased conflict over groundwater development. Scientists expect that climate change will exacerbate stresses on surface water supplies, leading users of all types to seek alternative water sources.[97] Agricultural demands may remain steady or even decline, but conflicts between agricultural use of water and

---

93. Joan F. Kenny et al., U.S. GEOLOGICAL SURVEY, CIRCULAR 1334, ESTIMATED USE OF WATER IN THE UNITED STATES IN 2005 11 (2009), pubs.usgs.gov/circ/1344/pdf/c1344.pdf [https://perma.cc/2GBQ-9EW4] (providing 2005 ground water withdrawal estimates for all U.S. states). In 2012, groundwater accounted for 60% of all water used in Texas. *See* TEX. WATER DEV. BD., WATER FOR TEXAS 2012: STATE WATER PLAN 163, www.twdb.texas.gov/publications/state_water_plan/2012/2012_SWP.pdf [https://perma.cc/A5A9-3ADM] (2012).

94. *See, e.g.*, Christopher Brown, *Transboundary Water Resource Issues on the US-Mexico Border: Challenges and Opportunities in the 21st Century*, VERTIGO, Sept. 1, 2005, at 5, vertigo.revues.org/1883 [https://perma.cc/5QXC-MM8G]; Paul Westerhoff, et. al., *Drinking Water Quality in the US-Mexico Border Region* 5–7 (2004), scerpfiles.org/cont_mgt/doc_files/W-03-19-final.pdf [https://perma.cc/63HV-JW7E]; Suzanne Levesque & Helen Ingram, *Lessons in Transboundary Resource Management from Ambos Nogales*, *in* 2 THE ECONOMICS OF NON-MARKET GOODS AND RESOURCES 161, 168 (2003).

95. Eckstein, *supra* note 76, at 102.

96. *See* GOOD NEIGHBOR ENVTL. BD., *supra* note 82, at 31.

97. WINTER ET AL., *supra* note 36, at 12–14.

environmental protection of aquatic resources show no signs of abating.[98] Nearly 100,000 American farms depend upon groundwater,[99] which provides approximately 42% of the nation's irrigation supplies.[100] Agricultural landowners have challenged limits on their ability to pump, even though those limits are derived from well-documented shortages plaguing the aquifers.[101] Providing adequate quantities of pure, fresh water for humans and their diverse activities are and will continue to be a major problem. Further, if competition for water resources continues to escalate, this will have negative impacts on essential freshwater supplies for personal and agricultural use.[102] Population increases and migration will continue, creating new demands on available resources.

Presently, no comprehensive agreement exists between Mexico and the U.S. addressing the regulation, management, allocation, or protection of the aquifers that traverse the frontier.[103] With one prominent exception, groundwater resources are only cursorily referenced in a few bilateral instruments and little evidence points to a more formal, comprehensive accord on the horizon.[104]

III. MAKING IT WORK: BECOMING AMICABLE NEIGHBORS

A move toward a successful water policy between the U.S. and Mexico is the struggle of two neighbors dealing with a common space played out on a national level on a global stage. Of course, that characterization is an over-simplification of the relationship and the motivations driving these two sovereign nations. To magnify one area of the problem, California is faced with an ongoing drought and, as a result, has taken water conservation

98. Owen, *supra* note 14, at 254.

99. According to the U.S. Geological Survey, "[a]n estimated 42.9 million people in the United States . . . supplied their own water for domestic use in 2005. . . . Nearly all (98[%]) of these self-supplied withdrawals were from fresh groundwater." U.S. GEOLOGICAL SURVEY, ESTIMATED USE OF WATER IN THE UNITED STATES IN 2005 42 (2009). NAT'L GROUNDWATER ASS'N, GROUNDWATER USE FOR AMERICA (2010), ngwa.org/Documents/Awareness/usfactsheet.pdf [https://perma.cc/LBH8-PS6X].

100. *See* U.S. GEOLOGICAL SURVEY, HIGH PLAINS REGIONAL GROUND-WATER STUDY 3 (2000) ("Water from the High Plains aquifer is the principal source of supply for irrigated agriculture[.]"); Barton H. Thompson, Jr., *Tragically Difficult: The Obstacles to Governing the Commons*, 30 ENVTL. L. 241, 249 n.45 (2000) (providing statistics on the importance of groundwater to rural areas).

101. *See* Cross-Appellants' Brief at 4-13, Edwards Aquifer Auth. v. Bragg, 2013 Tex. App. LEXIS 10838 (Aug. 28, 2013) (No. 04-11-00018-CV).

102. David Pimentel et al., *Water Resources: Agricultural and Environmental Issues*, 54 BIOSCIENCE 909 (2004).

103. Eckstein, *supra* note 76, at 103.

104. *Id.*

seriously within their communities.[105] Neighborhood watches no longer patrol solely to keep the streets safe, but also to monitor everyone's water usage.[106] However, for every water progressive citizen who polices another's water consumption, there are many California citizens and communities continuing to treat water as a bottomless resource.[107] This attitude has led to passive-aggressive reporting and water shaming, not a water solution. Moreover, this illustrates the issue of individuals, or countries acting as individuals, who only influence and control a very small segment of water usage. Correcting water policy must occur at a macro level—countries must assume their role in enacting regulations and agreements rather than hoping for citizens to be good neighbors and conserve water for the community. U.S. and Mexican officials need to collectively create an overarching policy and come to a consensus as to how to manage the underground aquifers before the water runs out or is contaminated. The crux of the problem is trying to fix and understand how each country can become a better, selfless neighbor.

The relationship between the U.S. and Mexico has been characterized as one of ambivalence with flare-ups of strife.[108] Analysts attribute the great disparities in wealth between the two countries as the catalyst for antagonism; additionally, the U.S. history of intervention makes Mexico highly critical and suspicious.[109] The commonality of a limited and vital resource, however, cannot be ignored. These cultural and political gaps must be bridged to address the water shortage.

Mexico has a history of defying the U.S. on a number of crucial hemispheric issues. In the early 1960s, Mexico maintained relations with the Cuban communist regime.[110] During President Echeverría's State of

105. Kurtis Alexander, *Wasting Water? Fear Ratting Neighbors, Not Relentless Cops*, SAN FRANCISCO CHRONICLE, July 18, 2014, sfgate.com/news /article/Little-enforcement-of-new-water-rules-planned-5629287.php [https://perma.cc/V42G-4NXG].

106. *Id.*

107. *Id.*

108. Throughout its history, Mexico has had an ambivalent love-hate relationship with its northern neighbor. Nationalist rhetoric continuously highlights the loss of one-half of Mexico's territory and natural resources to the United States in the 1800s. Even at times when United States-Mexico relations have been at their best, this loss is still present in Mexican rhetoric. During the Rio Group summit in September 1994, for example, President Salinas commented on the United Nations-sponsored United States intervention in Haiti, "Having suffered an external intervention by the United States, in which we lost more than half of our territory, Mexico cannot accept any proposal for intervention by any nation of the region." John Pike, *Mexico - Relations with the United States*, GLOBAL SECURITY.ORG (2015), globalsecurity.org /military/world/mexico/foreign-relations-us.htm [https://perma.cc/XZ4R-D9BA].

109. *Id.*

110. *History of Mexico*, HISTORY.COM, history.com/topics/mexico/history-of-mexico [https://perma.cc/5K5R-QZHD] (last visited Feb. 13, 2017).

the Union address, Mexico took a leading role in demands for a new international economic order.[111] During the 1970s, Mexico challenged the U.S.'s position in Central America and led a concerted regional effort that excluded the U.S. to bring a peaceful end to regional conflicts.[112] During the 1980s, Mexico was highly critical of U.S. policy in El Salvador and, along with the French government, called for formal recognition of the Salvadoran guerrillas in the peace process.[113]

To overcome this contentious past, a simple agreement with plain terms and no ambiguities needs to be ratified by both countries. Mimicking the recent Middle East success, this agreement should be: short with a few, detailed articles to define the water problem; lay out proper drilling and management techniques; and should avoid any contentious issues that would hinder the agreement's ratification.

In contrast to the stalemate and false promises of cooperation in the West, Jordan and Saudi Arabia were able to come to an agreement while facing a dire situation. The Middle East makes up 5% of the world's population but only enjoys access to a limited 0.9% of the world's water resources.[114] In particular, Jordan and Saudi Arabia represent two of the driest and most water starved countries in the world.[115] They share a single aquifer, the al-Sag/al-Disi,[116] along the border between the two nations.[117] Despite these harsh statistics and sparse availability of water, on April 30, 2015, Jordan and Saudi Arabia entered into an agreement for the management and utilization of the groundwater in the al-Disi layer.[118]

---

111. *Id.*
112. *Id.*
113. *Id.*
114. Benjamin R. Long, *Middle East Water Conflict: The Battle Over the Al-Disi Aquifer*, AMERICAN INSTITUTE (Dec. 11, 2003), www1.american.edu/TED/ice/aquifer.htm [https://perma.cc/NZ7L-XLC3].
115. Alexandra Barton, *Water In Crisis-Spotlight Middle East*, THE WATER PROJECT, thewaterproject.org/water-in-crisis-middle-east [https://perma.cc/DHG7-RVTG] (last visited Feb. 13, 2017).
116. Two different names are provided because in Saudi Arabia it is the "al-Sag" aquifer, but in Jordan it is named "al-Disi." For consistency, this paper will refer to it as "al-Disi."
117. Long, *supra* note 112.
118. Dr. Sami Shubber, *Agreement Between the Government of the Hashemite Kingdom of Jordan and the Government of the Kingdom of Saudi Arabia for the Management and Utilization of the Ground Waters in the Al-Sag/Al-Disi Layer*, INT'L WATER LAW PROJECT (2015), internationalwaterlaw.org/documents/regionaldocs/Disi_Aquifer_Agreement-English2015.pdf [https://perma.cc/U8AZ-77TB] (citing to an unofficial English translation of the agreement provided by Dr. Sami Shubber).

IV. MOTIVATION IN THE MIDDLE EAST

There are many factors of the Middle Eastern agreement that can be emulated by the U.S and Mexico to help frame a successful agreement. However, there are a few specific to the region that cannot be imitated, such as the shared religion, the unique aspects of the shared aquifer and the security risk of sharing water data. To better understand the significant impact of this new agreement and how it can be adopted in other countries, the outlying factors need to be discussed. However, the core principles of the agreement need to be distilled and extrapolated for implantation in other transboundary water agreements.

A. Islamic Law

The shared commonality of religion and religious law of the Middle Eastern countries is a unique driving force that requires elaboration. Islamic legal tradition may have one of the richest laws applicable to groundwater resources, and has created a shared route to modern cooperation.[119] Over time, priority of rights to water access and use developed, including the rights to consume, to sustain domestic animals, to irrigate land, and to share to meet the needs of the community.[120] Islam considers the sharing of water a holy duty.[121] However, like the Western legal systems, the Islamic legal tradition rarely considered groundwater contemporaneously with surface water and does not address transboundary ownership and allocation issues.[122] Yet, the common understanding that sharing and providing water for a neighbor is not a mere suggestion, but rather a holy duty, easily translates into a uniquely Islamic motivation to sit at the negotiation table.

---

119. *See* William S. D. Cravens, *The Future of Islamic Legal Arguments in International Boundary Disputes Between Islamic States*, 55 WASH. & LEE L. REV. 529, 567 (1998).

120. *See* Albert E. Utton, *The Development of International Groundwater Law*, 22 NAT. RESOURCES J. 95, 96 (1982); *see also* Dante A. Caponera & Dominique Alheritiere, *Principles for International Groundwater Law*, 18 NAT. RESOURCES J. 589, 600 (1978).

121. *See* Caponera & Alheritiere, *supra* note 118, at 597–98.

122. *See* Utton, *supra* note 118, at 98 ("The laws governing ground water nationally are inadequately developed, and the law governing transboundary groundwaters is only at the beginning state of development."); *see also* Caponera & Alheritiere, *supra* note 118, at 592–94, 612–13.

B. Non-Recharging Aquifer

The al-Disi aquifer lies under southern Jordan and northern Saudi Arabia. Discovered in 1969,[123] the water contained is age dated at 30,000 years and rests in a sandstone structure that dips northward to the Dead Sea.[124] The water movement is extremely slow within the aquifer, such that it is not considered to form a "unitary whole" with surface water.[125] The al-Disi is a non-rechargeable,[126] or fossil, groundwater source.[127] Moreover, this aquifer does not form a hydraulic relationship with any surface water resources, so it is isolated underground from the rest of the water cycle. [128] Because it is located at such a depth underneath non-porous sandstone rock, the water is locked; it cannot be recharged by rainfall.[129] For those reasons, the al-Disi is capable of little or no appreciable natural recharge, and cannot discharge naturally.[130] Non-recharging aquifers constitute non-renewable resources that can thus be wholly depleted through consumption and extraction. By definition, a state cannot sustainably utilize such an aquifer, and therefore, any withdrawal will eventually exhaust the resource. States utilizing a transboundary aquifer that does not recharge are slowly depleting and will eventually exhaust this resource.[131]

From 1985 to 2005, the amount of water being pumped from the al-Disi aquifer increased more than fourfold—from about 2 billion to more than 8.7 billion cubic meters per year.[132] In 2008, estimates of the sustainable yield and

123. W. TODD JARVIS, CONTESTING HIDDEN WATERS: CONFLICT RESOLUTION FOR GROUNDWATER AND AQUIFERS 144 (2014).

124. *Id.*

125. *See* Andrew Macoun & Hazin El Naser, *Groundwater Resources Management in Jordan: Policy & Regulatory Issues, in* GROUNDWATER: LEGAL AND POLICY PERSPECTIVES, PROCEEDINGS OF A WORLD BANK SEMINAR 105, 111 (Salman M.A. Salman ed., 1999).

126. *See* Raj Krishna, & Salman M.A. Salman, *International Groundwater Law and the World Bank Policy for Projects on Transboundary Groundwater, in* GROUNDWATER: LEGAL AND POLICY PERSPECTIVES, PROCEEDINGS OF A WORLD BANK SEMINAR 163, 181 (Salman M.A. Salman ed., 1999) (describing the Complex Terminal Aquifer as an unrelated, recharging aquifer).

127. *Id.* at 183.

128. Eckstein & Eckstein, *supra* note 18, at 224–27.

129. Long, *supra* note 112.

130. Eckstein & Eckstein, *supra* note 18, at 115–16.

131. *Id.* at 247.

132. Markus Becker, *Contaminated Aquifers: Radioactive Water Threatens Middle East*, SPIEGEL ONLINE, Nov. 12, 2012, spiegel.de/international/world/contaminated-aquifers-radioactive-water-threatens-middle-east-a-865290.html [https://perma.cc/M2QS-ZP2Z].

the duration of the al-Disi extraction project were revised to project a volume of 100 million meters cubed per year for fifty years.[133]

Non-recharging aquifers have limited flow from surface water sources, however, flow intensifies near artificial extraction points like wells and pipelines. [134] This extraction creates a "cone of depression," which allows gravity to shift water toward the extraction point.[135] As the water flows toward the point of extraction, the groundwater table drops.[136] It is possible that if either Jordan or Saudi Arabia began to increase their pumping, they could risk moving the "shared" water onto one side completely.

C. Security Issues

Traditionally, water has been a source of cooperation rather than conflict. However, it has more recently become a target of non-state actors in their unconventional methods of waging war.[137] Water security is particularly a problem for the Middle East because the region is water scarce, governments often lack the resources or commitment to resolve water security issues, and the presence of non-state actors creates vulnerabilities since water infrastructure is easy to contaminate or disrupt but difficult to maintain.[138] The negotiation of an agreement between Jordan and Saudi Arabia required both countries to disclose their extraction rates from the al-Disi aquifer. This extensive and open disclosure is contrary to the norms associated with natural resource management.[139] Like many countries, Jordan adopted a "securitization" strategy related to its water usage, which turned natural resource use into a part of national security.[140] Perhaps sharing water data would alert enemies of potential vulnerabilities. Further, water data could be used in collaborations and thus double resources, ultimately protecting and defending such a valuable commodity.

---

133. JARVIS, *supra* note 121, at 146.
134. Eckstein & Eckstein, *supra* note 18, at 247.
135. A "cone of depression" creates problems when the initial well that is pumping the water lowers the water table beneath the reach of a second well or extraction site. The first drilling site effectively deprives the second well of being able to reach any water. GARY L. WIDMAN, GROUNDWATER—HYDROLOGY AND THE PROBLEM OF COMPETING WELL OWNERS, 14 ROCKY MTN. MIN. L. INST. 16 (1968).
136. Eckstein & Eckstein, *supra* note 18, at 247.
137. Philip Rossetti, *The Middle East Struggles with Water Security*, AM. SECURITY PROJECT, Mar. 24, 2015, americansecurityproject.org/the-middle-east-struggles-with-water-security/ [https://perma.cc/HKV9-9WRF].
138. STRATEGIC FORESIGHT GROUP, *Water and Violence: Crisis of Survival in the Middle East* (2015), strategicforesight.com/publication_pdf/63948150123-web.pdf [https://perma.cc/T5GD-ZM8V].
139. JARVIS, *supra* note 121, at 147.
140. *Id.*

V. HOW TO STRUCTURE A MUTUALLY BENEFICIAL AGREEMENT

The Saudi-Jordanian agreement is comprised of a loose framework that addresses the main tenets of good water guardianship. The water diplomacy structure sets its sights on ensuring flexible water use and establishing joint fact-finding systems to create value, rather than zero-sum thinking,[141] through societal, political and natural networks.[142] However, this agreement was not necessarily driven by the water diplomacy structure, however. Rather, two countries on the brink of resource collapse drafted this agreement to prevent full depletion of their shared water reservoirs. The situation in Jordan and Saudi Arabia is much more dire than the one currently facing the U.S. and Mexico: Jordan and Saudi Arabia receive far less rain, and their main aquifer is non-renewable and contains water collected roughly 30,000 years ago.[143] When the well dries up, no amount of drilling will find more water. As such, both countries desperately need this finite supply of water.

The Saudi-Jordanian agreement takes a minimalist approach and is composed of only four main articles.[144] Article One contains relevant terms and definitions; Article Two describes the main norms for managing the aquifer; Article Three discusses the creation and responsibilities of a Joint Saudi-Jordanian Technical Committee; and Article Four contains administrative provisions related to the implementation of the agreement.[145]

Utilizing this structure, the U.S. and Mexico should look to keep their agreement format brief, yet detailed. The first section should define key terms to ensure clarity. The terms should include what drilling techniques will be used and the depths at which drilling will be permitted. Establishing a common language and guideline for both countries to follow will help eliminate confusion. Moreover, a baseline of shared knowledge must be established to eliminate misunderstanding.

---

141. In game theory and economic theory, a zero-sum game is a mathematical representation of a situation in which each participant's gain (or loss) of utility is exactly balanced by the losses (or gains) of the utility of the other participant(s). *Zero-sum*, MERRIAM-WEBSTER DICTIONARY, merriam-webster.com/dictionary/zero-sum [https://perma.cc/X89Z-6TJ9].

142. JARVIS, *supra* note 121.

143. Gabriel Eckstein, *The Newest Transboundary Aquifer Agreement: Jordan and Saudi Arabia Cooperate Over the Al-Sag/Al-Disi Aquifer*, INT'L WATER LAW PROJECT (2015), internationalwaterlaw.org/blog/2015/08/31/the-newest-transboundary-aquifer-agreement-jordan-and-saudi-arabia-cooperate-over-the-al-sag-al-disi-aquifer/ [https://perma.cc/KLQ8-EBUU] [hereinafter Newest Transboundary Aquifer Agreement].

144. *See* Shubber, *supra* note 116.

145. *See id.*; *see also* Eckstein, *supra* note 143.

Similar to Article Two of the Saudi-Jordanian agreement, norms need to be established for managing the transboundary aquifer systems that underlie the border. In order to enforce and promote the accepted management techniques, the U.S. and Mexico should create a joint-task force, with equal representation from both countries. The task force would help govern the rules set forth in the treaty, without involving the complications of bureaucracy. The task force should be able to operate without needing clearance from multiple governing bodies during the scope of their duty. Lastly, there should be clear administrative provisions guaranteed to help the treaty be respected, such as allowing for penalties and other measures to ensure enforcement.

The U.S. and Mexico need to reach an agreement on the management of their shared water supply. Until now, there has been no sense of urgency, priority, or of the looming shortages. However, there is still time for both parties to come to the negotiating table and agree on how to manage and preserve the aquifers. Jordan and Saudi Arabia were the first to bridge the gap, and they created a viable document that can be adopted and modified to fit the specific circumstances of the U.S.-Mexican border.

The Saudi-Jordanian agreement is noteworthy on a global scale because it governs transboundary aquifers through a comprehensive management regime. Further, it is one of only two more with rudimentary consultative and data sharing agreements to date.[146] These three treaties of groundwater supervision juxtapose with over 3,600 treaties relating to the use of transboundary surface water penned since 800 C.E.[147] Now is the time for the litany of transboundary aquifer agreements to drastically increase.

The U.S. and Mexico may find additional support for creating an underground aquifer agreement by adopting the Middle East's "green" approach. An unheralded benefit of the Saudi-Jordanian agreement is its forward-thinking environmental approach. That trait is perhaps driven less by the desire to be "green" and more by the threats posed by the dearth of water in the region and by the economic burden of having to import enough water to satisfy the populace. Nevertheless, the agreement takes a strong stance on eliminating pollution from the extraction process. Since the aquifer is non-recharging, any pollutant that is introduced into the aquifer will contaminate the entire water supply. For this reason, Article

146. Gabriel E. Eckstein, *Protecting a Hidden Treasure: The U.N. International Law Commission and the International Law Transboundary*, 5 SUSTAINABLE DEV. L. & POL'Y (Winter 2005).

147. *Atlas of International Freshwater Agreements*, OR. STATE UNIV. & UNITED NATIONS ENVT. PROMGRAMME (2015), transboundarywaters.orst.edu/publications /atlas/ [https://perma.cc/2QRP-YDYT].

2(5) explicitly prohibits horizontal or slant wells.[148] This measure aims to prevent any injection of pollutants into the finite resource.

Another innovative provision allows for the formation of a Joint Technical Committee (JTC). The JTC's primary objectives are: "monitoring both the quantity and quality of extractions, collecting and exchanging information, analyzing collected data, and submitting JTC's findings to the competent authorities in both nations."[149] This could cause some friction if created with the U.S. and Mexico because there has been a lot of mistrust and apprehension about the ongoing border control issues.[150] But, both countries have increased cooperation with cracking down on drug trafficking;[151] forming a JTC to control water may strengthen the commitment to collaboration and ultimately being good neighbors.

The Saudi-Jordanian agreement does not place a numerical limit on extraction, which may be problematic in future applications. Instead of a limit, the agreement creates a buffer zone of no activity, which limits and controls the area in which drilling and extractions can take place. The agreement additionally creates a broader "management area" that encompasses the protected area and spans approximately 1,000 square kilometers in each country. These provisions effectively protect ongoing water projects supplying citizens on both sides of the border. However, there are no definite volume numbers or limits, which may lead to conflict down the line.

For instance, if Jordan is forced to accept additional Syrian refugees from the ongoing crisis,[152] their population and demand for water will greatly increase.[153] How much additional water can they withdraw from the al-Disi aquifer? There are no safeguards or procedures in place to reevaluate a country's demand for water. As such, the question remains

148. Shubber, *supra* note 116.

149. Shubber, *supra* note 116.

150. Fernanda Santos, *Shootings by Agents Increase Border Tensions*, N.Y. TIMES, June 10, 2013, nytimes.com/2013/06/11/us/shootings-by-agents-increase-border-tensions.html?_r=0 [https://perma.cc/LGW2-6UZQ].

151. Azam Ahmed, *El Chapo, Escaped Mexican Drug Lord, Is Recaptured in Gun Battle*, N.Y. TIMES, Jan. 8, 2016, nytimes.com/2016/01/09/world/americas/El-Chapo-captured-mexico.html [https://perma.cc/9ZVW-KETP].

152. Jordan is hosting more than 600,000 of the 4.6 million Syrians who have registered with the UN as refugees since the civil war broke out in the country in 2012. However, the Jordanian government claims that there are another 1 million unregistered Syrians living in the country. Matt Dathan & David Wilkes, *A Migrant City the Size of Bath*, DAILY MAIL (Feb. 3, 2016) dailymail.co.uk /news/article-3429835/King-Abdullah-says-Jordan-boiling-point-number-Syrian-refugees.html [https://perma.cc/79NH-SACB].

153. *United Nations High Commissioner for Refugees: Jordan*, UNHCR.ORG, unhcr.org/pages/49e486566.html [https://perma.cc/DY2M-A6NH] (last visited Feb. 13, 2017).

whether Jordan would even be obliged to discuss drilling more wells. To that end, one must ask at what point Jordan takes too much water and destroys the spirit of cooperation with Saudi Arabia. It is these uncertainties that need to be directly addressed in a new treaty, and not solved on an *ad-hoc* basis.

While neither the U.S. nor Mexico faces a refugee problem anywhere close to that in the Middle East, having defined limits on water usage will assuage any potential disagreements. The doctrine of "reasonable use" may be harder to define if the U.S. exerts its considerable influence as a superpower to justify taking more than its "reasonable" share.[154] Outlining numerical values and metrics on extraction in writing may be an easy preemptive measure to prevent future conflict over the shared resource. This would also assure Mexico that the U.S. intends to be a partner in water management and not solely a consumer.

CONCLUSION

Groundwater respects no political boundaries.[155] Both Mexico and the U.S. feel entitled to the water beneath their soil, even though that water may be contiguous with supplies across the border. Each nation's withdrawal of water seems an affront to their sovereignty. The inchoate nature of groundwater law exacerbates these tensions because piecemeal legislation and cultural norms will not regulate or reign over either side.[156] The U.S. and Mexico do not face the dire water situation looming over the Middle East. However, the U.S.-Mexico border needs an increasing amount of water to parallel the population increases. Under the border, there are aquifers that could play a vital role in quenching the thirst of millions. Without an agreement, this life sustaining resource will be polluted, wasted, or unequally divided between the people.

While an agreement that follows in the footsteps of Jordan and Saudi Arabia would not eliminate the upcoming water shortages, proper management and conservation of current assets are vital for human life. Unfortunately, if the U.S. and Mexico do not pay heed to this agreement, they will face the disappointing truth of Benjamin Franklin's statement,

---

154. Mexico is the United States' second-largest export market (after Canada) and third-largest trading partner (after Canada and China). In 2013, two-way trade in goods and services was more than $550 billion. Mexico's exports rely heavily on supplying the U.S. market. Mexico, however, dependent on the U.S. market for 80% of its exports, is much less able to stand up to the superpower. U.S. DEP'T OF STATE, *Mexico*, state.gov/r/pa/ei/bgn/35749.htm [https://perma.cc/6RJG-42S3] (last visited Feb. 13, 2017).

155. *See* Utton, *supra* note 118, at 98.

156. *Id.*

"when the well is dry, we will know the worth of water."[157] The Saudi-Jordanian pact offers structure and perhaps some motivation to spur the adoption of similar agreements by other countries—agreements that will manage and protect their respective transboundary aquifers. Hopefully, the U.S. and Mexico realize the importance of guarding their aquifers and cooperating with their neighbor, and management will become a policy priority.

Jane M. Daily[*]

157. Benjamin Franklin, *Poor Richard's Almanac*, 130 (Paddington Press Ltd., 1976) (1746).

* J.D./D.C.L., 2017 Paul M. Hebert Law Center, Louisiana State University. Thanks to Professor Squillace who opened the floodgates on this topic while in Lyon. To Professor Eckstein thanks for your advice and scholarship in the field. Additionally, to my family thanks for the encouragement and listening to me talk about aquifers (repeatedly).