GROUNDWATER LAW, THE SAN LUIS VALLEY, AND CLIMATE CHANGE

Rachel Grabenstein*

INTRODUCTION

Ask anyone who lives in the Southwest, and they will tell you it has been a dry year—but that may just be the way the Southwest is now. The Southwest has been in a severe drought since 2000.[1] 2021 looks to be no different. In fact, 2021 may usher in a whole new level of drought never experienced before.[2] A sample of regional newspapers headlines include:

* J.D., University of New Mexico, 2022; B.S. Wildlife Biology, University of Montana, 2016. Many thanks to the editorial staff at the Vermont Journal of Environmental Law for all their hard work and to Tanner for his constant support.

1. *Climate Change Indicators: A Closer Look: Temperature and Drought in the Southwest*, EPA, https://www.epa.gov/climate-indicators/southwest (last visited Feb. 14, 2021) [hereinafter *Climate Change Indicators*]; Henry Fountain, *Southwest Drought Rivals Those of Centuries Ago, Thanks to Climate Change*, N.Y. TIMES (Apr. 16, 2020), https://www.nytimes.com/2020/04/16/climate/drought-southwest-climate-change.html.

2. Andrew Freedman & Hannah Dormido, *Drought is the Sleeper Weather Story You'll Hear More About in 2021*, WASH. POST (Jan. 7, 2021), https://www.washingtonpost.com/weather/2021/01/07/drought-expands-north-america/?arc404=true; Theresa Davis, *NM Water Managers Warn Communities to Prepare for Low Rio Grande*, ALBUQUERQUE J. (Jan. 31, 2021), https://www.abqjournal.com/2354734/nm-water-managers-warn-communities-to-prepare-for-low-rio-grande.html; *Contra* Climate Prediction Center Internet Team, *U.S. Seasonal Drought Outlook*, NAT'L WEATHER SERV. CLIMATE PREDICTION CTR, https://www.cpc.ncep.noaa.gov/products/expert_assessment/sdo_summary.php (last visited Feb. 14, 2021) (stating that "[e]ntering into a climatologically wetter season for much of the west, coupled with the development of La Niña conditions, increases chances for improving drought conditions.")).

"NM water managers warn communities to prepare for low Rio Grande"; "Winter recovering in Southwest Colorado, but intense drought lingers"; "Drought conditions expected to continue to worsen through spring months"; and "Upper Colorado River drought plan triggered for first time."[3]

There is no denying that climate change is here. Climate change is and has been a well-accepted phenomenon in the scientific community for decades.[4] In fact, "a vast region of the western United States, extending from California, Arizona and New Mexico north to Oregon and Idaho, is in the grips of the first climate change-induced megadrought observed in the past 1,200 years."[5]

Climate change is no longer a hypothetical future—western communities experience unprecedented events related to wildfires and drought today.[6] The Southwest is warmer.[7] There is less precipitation, which falls in different places and at different times than it did historically.[8]

Communities are seeing their ways of life change completely due to climate change.[9] Climate change prevents some indigenous communities from being able to perform traditional ceremonies.[10] The looming water crisis has the ability to limit development and certain activities in arid states

---

3. Andrew Shipley, *Drought Conditions Expected to Continue to Worsen Through Spring Months*, VALLEY CENT. (Jan. 29, 2021), https://www.valleycentral.com/weather/drought-conditions-expected-to-continue-to-worsen-through-spring-months/; Davis, *supra* note 2; Luke Runyon, *Upper Colorado River Drought Plan Triggered for First Time*, KUNC (Jan. 20. 2021), https://www.kunc.org/environment/2021-01-20/upper-colorado-river-drought-plan-triggered-for-first-time; Jim Mimiaga, *Winter Recovering in Southwest Colorado, but Intense Drought Lingers*, THE JOURNAL (Feb. 4, 2021), https://www.the-journal.com/articles/winter-recovering-in-southwest-colorado-but-intense-drought-lingers/; Luke Runyon, *Upper Colorado River Drought Plan Triggered for First Time*, KUNC (Jan. 20. 2021), https://www.kunc.org/environment/2021-01-20/upper-colorado-river-drought-plan-triggered-for-first-time.

4. *Do Scientists Agree on Climate Change?*, NASA, https://climate.nasa.gov/faq/17/do-scientists-agree-on-climate-change/ (last visited Feb. 14, 2021).

5. Becky Bollinger & Andrew Freedman, *Historic Drought Deepens in the West as Window for Rain, Snow Closes*, WASH. POST (Mar. 3, 2021), https://www.washingtonpost.com/weather/2021/03/03/drought-worsens-west/.

6. Andrew Freedman & Darryl Fears, *The Western U.S. is Locked in the Grips of the First Human-caused Megadrought, Study Finds*, WASH. POST (Apr. 15, 2020), https://www.washingtonpost.com/weather/2020/04/16/southwest-megadrought-climate-change/; Fountain, *supra* note 1.

7. *Climate Change Indicators*, *supra* note 1.

8. CLIMAS, *Climate Change in the Southwest*, UNIV. ARIZ., https://climas.arizona.edu/sw-climate/climate-change-southwest (last visited Nov. 22, 2021).

9. Lauren Paskus, *Climate Report Details Deep Hits to the Southwest*, HIGH COUNTRY NEWS (Nov. 26, 2018), https://www.hcn.org/articles/climate-change-the-fourth-national-climate-assessment-details-deep-hits-to-the-southwest.

10. Anna V. Smith, *Ongoing Fish Kill on the Klamath River is an "Absolute Worst-Case Scenario*, HIGH COUNTRY NEWS (May 27, 2021), https://www.hcn.org/issues/53.7/indigenous-affairs-fish-ongoing-fish-kill-on-the-klamath-river-is-an-absolute-worst-case-scenario.

like Arizona.[11] Farmers are altering their practices in response to the changing climate.[12] Hurricanes and wildfires have destroyed communities and will likely continue to do so, making return impossible for some communities after such disasters.[13] The impacts of climate change are being felt now.

One resource is particularly impacted by climate change: water. Much has been written about the relationship between water and climate change.[14] It is hard to ignore this relationship for several reasons. First, dry rivers or *bathtub rings* in low-level reservoirs are visually striking and difficult to ignore. Second, communities in the United States have started to feel and experience the impacts of climate change on their water resources.[15]

A notorious example of climate change's impact on a community's water resources occurred in California during the 2015 drought. That was the first year the State of California implemented mandatory water restrictions.[16] Those restrictions required California water agencies "to cut their output by 25 percent or face fines of up to $10,000 per month."[17] In an effort to reduce use, water agencies asked homeowners to water their lawns and wash their cars less.[18] Homeowners who failed to comply could be fined.[19] Additionally, large landscapes like golf courses and cemeteries had to stop water use immediately.[20]

---

11. Sarah Tory, *Rapid Growth in Arizona's Suburbs Bets Against an Uncertain Water Supply*, HIGH COUNTRY NEWS (June 1, 2021), https://www.hcn.org/issues/53.6/south-water-rapid-growth-in-arizonas-suburbs-bets-against-an-uncertain-water-supply.

12. Meera Subramanian, *The Flash Drought Brought Misery, But Did it Change Minds on Climate Change?*, HIGH COUNTRY NEWS (July 17, 2018), https://www.hcn.org/articles/climate-change-the-flash-drought-brought-misery-but-did-it-change-minds-on-climate-change.

13. Piper McDaniel, *After the Camp Fire, Paradise is still home*, HIGH COUNTRY NEWS (Apr. 6, 2020), https://www.hcn.org/articles/south-wildfire-after-the-camp-fire-paradise-is-still-home.

14. Michael Dettinger et al., *Western Water and Climate Change*, 25 ECOLOGICAL APPLICATIONS 2069, 2069 (2015); Kenneth D. Frederick & David C. Major, *Climate Change and Water Resources*, *in* 37 CLIMATE CHANGE 7, 7 (1997).

15. Dettinger et al., *supra* note 14, at 2078.

16. Darryl Fears, *As Water Runs Dry, Californians Brace for a New Way of* Life, WASH. POST (Apr. 4, 2015), https://www.washingtonpost.com/national/health-science/as-water-runs-dry-californians-brace-for-a-new-way-of-life/2015/04/04/f1ebb4ba-daba-11e4-b3f2-607bd612aeac_story.html.

17. *Id.*

18. *Id.*

19. *Id.*

20. *Id.;* Darryl Fears, *Calif. Governor Orders Statewide Mandatory Water Restrictions*, WASH. POST (Apr. 1, 2015), https://www.washingtonpost.com/national/health-science/calif-governor-orders-statewide-mandatory-water-restrictions/2015/04/01/3495867a-d89e-11e4-8103-fa84725dbf9d_story.html.

It was clear during the 2015 California drought that surface water was either unavailable or available in much lower amounts than usual.[21] Surface water includes all above-ground water sources like in rivers, lakes, and oceans.[22] It is common during droughts and climatic events to focus on surface water because it is the most visible resource.[23] Therefore, most of the discussions in the United States regarding climate change and water relate to surface water.[24]

However, there is another water source impacted by climate change that does not receive comparable attention: groundwater. Groundwater is also of particular significance for the United States because it "constitutes about 22% of the nation's fresh water supply" and "about one-half of the population of the United States relies on groundwater as its primary source of drinking water."[25] But because groundwater is underground, as the saying goes, it is often out of sight and out of mind. However, in times of drought and crisis, groundwater is the resource that everyone relies upon.[26]

Most legal research and analysis in the United States focuses on surface water.[27] There has been less of a focus on groundwater.[28] Recent progress in legal research and analysis has focused on new groundwater laws or climate change adaptations.[29]

Conjunctive management, or the "coordinated use of surface water and groundwater," is one of the best paths forward to deal with climate change.[30]

---

21. *See* Zoe Meyers, *Millions in Debt, a Community Wonders if its Water Source will P*rovide, HIGH COUNTRY NEWS: WORTH OF WATER (Dec. 8, 2015), https://www.hcn.org/articles/worth-of-water-mountain-house-drought-california-debt (showing how the California drought in 2015 has diminished irrigation from surface water and how that has impacted residents).

22. *Surface Water*, USGS DICTIONARY OF WATER TERMS, https://www.usgs.gov/special-topic/water-science-school/science/dictionary-water-terms?qt-science_center_objects=0#qt-science_center_objects (last visited Nov. 11, 2021) (Definition of surface water).

23. *Drought and Climate Change*, CTR. FOR CLIMATE & ENERGY SOLS., https://www.c2es.org/content/drought-and-climate-change/ (last visited Jan. 29, 2022).

24. *See Generally* BUREAU OF RECLAMATION, LITERATURE SYNTHESIS ON CLIMATE CHANGE IMPLICATIONS FOR WATER AND ENVIRONMENTAL RESOURCES (3rd ed. 2013) (suggesting that surface water is discussed more than other types of water regarding climate change).

25. *Id.*

26. ANTHONY DAN TARLOCK & JASON ANTHONY ROBISON, LAW OF WATER RIGHTS AND RESOURCES §4:4 (2020 ed.).

27. Robin Kundis Craig, *Water Law and Climate Change in the United States: A Review of the Scholarship* (Jan. 2, 2020) (research paper No. 357, available on the Utah Law Digital Commons), https://dc.law.utah.edu/scholarship/186/.

28. *Id.*

29. *Id.*

30. *Conjunctive Use*, WATER EDUC. FOUND., https://www.watereducation.org/aquapedia/conjunctive-use (last visited Nov. 9, 2021); *See* Brian E. Gray, *Global Climate Change: Water Supply Risks and Water Management Opportunities*, 14 HASTINGS

However, there has been little focus on the "traditional groundwater legal regimes as a climate change issue."[31]

This paper explores how climate change and the current groundwater legal regimes interact in Colorado's San Luis Valley (Valley). The Valley was chosen as a case study because it is an example of a community that introduced voluntary measures to address the overuse of groundwater. This paper examines how those measures might have been sufficient if not for the additional challenge of climate change.

This paper will first explain the history of water management in the Valley. This paper will then provide a brief overview of groundwater hydrology and groundwater law in Colorado. Next, it will explain how voluntary water management developed in the Valley. Then, the paper will analyze why the voluntary water management system is not adequate in light of climate change and argue that the time for binding enforcement measures is now. The paper concludes that, without institutional accountability, groundwater law and management practices will continue to struggle with climate change.

A. Historical Context for San Luis Valley Voluntary Measures

The Valley is located in Southern Colorado, extending briefly into Northern New Mexico. It is a valley surrounded by mountains, the San Juan to the west and the Sangre de Cristo range to the east. It is an area in which the primary economic income is derived from farming.[32] The main crops are potatoes, barley, and alfalfa; all water intensive crops.[33] The valley has been consumed by a never-ending water saga.

The Valley does not receive much, if any, rainfall. It only receives about seven inches of rain per year on average.[34] So, where does the water that

---

W.-N.W. J. ENV'T. L. & POL'Y 1453, 1457 (2008) (explaining the impacts of climate change on the water supply and recommendations to mitigate those impacts); *See generally*, Justice Gregory J. Hobbs, Jr., *Protecting Prior Appropriation Water Rights Through Integrating Tributary Groundwater: Colorado's Experience*, 47 IDAHO L. REV. 5, 11 (2010) (explaining conjunctive management and Colorado water law).; John Hedges, *Currents in California Water Law: The Push to Integrate Groundwater and Surface Water Management Through the Courts*, 14 U. DENV. WATER L. REV. 375, 382 (2011).

31. Craig, *supra* note 27.

32. Carly Carswell, *Farmers Agree to Tax Those Who Deplete Groundwater,* HIGH COUNTRY NEWS (Feb. 25, 2013), https://www.hcn.org/issues/45.3/conservative-farmers-agree-to-tax-those-who-deplete-groundwater.

33. *Id.*

34. Paige Blankenbuehler, *After Years of Drought and Overuse, the San Luis Valley Aquifer Refills,* HIGH COUNTRY NEWS (May 26, 2016), https://www.hcn.org/articles/after-years-of-drought-and-overuse-a-water-basin-refills-in-the-san-luis-valley.

sustains the agricultural economy come from? Two places: (1) the Rio Grande River running through the Valley and (2) the two large aquifers that sit beneath the Valley.[35]

Water issues in the Valley originate from the compact delivery obligations placed upon the Rio Grande. Under the Rio Grande Compact and an international treaty with Mexico, Colorado must send a certain amount of water downstream to New Mexico, Texas, and Mexico.[36] The water delivery requirement is legally binding and, therefore, enforceable upon violation.[37] Colorado first violated these delivery obligations when a drought struck the Valley in the 1950s.[38] This drought led to a rise in groundwater pumping which took water away from the Rio Grande.[39]

After years of under-deliveries, Texas and New Mexico finally sued Colorado in 1966 for an "accumulated underdelivery of 944,000 acre-feet."[40] To comply with these delivery obligations, Colorado shut down or greatly restricted Rio Grande (i.e., surface water) users.[41] However, during this same time, well (i.e., groundwater) users faced no restrictions and continued pumping.[42] The differences in treatment between surface and groundwater users lead to litigation.[43] Many users fell into both categories because farmers in the Valley historically used wells to supplement their surface water supplies.[44]

In the 1970s, Colorado coordinated with the U.S. Bureau of Reclamation to develop the Closed Basin Project (CBP) to allocate water fairly between users.[45] The Closed Basin is a part of the Valley that is unconnected hydrologically to the Rio Grande.[46] There, water that flows into the Closed

35. Helen Smith, *San Luis Valley Water: Beneath the Surface*, ALAMOSA NEWS (May 17, 2017), https://alamosanews.com/article/san-luis-valley-water-beneath-the-surface.

36. Rio Grande Compact, N.M.S.A. § 72-15-23 Art. II-III (1978).

37. NICOLE T. CARTER ET AL., CONG. RSCH. SERV., R45430, SHARING THE COLORADO RIVER AND THE RIO GRANDE: COOPERATION AND CONFLICT WITH MEXICO 5 (2018).

38. Kathleen A. Miller et. al., *Groundwater Rights in an Uncertain Environment: Theoretical Perspectives on the San Luis Valley,* 33 NAT. RES. J. 727, 748 (1993).

39. *Id.*

40. *Id.*

41. Carswell, *supra* note 32.

42. *Id.*

43. Carswell, *supra* note 32; G.E. RADOSEVICH & R.W. RUTZ, SAN LUIS VALLEY WATER PROBLEMS: A LEGAL PERSPECTIVE, COLO. WATER RES. RSCH. INST. 25–29 (1979).

44. *See* William A. Paddock, *Implementation of Integrated Surface and Groundwater Administration Under the 1969 Act in the Rio Grande Basin, Water Division No. 3*, 22 U. DENV. WATER L. REV. 247, 266 (2019) (explaining how the moratorium on issuing well permits impacted users depending on both confined and unconfined aquifers).

45. Carswell, *supra* note 32.

46. Paddock, *supra* note 44, at 250.

Basin does not enter the Rio Grande.[47] That is, *inter alia*, a reason why the Closed Basin water is excluded from the waters of the Rio Grande Compact.[48] The "lowest part of the Closed Basin is known . . . as the 'sump.'"[49] The *sump* is an area where water pools and collects.[50] "There is no drainage from the basin and much of the water that flows into it is lost through evapotranspiration."[51]

The CBP was an attempt to take advantage of this unused water and satisfy multiple stakeholders at once. The CBP works by using wells to pump and drain water out of the Closed Basin area.[52] Then the "[w]ater salvaged from the . . . area is to be delivered to the Rio Grande River to help meet Colorado's obligations to New Mexico and Texas under the Rio Grande Compact."[53]

The reasoning behind the CBP was that by tapping into a previously inaccessible water source for compact deliveries, compact delivery obligations could be satisfied and well pumping would not have to stop.[54] Thus, well users through the Valley could keep pumping because the compact deliveries would be satisfied by another source of water.[55]

Unfortunately, the CBP never lived up to its promise. In the 1980s and 1990s it worked fairly well because there was plenty of precipitation and, therefore, multiple wet years.[56] Because of the ample precipitation, there was both enough water for well users to pump and enough surface water to meet delivery obligations.[57] However, the Closed Basin Project underdelivered.[58] This became a problem when drought struck the Valley in the early 2000s.[59]

Because the Project always underdelivered, Colorado could no longer meet its delivery obligations when drought arrived.[60] As a result, there was not enough water available for both well users and surface water users to

---

47. *Id*. at 269–70; Carswell, *supra* note 32 (stating "streams don't drain to the Rio Grande.").

48. *Id.* at 252.

49. PHILIP A. EMERY, HYDROGEOLOGY OF THE SAN LUIS VALLEY, COLORADO – AN OVERVIEW AND A LOOK AT THE FUTURE 1 (1996).

50. *See generally* Paddock, *supra* note 44, at 251 (describing the *sump* in the Rio Grande Basin).

51. Wm. Joe Simonds, *The San Luis Valley Project*, U.S. BUREAU OF RECLAMATION (last updated Aug. 4, 2015), https://www.usbr.gov/history/sanluisv.html.

52. Paddock, *supra* note 44, at 250-51.

53. Closed Basin Landowners Ass'n v. Rio Grande Water Conservation Dist., 734 P.2d 627, 629 (Colo. 1987).

54. Paddock, *supra* note 44, at 280-281; Carswell, *supra* note 32 ("The Closed Basin Project seemed like a win-win: Wells kept pumping, river irrigators got water, and regulators backed off.").

55. Paddock, *supra* note 44, at 274.

56. Carswell, *supra* note 32.

57. *Id.*

58. *Id.*

59. Carswell, *supra* note 32; Paddock, *supra* note 44, at 295.

60. Carswell, *supra* note 32.

sustain use as before the drought struck.[61] This led Colorado to cut off surface water users again while no limits were imposed on well users.[62] Old fights rose anew. The modern-day struggles of water management in the Valley had begun—and they have not stopped since.

I. PART I

Groundwater hydrology and groundwater law will help people understand the Valley's issues. To that end, this section first discusses the hydrologic relationship between surface water and groundwater. It then provides a brief historical overview of the development of groundwater law in Colorado, before moving onto legal structures unique to the Valley.

The scientific definition of groundwater is water that "exists in saturated soils beneath the earth's surface and in aquifers."[63] Groundwater can be either a finite or a renewable source depending on where it is located.[64]

The Valley has surface water and groundwater stored in aquifers.[65] "Aquifers are shallow and deep geologic formations" which store water underground.[66] They can either be confined or unconfined.[67] Water in a confined aquifer is trapped and cannot easily leave the aquifer.[68] This, in turn, creates constant pressure on the confined aquifer.[69]

In contrast, an unconfined aquifer moves around easier, and the water table rises and falls subject to atmospheric pressure.[70] Unconfined aquifers "are usually closer to the Earth's surface than confined aquifers are, and as such are impacted by drought conditions sooner than confined aquifers."[71]

---

61. *Id.*
62. *Id.*
63. TARLOCK & ROBISON, *supra* note 26, at 179.
64. *Id*. at 180. Typically, an aquifer can be considered to be a renewable resource if it has a high rate of recharge and is sustainably managed. A high rate of recharge means there is a large amount of water entering the aquifer. To sustainably manage an aquifer, managers must not take out more water than goes into the aquifer on average. "Pumping that exceeds a safe or sustained yield is mining" and turns an aquifer into a non-renewable resource. Then, an aquifer does not have water coming in to replace how quickly the water is being removed. *Id.* at §4:5.
65. EMERY, *supra* note 49, at 3.
66. TARLOCK & ROBISON, *supra* note 26, at 179.
67. *Id.*
68. *What is the Difference Between a Confined and Unconfined (Water-Table) Aquifer?,* USGS, https://www.usgs.gov/faqs/what-difference-between-confined-and-unconfined-water-table-aquifer#:~:text=A%20confined%20aquifer%20is%20an,the%20top%20of%20the%20aquifer (last visited Jan. 29, 2022).
69. *Id.*
70. *Id.*
71. *See id.*(stating that water in unconfined aquifers is able to "rise and fall.").

The Valley has both an unconfined and a confined aquifer.[72] The unconfined aquifer sits on top of the confined aquifer.[73] Generally, the two different aquifers exchange some water.[74] However, the unconfined aquifer interacts closer with surface water uses than the confined aquifer does.[75]

Confined aquifers are valuable because they are under constant pressure. Due to this pressure, when "the aquifer is first tapped . . . the cost of extraction is low."[76] Confined aquifers are "classified as artesian" sources.[77] This classification as *artesian* made a difference because historically "groundwater was subdivided into three major arbitrary and unscientific categories: artesian, percolating, and underground watercourses."[78] While groundwater laws in the United States have evolved over time, these classifications can still make a difference in how a particular type of groundwater is managed.

When water laws were developing, states, scientists, and lawyers did not have the technical understanding of groundwater that they do today.[79] Initially, it was thought that groundwater and surface water were two separate, distinct systems.[80] However, it is well known now that groundwater and surface water can be intimately related and are often the same system.[81] Actions that affect groundwater also affect surface water and vice versa. For example, "[p]umping and withdrawal of groundwater supplies often diminishes surface water supplies, causing it to percolate in aquifers, while diversion of surface water often leads to depletion of groundwater supplies."[82] Conversely, "surface water levels may increase when groundwater use is restricted."[83]

Unfortunately, this historical misunderstanding of the relationship between surface water and groundwater resulted in the development of a complicated groundwater management system. The initial belief that surface

---

72. EMERY, *supra* note 49, at 3.
73. *Id.*
74. *Id.*
75. *Id.*
76. TARLOCK & ROBISON, *supra* note 26, at 179.
77. *Id.*
78. *Id.*
79. *Id*.
80. *Id*.
81. Ruopu Li et al., *Evaluating Hydrologically Connected Surface Water and Groundwater Using a Groundwater Model*, 52 J. AM. WATER RES. ASS'N 799, 799 (2016).
82. Allison Evans, *The Groundwater/Surface Water Dilemma in Arizona: A Look Back and a Look Ahead Toward Conjunctive Management Reform*, 3 PHOENIX L. REV. 269, 273 (2010).
83. *Id.*

and groundwater were two separate systems led many states to manage them under two distinct legal regimes as separate resources.[84]

Historically, Colorado treated groundwater and surface water as two different resources.[85] Thus, initial efforts to comply with delivery obligations in the Valley resulted in a limitation on surface water users exclusively.[86]

Starting in the 1940s, "the amount of ground water appropriation dramatically increased" and "[c]onflicts between surface water users and ground water users became common."[87] Colorado started to see changes in surface flows due to poorly regulated groundwater pumping.[88] Change came in the 1960s when Colorado began to integrate surface and groundwater management.[89]

Colorado recognized that surface water use and groundwater use were connected. To maximize water usage and satisfy both surface and groundwater users, Colorado enacted the 1965 Groundwater Management Act (1965 Act). [90] This 1965 Act "was intended to bring groundwater into surface water rule."[91]

The surface water rule was that of prior appropriation.[92] Under prior appropriation, priority is given to "uses that are first in time."[93] This means that in times of scarcity, senior users are prioritized ahead of junior users.[94] This "doctrine is prevalent in the western United States" and when related to groundwater, "is the only doctrine . . . that does not necessarily relate water rights to ownership of the land overlying the groundwater."[95]

By recognizing that surface and groundwaters were connected, Colorado began to conjunctively manage its water resources. "'Conjunctive use' is the coordinated appropriation of ground and surface waters that are hydrologically connected."[96] This means that the same law is applied to both

---

84. LINDA A. MALONE, ENVIRONMENTAL REGULATION OF LAND USE – PRESERVATION OF ENVIRONMENTAL QUALITY § 9:2 (2020 ed.).

85. *See* Hobbs, J., *supra* note 30, at 12 (explaining that the Colorado Doctrine first recognized both surface and groundwater as a public resource).

86. *Id.*

87. Gallegos v. Colo. Ground Water Comm'n, 147 P.3d 20, 27 (Colo. 2006).

88. *See* RAST ET AL., GUIDANCE DOCUMENT – CONJUNCTIVE MANAGEMENT OF SURFACE AND GROUNDWATER IN THE RIO GRANDE BASIN 12 (2010).

89. *Gallegos*, 147 P.3d at 27–28.

90. Ari J. Stiller-Shulman, *No Seat at the Water Table: Colorado's New Groundwater Basin Statute Leaves Senior Surface Rights in the Lurch*, 84 U. COLO. L. REV. 819, 830 (2013).

91. RAST ET AL., *supra* note 88, at 12.

92. Stiller-Shulman, *supra* note 90, at 828.

93. LINDA A. MALONE, ENV'T. REGUL. OF LAND USE § 9:2 (2020 ed.).

94. TARLOCK & ROBISON, *supra* 26, at § 5:32.

95. *Id.*

96. *Id.*

surface and groundwater, usually in recognition of how closely connected the two types of waters are.[97] Conjunctive use is recognized as one of the better approaches for managing water.[98] The 1965 Act created the Colorado Groundwater Commission, which had the authority to regulate groundwater pumping through the issuance of permits and by designating "basins where groundwater would not injure surface rights."[99]

Colorado groundwater management was further refined with the Water Right Determination and Administration Act of 1969 (1969 Act). The 1969 Act essentially codified prior appropriation as the system of allocation for groundwater.[100] Significantly for the Valley, "well pumping came under the existing priority system, but junior rights would not be curtailed unless they caused definable injury to senior water rights."[101] Junior well users managed to squeak by and continue to pump through the use of temporary augmentation plans (aug plans).[102] Under an *aug plan*, well users balance what they extract by increasing supplies for senior-right holders in other ways.[103]

However, in the infamous South Platte litigation, the Colorado Supreme Court revoked the State engineer's authority to allow these temporary plans.[104] This meant well owners had to come up with permanent plans. Unfortunately, permanent *aug plans* are hard to create and get approved. To do so takes a lot of time and money, resources that most users cannot afford.[105] The threat of these permanent plans, combined with the drought that began in 2000, scared the Valley's groundwater users.[106] As a result, the groundwater users began to think of ways they could avoid having their water shut off.[107]

The Valley was able to consider alternative ways to solve their water crisis under the Rio Grande Compact and the Rio Grande Convention.[108] Colorado is legally obligated to deliver a certain amount of Rio Grande water

---

97. *Id.*

98. Gray, *supra* note 30; Hedges, *supra* note 30; Hobbs, J., *supra* note 30 (discussing water management practices and climate change).

99. Stiller-Shulman, *supra* note 90, at 830-831.

100. Gallegos v. Colo. Ground Water Comm'n, 147 P.3d 20, 27 (Colo. 2006).

101. RAST ET AL., *supra* note 88, at 12.

102. *See* Carswell, *supra* note 32 (explaining that well owners used annual plans to continue pumping water).

103. *Id.*

104. Empire Lodge Homeowners' Ass'n v. Moyer, 39 P. 3d 1139, 1152 (Colo. 2001).

105. Carswell, *supra* note 32.

106. *Id.*

107. *E.g. id*. (describing proposals made by groundwater users to improve the aug plan system).

108. *Id.*

to Texas, New Mexico, and Mexico.[109] This obligation is Colorado's primary concern in its management of the Valley water resources and what motivated the State's previous enforcement of groundwater delivery.[110]

This is different than other parts of Colorado. Usually, "Colorado water law requires water right owners to take an active role in protecting their rights against possible injury."[111] Today, much of the work to prevent injury is done by user-to-user compliance.[112] This self-policing means users monitor one another for overuse and sue one another when they think there has been a violation.[113]

However, Colorado is primarily concerned with Compact delivery obligations in the Valley.[114] If users came up with a solution of their own and still satisfied Compact deliveries, the State would likely let the Valley manage its own water resources.

But the water resources outlook in the Valley has changed yet again. It is entering another year of drought, a drought that shows no signs of letting up.[115] In the next section, this paper argues that due to climate change, Colorado must step in and manage water in the Valley. The self-imposed, voluntary measures have not done enough to conserve water in the aquifer, nor will they, due to climate change.

II. PART II

The first part of this section will go through the history and evolution of self-governance in the Valley. Legislation provided users in the Valley with three options: develop an aug plan, create fallow fields, or join a Subdistrict. The focus will be primarily on that legislation and the development of Subdistricts. The second part of this section will discuss why these measures have not been effective in managing groundwater. The primary reason being that economics and behavior do not incentivize conserving groundwater.

---

109. *Supra* Introduction, § *A. Historical Context for San Luis Valley Voluntary Measures.*

110. *Id.*

111. Miller et al., *supra* note 38, at 750.

112. Eds. note: Author's assertion

113. Eds. note: Author's assertion

114. Kelsey C. Cody et al., *Emergence of Collective Action in a Groundwater Commons: Irrigators in the San Luis Valley of Colorado*, 28:4 SOC'Y & NAT. RES. 405, 407 (2015); RADOSEVICH & RUTZ, *supra* note 43, at 3–5.

115. *See* Carswell, *supra* note 32 (discussing the Rio Grande Basin's record-setting drought).

A. Evolution and History of Water Self-governance in the Valley

In the early 2000s, drought struck all of Colorado.[116] Groundwater users across the State faced a reckoning. How could they reconcile their usage with the diminishing supplies available? In several regions, the State had to step in and limit usage.[117] And that was precisely what the Valley was afraid of. Rather than have the State step in and tell them what to do, farmers in the Valley thought to try and save their lives and community before someone else stepped in who would not.[118] To that end, users in the Valley pushed through legislation, developed strategies to conserve the aquifer, and even managed to restore some of the aquifer.[119]

The first step the Valley took in trying to deal with its water management issues was through the creation of a bill. In 2004, the Colorado General Assembly enacted Senate Bill 04-222 (SB 04-222).[120] SB 04-222 amended the 1969 Act by adding a new section that is only applicable to the "use of 'underground water'" in the Valley.[121] This legislation was unique in that it allowed a "form of self-regulation not available in other parts of the state."[122] This speaks to, and perpetuates, the difference in how Colorado allows the Valley to manage its water.

There were two significant parts to SB 04-222. First, it "directed the state to finally develop well regulations for the [V]alley."[123] In 2004, the Colorado State Engineer promulgated new rules governing the new groundwater uses in the Valley.[124] The rules were promptly challenged but subsequently upheld by the Colorado Supreme Court.[125]

Second, SB 04-222 recognized that the goal was no longer maximum utilization of water; instead, the goal was to sustainably manage groundwater

---

116. Bradley Udall & Jonathan Overpeck, *The Twenty-First Century Colo. River Hot Drought and Implications for the Future*, Water Res. Rsch., Mar. 24, 2017, at 2404.

117. Carswell, *supra* note 32.

118. *Id*.

119. *Id*.

120. Paddock, *supra* note 44, at 295.

121. *Id.*

122. *Id.* at 296.

123. Carswell, *supra* note 32.

124. There were nine new rules. "Rule 1 is the title, Rules 2 states the authority for the rules, and Rule 3 explains the scope and purpose of the rules… Rule 4 contains the definition of terms used in the New Use Rules… Rule 5 contains the principles and findings upon which the New Use Rules are based. Rule 5 summarizes the legal and factual standards the state engineer must apply when promulgating the rules…. Rule 6 is…the requirements for new withdrawals of groundwater affecting the Confined Aquifer System." Paddock, *supra* note 44, at 297–300.

125. *Id.* at 300–01.

long term.[126] To do this SB 04-222 "authorized sub-districts to charge for pumping and create court-approved groundwater management plans and state-endorsed annual plans to bolster rivers."[127]

SB 04-222 left citizens of the Valley with three options: "participate in a district, fallow their fields or work with water engineers to develop their own augmentation plans, which in turn need to be approved by state water courts."[128]

The idea of subdistricts came from citizens of the Valley itself.[129] The idea was that these subdistricts would be divided and set up by geography, so they would group those who already worked and lived together into a formal organization.[130] This would allow these subdistricts to make hard decisions internally.

These subdistricts would charge for pumped water and use that money to pay to fallow fields. Additionally, "[c]omputer models would determine the collective impact of each sub-district's wells to figure out how much the group needed to trim its pumping to rebuild the aquifer."[131]

In 2006, the rubber started to hit the road and Subdistrict 1 was created.[132] "Subdistrict 1 contains some 174,000 acres of irrigated farmland and approximately 3,000 irrigation wells, some 300 of which withdraw water from the confined aquifer system, and the balance of which withdraw water from the unconfined aquifer."[133] The board of managers of Subdistrict 1 were tasked with developing a water management plan.[134]

The goal of that water management plan was to restore water levels and "maintain a sustainable irrigation water supply in the [u]nconfined [a]quifer."[135] The plan provided an alternative to state-imposed water management regulations that would limit the use of irrigation wells within Subdistrict 1.[136] Instead, the water management plan used "a system of self-regulation based on economic incentives to promote responsible irrigation water use and management."[137]

126. *Id.* at 296.
127. Carswell, *supra* note 32.
128. Blankenbuehler, *supra* note 34.
129. Carswell, *supra* note 32.
130. *Id*.
131. *Id.*
132. *Id.*
133. Paddock, *supra* note 44, at 308.
134. *Id.* at 309.
135. *Id.*
136. *Id.*
137. *Id.*

There were multiple objections filed after publication of the initial water management plan.[138] After a series of lawsuits and amendments, an amended plan was created.[139] The amended plan gave Subdistrict 1 until 2031 to "restore the aquifer" and required the creation of annual replacement plans.[140] The amended plan was upheld in 2011 and the State Engineer approved Subdistrict 1's first annual replacement plan in 2012.[141]

The annual replacement plan was challenged as well and went all the way to the Colorado Supreme Court, where it was upheld.[142] "Subdistrict No. 1 has submitted an [annual replacement plan] and received state engineer approval thereof every year since 2012; none of which have been opposed."[143]

Unfortunately, under its water management plan Subdistrict 1 lacks enforcement authority. For example, it cannot require water cutbacks.[144] Furthermore, nowhere in SB 04-222 were water cutbacks statutorily required.[145] This meant Subdistrict 1 had "minimal tools besides higher taxes to restrain pumping or manage competition between members."[146] This lack of enforcement power is crucial because, as will be explained below, without enforcement power the Valley has not been able to conserve enough water.

The Valley has learned some lessons. There are now six subdistricts in the Valley, five new ones and the original Subdistrict 1.[147] All of these subdistricts can charge pumping fees, use that money to pay farmers to fallow fields, and pay farmers for general reductions in water use.[148]

There are a couple of significant differences between Subdistrict 1 and these newer subdistricts. First, the newer subdistricts can require water

---

138. *Id*. at 310.

139. *Id*. at 310–11.

140. Caitlin Coleman, *Hundreds of San Luis Valley Farm Wells at Risk as State Shortens Deadline to Repair the Rio Grande River*, WATER EDUCATION COLO. (Aug. 5, 2020), https://www.watereducationcolorado.org/fresh-water-news/hundreds-of-san-luis-valley-farm-wells-at-risk-as-state-shortens-deadline-to-repair-rio-grande-river/ [hereinafter *Hundreds of Farm Wells at Risk*]; *see* Paddock, *supra* note 44, at 316 (explaining that the first ARP was submitted to the state engineer in April 2012 and interested parties were given notice and opportunity to object the ARP).

141. Paddock, *supra* note 44, at 311–16.

142. *Id*. at 316–21.

143. *Id*. at 321.

144. Nick Bowlin, *Colorado Farmers Fight to Save Their Water and Their Community's Future*, HIGH COUNTRY NEWS (Sept. 16, 2019), https://www.hcn.org/issues/51.16/water-colorado-farmers-fight-to-save-their-water-and-their-communitys-future.

145. *Id.*

146. *Id.*

147. Blankenbuehler, *supra* note 34; The new subdistricts are "Conejos, Alamosa-La Jara, Rio Grande, San Luis, and Saguache Creek Response Areas." Paddock, *supra* note 44, at 332.

148. Carswell, *supra* note 32.

restrictions.[149] On the other hand, these newer subdistricts are based on an 'opt-in' approach where irrigation groundwater users within a response area elect to be included in the sub-district.[150] This results in a *checkerboard* subdistrict that includes parcels of land that may not be contiguous.[151] It is worth noting that some users in the Valley will never be part of a subdistrict because they are geographically outside the boundaries of the subdistricts or because they are a municipality or on federal land.[152]

For a while, the subdistrict initiatives worked. In 2012, the aquifer levels in the Valley were rebounding.[153] "Water users in sub-district 1 pumped one-third less water . . . Area farmers have fallowed 10,000 acres . . . Since a low point in 2013, the aquifer . . . recovered nearly 250,000 acre-feet of water."[154] It appeared the aquifer would keep recovering. Then a dry spell in 2018 wiped out any gains.[155] The aquifer dropped "about 800,000 acre-feet below the . . . legally mandated recovery level."[156] The next section will explore why the subdistrict's voluntary measures, particularly those of Subdistrict 1, are not sufficient in the context of climate change.

B. Analysis of Self-governance Measures

In an attempt to conserve their communal resource, groundwater users in the Valley supported legislation that provided users in the Valley with three options.[157] Users could "participate in a district, fallow their fields or work with water engineers to develop their own augmentation plans."[158] These districts in turn could adopt rules that would increase the cost to pump water, pay farmers to fallow fields, or use other tools they developed.[159]

Ultimately, due to climate change, these initiatives have not been enough to conserve groundwater in the Valley. Climate change and the prolonged

149. Bowlin, *supra* note 144.
150. *Id.*
151. Paddock, *supra* note 44, at 333.
152. *Id*. at 334.
153. Blankenbuehler, *supra* note 34.
154. *Id.*
155. Bowlin, *supra* note 144.
156. *Id.*
157. Blankenbuehler, *supra* note 34.
158. *Id.*
159. Bowlin, *supra* note 144 ("Subdistrict 1 has several tools at hand to curb pumping. The primary one is a fee on pumped water, . . . There is also a program that pays farmers to take land out of production"); *Enhancing and Protecting the Water Rights of the Citizens of the San Luis Valley who Reside Within the Boundaries of the District*, RIO GRANDE WATER CONSERVATION DIST., https://www.rgwcd.org/sd-1-conservation-page (last visited Jan. 29, 2022).

drought have put the Valley on the edge of a *tragedy of the commons*. The economics and behavior of water usage do not incentivize conserving water.

The *tragedy of the commons* occurs when there is uninhibited access to a communal resource. Some users begin to take more than their fair share of that resource, which in turn encourages others to take more than their fair share as well.[160] This leads to unsustainable resource consumption to the point of depletion.[161] "As long as users show restraint the resource is maintained."[162]

An idea that is closely related to the tragedy of the commons is a *common pool resource*. A *common pool resource* is any resource "from which it is difficult to exclude or limit users once the resource is provided" by nature or produced by humans.[163] A common pool resource is prone to depletion when one's use of the resource makes it unavailable for another person's use. When a common pool resource has a high value, but weak legal or institutional constraints, users have strong incentives to take as much as they can and deplete the overall supply available for future users.[164]

That is exactly what happened in the Valley. Prior appropriation, combined with lax management of groundwater in the Valley led water users to pump water to the full extent of their rights with little regard for other users. This overuse combined with drought caused Colorado to fall behind on compact deliveries in the 1960s.[165] As a last-ditch effort, Colorado imposed water restrictions.[166]

This is a classic example of a common pool tragedy; individuals work to maximize their own benefit at the expense of others. With weak constraints in effect for some, and no constraints at all for others, well users continued to pump away. Potentially, had all water users worked together to ration the limited resource, then more users could have kept using the resource in the future. However, conservation for mutual benefit is difficult to achieve.

Research has shown that "resource dilemmas are best resolved when there is communication between group members, when a sense of group identity or solidarity exists among group members, or when education is

---

160. Kennon M. Sheldon & Holly A. McGregor, *Extrinsic Value Orientation and the "Tragedy of the Commons"*, 68 J. OF PERSONALITY 383, 384.

161. *Id.* at 383–85.

162. *Id.* at 384.

163. Elinor Ostrom, *Coping with Tragedies of the Commons*, 2 ANNU. REV. POL. SCI. 493, 497 (1999).

164. Melissa K. Scanlan, *Droughts, Floods, and Scarcity on a Climate-Disrupted Planet: Understanding the Legal Challenges and Opportunities for Groundwater Sustainability*, 37 VA. ENVTL. L.J. 52, 59 (2019).

165. Carswell, *supra* note 32.

166. Gallegos v. Colo. Ground Water Comm'n, 147 P.3d 20, 27 (Colo. 2006).

given regarding the long-term benefits of cooperation."[167] The Valley has taken all of these steps and, so far, managed to avoid a complete collapse of its groundwater resources. The Valley has avoided this tragedy because users began to work together to conserve their groundwater, their common pool resource.[168]As users became aware of the effects of their actions on others, some began to recognize that if they all wanted to continue to pump water, they would have to work together and impose limits on everyone in order for everyone to continue pumping, albeit at a lower rate.[169]

These self-governance efforts are not enough without enforcement power to actually shut off and limit pumping. There are lots of reasons for farmers in the Valley to only look out for themselves and there are lots of economic incentives to do so as well. Small farmers are struggling with expensive bills.[170] Other farmers who can afford to pump are outcompeting those who cannot.[171] But the biggest problem, by far, is the weather, a factor that no one can control. If the Valley continues to experience drought, no amount of conservation will solve the problem.

Think of an aquifer like a bank account. When more water goes in, more water can be taken out or in the alternative saved. When less water goes in, less water can be taken out. If the Valley continues to have dry years, it does not matter how little water is taken out of the aquifer because there is not enough water going in to make up for the amount being taken out.

Ultimately, the *tragedy of the commons* is a behavioral issue. To work to preserve a common resource so everyone can keep using it takes some thought. You have to buy into the solutions, and you need to care about those affected. In the Valley, that is not always the case. There are some who simply do not care. They have "vowed that as long as there's water in their hole, they're going to pump it."[172] Others say there is a "mindset of, 'I can pay for it, so it's my neighbor's problem.'"[173] It makes no sense for others to conserve a resource when they can see others who are not conserving it. It undermines the whole project.

The communal mindset also suffers in the Valley due to its changing demographics. The Valley was historically a tightly knit community.[174]

---

167. Sheldon & McGregor, *supra* note 160, at 384.
168. *See also* Cody et al., *supra* note 114, at 406.
169. Carswell, *supra* note 32; Bowlin, *supra* 144.
170. Bowlin, *supra* note 144.
171. *Id.*
172. Carswell, *supra* note 32.
173. Bowlin, *supra* note 144.
174. Cody et al., *supra* 114, at 418; Bowlin, *supra* note 144.

Today, only about 50,000 people live in the entire area.[175] Agriculture has driven the economy for decades, often with small farms.[176] But that has started to change. No longer is the community composed of only tightly knit neighbors. As families sell and leave the Valley, farms are purchased and consolidated by corporations.[177] "Department of Agriculture census records show an increase in the number of large . . . farms in recent decades."[178] "In the past few years . . . three locally owned farms nearby sold, in part due to the ever-rising pumping fee, with most of the land going to out-of-state investment firms."[179] For farms and companies with a smaller stake in taking care of the Valley, it is not a life-or-death matter if they cannot continue farming and living in the area. These large corporate farms do not care as much about the community nor conserving its resources.

This brings up the second reason why the Valley is turning into a *tragedy of the commons*—economics. In order to stave off a *tragedy of the commons*, everyone must take a cut so everyone can still prosper. This does not work when some farms cannot survive, even with a small cut or when there are those who can afford to pay more for the resource.

As mentioned earlier, the Valley was historically a tight-knit community made up of small farms.[180] These small farms operate on tight financial budgets.[181] In order to simply survive, these small farms will pump as much groundwater as they legally can. They will not able to survive otherwise. This problem is exacerbated in wetter years. When there is enough water to go around, farms will choose to plant more water-intensive crops like alfalfa and barley because these water-intensive crops are more lucrative than other crops.[182] This means in wetter years, short term farming economics incentivize more water use instead of conservation, which might restore groundwater reserves.

In drier years, the Valley has tried to conserve groundwater by increasing the price farmers pay per gallon when pumping groundwater.[183] Unfortunately, this also has unintended consequences. Increasing the price of groundwater favors senior water right holders and large corporate farms.

---

175. Blankenbuehler, *supra* note 34.
176. Bowlin, *supra* note 144 ("The San Luis Valley depends on agriculture.").
177. *Id*.
178. *Id*.
179. *Id*.
180. Bowlin, *supra* note 144.
181. *Id.*
182. *Id.*
183. *Id.*

Increasing the price to pump groundwater favors senior water rights by working in combination with another water conserving tool: a credit.[184] Under this credit system, "those with excess water can sell it to those who want more."[185] This favors senior water rights because in wetter years, they can either use that water to grow the lucrative water-intensive crops such as alfalfa or barley, or in drier years they can sell that water.[186] Either way, senior water users profit at the expense of junior users.

However, senior water users do not always profit from this scheme. Some senior water users have seen their crops suffer as large commercial farms around them take advantage of the credit system.[187] The credit system only allows permitted groundwater to be drawn out of the system. It doesn't allow more water to be drawn out than that. Thus, it shouldn't matter if a senior or junior user draws that water because they have a right to do so.

Yet, due to the complexities of hydrology, depending on where the water is physically pumped from, it can lower the water table for other water users, preventing them from being able to use their water rights.[188] So, in some cases, a large farm will buy credits with the effect that a neighboring senior rights holder will be unable to pump their share of water.[189]

It is also hard for the Valley to conserve water by increasing the price of water because smaller farms, with tighter operating budgets, struggle to afford these higher water prices.[190] Larger farms can.

This has potential to create a vicious feedback loop where smaller farms cannot compete with larger farms, and the smaller farms are forced out of business.[191] This in turn could free up more water for larger corporate farms. These large farms are not as invested in the Valley, and do not always subscribe towards the communal view necessary to save groundwater in the Valley. Some farmers also argue that the price set for water is artificially

184. *Id.*
185. *Id.*
186. *Id.*
187. *Id.*
188. This is a phenomenon is known as the groundwater cone of depression. *Groundwater and Wells: Understanding Groundwater*, OR. STATE UNIV., https://wellwater.oregonstate.edu/groundwater/understanding-groundwater/groundwater-and-wells (last visited Jan. 29, 2022).
189. *E.g.*, Carswell, *supra* note 32 ("Plus, the North Star wells and others have for years slowly strained the supply of creek water and lowered the water table.").
190. Bowlin, *supra* note 144.
191. *Id*.

low.[192] Farmers are still paying less for pumped water than they would for imported water.[193] This is part of what encourages large commercial farms.

Another economic issue facing the Valley is that of water exportation. The Valley has long been eyed by front-range developers for its water.[194] For smaller farms, if the price paid for exported water is high enough, it could be hard to say no. While not many in the Valley support exporting water, some may have no choice.

Finally, another incentive Subdistrict 1 has tried to implement is paying farmers to fallow fields instead of planting crops.[195] This only works if fallowing is more than, or at least as profitable as, farming. That is not always the case.

In years where commodity prices are higher than what Subdistrict 1 can pay to fallow fields, the high prices make conserving water hard because it is not economically worth it.[196] For one farmer, "[t]he $96,000 payment from Sub-district 1 for fallowing a quarter of his total acreage was at most a third of what the Coors beer company would have paid for a rotational barley crop."[197]

2012 was the first year the Valley paid farmers in Subdistrict 1 to fallow fields.[198] The goal is to ultimately fallow 40,000 acres by 2021.[199] In 2012, 8,300 acres were fallowed through contracts with Subdistrict 1.[200] While "another 15,000 to 20,000 acres were rested through private insurance that pays farmers not to plant during droughts," the private program does not promote the long-term fallowing that Subdistrict 1 seeks to achieve.[201] "10,000 acres were fallowed by 2016."[202] 2020 saw the highest participation in the fallow program yet with an additional 13,000 acres enrolled.[203] But that is still short of the 40,000-acre goal.

The Valley is not simply fighting against economics. Economics can be figured out. The weather is the biggest challenge facing the Valley's

192. Carswell, *supra* note 32.
193. *Id.*
194. *Id.*
195. Paddock, *supra* note 44, at 310.
196. Carswell, *supra* note 32.
197. *Id*.
198. *Id.*
199. *Id.*
200. *Id.*
201. *Id.*
202. Blankenbuehler, *supra* note 34.
203. Caitlin Coleman, *Wells at Risk as State Shortens Deadline to Repair Rio Grande River*, THE FENCE POST (Aug. 5, 2020), https://www.thefencepost.com/news/hundreds-of-san-luis-valley-farm-wells-at-risk-as-state-shortens-deadline-to-repair-rio-grande-river/.

groundwater and conservation efforts—it threatens to pull out the rug from underneath all the residents' efforts is the weather. Despite residents' efforts, no progress has been made on restoring the aquifer, and aquifer levels have declined.[204] "Between July 2019 and July 2020 the [V]alley's unconfined aquifer . . . dropped by 112,600 acre-feet. All told, the aquifer has lost around 1 million acre-feet of water since the drought of 2002."[205]

2018 was an incredibly dry year. "The U.S. Department of Agriculture designated the valley a drought disaster area."[206] Because the Valley was so dry that year, farmers pumped so much groundwater they wiped out the gains and replacements they had put into the aquifer in previous years.[207] In other years when the Valley has been dry, the aquifer has lost more water than it has gained.[208] Even when wet years are interspersed with dry ones, the wet years do not help the aquifer.[209] Due to the economic situations mentioned previously, when there are wet years, the Valley has not been able to make gains on restoration because everyone uses the extra water.[210]

Furthermore, even if users were able to conserve extra water, the Valley cannot rely on wet years to restore the aquifer. The southwest is experiencing a general drying and warming trend.[211] Dry and warm could possibly become the new normal. If that is the future, what is the Valley to do?

Combining economics with behavior and the climate makes for a potent combination. The combination makes conserving groundwater in the Valley particularly challenging. From the behavioral side, all these efforts to conserve water can seem in vain when the weather does not cooperate, and not everyone participates in efforts to conserve the resource.

This creates a death spiral of sorts. As efforts appear futile, more and more subdistrict participants might choose not to follow the rules. Or, participants not yet in subdistricts may decide not to form one at all. Valley residents are legally obligated to participate in a subdistrict, fallow their fields, or develop an *aug plan*, which requires well users to replace the water they consume.[212] Yet without enforcement, residents are not easily made to participate in these options.

---

204. Bowlin, *supra* note 144.
205. Coleman, *supra* note 140.
206. Bowlin, *supra* note 144.
207. *Id.*
208. Carswell, *supra* note 32.
209. Bowlin, *supra* note 144.
210. *Id.*
211. *Climate Change Indicators*, *supra* note 1.
212. Carswell, *supra* note 32; Paddock, *supra* note 44, at 333.

As more users choose not to participate in conservation, it begins to seem pointless. This, in turn, makes it harder to conserve the resource because fewer and fewer users are helping.

While a total lack of participation has not happened yet, if the drought becomes worse and agriculture becomes less profitable, it is entirely possible to achieve full participation. For many Valley residents, the reason they keep up the thankless work of trying to use less water is because of their love for the community, area, and farming.[213] It is hard to predict when or if the breaking point of that love will come.

Given the challenges that the Valley is facing, some might ask why bother? Especially given the realities of climate change, why not give up farming in the Valley entirely? In response, people in the Valley say their lives and livelihoods are worth just as much as anyone else.[214] "People who live here aren't any more special than people anywhere else . . . but they also aren't any less special than anyone else."[215]

The people in the Valley are afraid of a complete well shut off.[216] A complete well shut off will ruin lives.[217] In 2020, the Colorado State Engineer said, "we'll see in the next couple of years if we can turn around this trick."[218] Given how dry the winter of 2021 has been, the threat seems imminent.[219] While residents of the Valley knew this threat was always looming in the background, greater institutional accountability was needed to prevent it. An example would be mandatory water restrictions. The subdistricts had a lot of potential to solve water issues in the Valley. However, considering climate change, they needed something more—they needed enforcement authority.

No one wants to be the person who says no. No one wants to be the one to say "enough." While the people of the Valley thought voluntary and market measures would be enough to conserve their groundwater, they have not been. Economics, behavior, and the weather have proved them wrong.[220] Unfortunately, someone or something has to step in at some point and stop or limit groundwater pumping. That someone might be the Colorado State Engineer in the next couple of years. But it could have been Subdistrict 1 if it had been granted enforcement authority.

---

213. *See* Bowlin, *supra* note 144 (detailing interviews with community members about their love of agriculture and the community).

214. *Id.*

215. *Id.*

216. *Id.*

217. *Id.*

218. *Hundreds of Farm Wells at Risk*, *supra* note 140.

219. Bollinger & Freeman, *supra* note 5.

220. Bowlin, *supra* note 144.

Either way, greater institutional accountability is required in order to conserve groundwater resources in the future. The Valley has proven that voluntary conservation efforts are not enough. Climate change is hard on farmers and businesses whose work depends on water use. People have to make a living and survive somehow. No one likes to address consequences, but a line must be drawn if we want to conserve a resource. Otherwise, there will always be those who will try to maximize the resource to the fullest extent possible.

Unfortunately, if institutions continue to follow the current law in the Valley, senior users will be prioritized over junior users. That means plenty of users will suffer. It is possible the Valley's attempts to conserve groundwater could still work if the Valley could make decisions on its own and enforce that. However, it may be too late to find out.

III. PART III

Greater institutional accountability is required to manage groundwater, regardless of what is known or unknown about the hydrology of certain groundwater resources. The lack of information regarding the future of climate change is often used as an excuse for inaction. The unknowns and fear of reprisal paralyze decision makers. This section will argue that decision makers in the Valley cannot wait for more scientific knowledge to decide how to conserve their resources. If decision makers continue to wait, it may be too late to rescue groundwater in the Valley.

In a place like the Valley and in general, waiting for more science in order to make a decision is no longer an option. As discussed earlier, the climate of the Valley is already changing. The changing climate is part of the megadrought gripping the Southwest.[221]

No one knows for certain what will happen to the Southwest climate as our climate changes. However, scientists already know "[s]treamflow totals in . . . the Rio Grande . . . were 5% to 37% lower between 2001 and 2010 than the 20th century average flows."[222] Parts of Colorado are already 3.6°F warmer than they were a century ago.[223]

While it may be harder to argue against the science of climate change, some might also point to the hydrology of the Valley and reliability of the

221. Freedman & Fears, *supra* note 6.

222. *Southwest*, NAT'L CLIMATE ASSESSMENT, https://nca2014.globalchange.gov/report/regions/southwest (last visited Nov. 12, 2021).

223. Mufson et al., *2°C: Beyond the Limit*, WASH. POST (Aug. 13, 2019), https://www.washingtonpost.com/graphics/2019/national/climate-environment/climate-change-america/.

RGDSS Groundwater Model as a reason for inaction. The RGDSS Groundwater Model is the Rio Grande Decision Support System.[224] Decision Support Systems are computer based systems that use data and computer models to help decision makers solve unstructured problems. Colorado has developed a decision support system for every major water basin in the state.[225]

The hydrology of the Valley is complex.[226] Initial hydrologic studies of the Valley during the 1960s and 1970s.[227] These studies were conducted in order to implement the 1969 Act.[228] The passage of HB 98-1011 mandated the most recent research into understanding the hydrology of the Valley, spurring the creation of RGDSS Groundwater Model.[229]

HB 98-1011 was passed in 1998 after efforts to export water out of the Valley.[230] "[W]ater users in the Valley sought help from the State of Colorado to undertake the scientific investigations needed to determine if and how further groundwater development could occur in the Valley without injury to vested water rights or interference with the state's obligations under the Compact."[231] Much was unknown about the confined aquifer, "its hydrologic connections to the overlying unconfined aquifer and surface waters (including the Rio Grande), [or] its sources of recharge and their interannual variability."[232]

In 2004 the RGDSS Groundwater Model was challenged as unreliable and inadequate.[233] The Colorado Supreme Court rejected this challenge and new data continues to improve RGDSS Groundwater Model.[234] However, without regular and continuous updates to the Model, "the Model will cease to be reliable and can no longer serve as a reasonable basis for groundwater administration in the San Luis Valley."[235]

---

224. Paddock, *supra* note 44, at 294.

225. *About Us*, COLORADO'S DECISION SUPPORT SYSTEMS, https://cdss.colorado.gov/about-us (last visited Jan. 29, 2022).

226. *Id.* at 250; Cody et al., *supra* note 114, at 407.

227. *See generally* P.A. EMERY ET AL., HYDROLOGY OF THE SAN LUIS VALLEY, SOUTH-CENTRAL COLORADO, U.S. DEP'T OF THE INTERIOR GEOLOGICAL SURV. (1969) (providing a study report from 1969); *See* P.A. EMERY ET AL., HYDROLOGY OF THE SAN LUIS VALLEY IN SOUTH-CENTRAL COLORADO: HYDROLOGIC INVESTIGATIONS ATLAS HA-381, U.S. DEP'T OF THE INTERIOR (1971) (geological survey).

228. Paddock, *supra* note 44, at 292.

229. *Id*. at 294.

230. *Id.* at 293.

231. *Id.*

232. Miller et al., *supra* note 38, at 751.

233. Paddock, *supra* note 44, at 301.

234. *Id*. at 302.

235. *Id*. at 334-35.

With the newer information provided by the RGDSS Groundwater Model, the Valley is still trying to collect more information about the hydrology of the area.[236] A large part of this stems from the fact that the Colorado Revised Statutes require "maintenance of artesian pressure while allowing pressure fluctuations within the ranges that occurred during the period of 1978 through 2000."[237] But no one knows what the pressure was during that time period because no one was collecting that data at that time.[238] To make up for the lack of historical information, the Valley hopes that new information can fill in some of these gaps.[239]

Defining the standard for a sustainable aquifer water supply is also difficult "[when there] is [a] lack of comprehensive data on the relationships between basin scale hydrologic conditions and the resulting artesian pressure in the confined aquifer."[240] To achieve this goal, the Valley continues to collect more data.[241]

While it is important for the Valley to continue collecting data to better understand the hydrology of the Valley for statutory and management reasons, a lack of a complete understanding of the hydrology of the Valley should not be an excuse for inaction. Valley residents and the State of Colorado recognize that changes in groundwater pumping have an effect on surface water availability and how much water is available in the aquifer.[242] So, while it may not be known precisely how much water is left in the Valley or how exactly everything is interconnected, that is no reason to delay enforcement or institutional accountability. The Colorado State Engineer has said that if it ever becomes clear the Valley cannot "reach a sustainable level by the year 2031, then, yes, . . . his office would shut off irrigation for a substantial part of the area."[243]

However, if the State Engineer waits that long, given how little is understood about the hydrology of the Valley, then it might be too late. If someone does not hold Valley residents accountable sooner, rather than later, users will continue to deplete the resource. The only thing that seems to scare Valley residents is the threat of a well shut-off.[244] When subdistricts were

236. *Id*. at 335.
237. COLO. REV. STAT. 37-92-501(4)(a)(III) (2019).
238. Paddock, *supra* note 44, at 335.
239. *Id*.
240. *Id*. at 327.
241. *Id.*
242. Bowlin, *supra* note 144.
243. *Id.*
244. *Id.*

created, the Valley thought they would be sufficient.[245] Yet, the Valley "could not account for the realities of a changing climate, and [Subdistrict 1] has proven unable to discourage enough farmers from pumping."[246]

No one ever wants to be the one to say enough. But without greater institutional enforcement, whether local or from the state, the aquifer cannot be saved. By not stepping in to limit pumping earlier, the Valley, perhaps this year, will face an even uglier reality than it already does.

CONCLUSION

Who cares if the Valley runs out of water? Who cares if the self-governance experiment does not work out in the Valley? Users of groundwater across the nation, particularly in the Southwest, should care. The Valley is a canary in the coalmine right now. Despite their best efforts, users in the Valley have been unable to conserve enough water in the face of climate change.

Conjunctive management is difficult. One often hears about how groundwater resources are overtaxed,[247] yet they are a resource that seems to keep lasting beyond anyone's expectations. The science keeps changing, extending the expected lifespan of groundwater resources. It is unclear how much humans can, or will, curb their behavior to conserve such resources.

But climate change is changing all that. Climate change has made it increasingly difficult to conserve enough water.[248] Voluntary measures are not enough to conserve water in light of the challenges climate change presents. Under the pressure of climate change, voluntary measures are not sufficient due to a combination of behavior and economics.

When there are no mandatory water restrictions in the Valley, users are unlikely to limit their water consumption. Some users only care about themselves and not the community as a whole. Other users, particularly small farms, are struggling with expensive bills.[249] Other users who can afford higher prices are outcompeting those who cannot.[250] Depending on the year, users either cannot afford to fallow fields, or it is not economically worth it

---

245. *Id.*

246. *Id.*

247. Lucas Bessire, *The Next Disaster Coming to the Great Plains*, THE ATLANTIC (Dec. 26, 2021), https://www.theatlantic.com/ideas/archive/2021/12/kansas-aquifer-ogallala-water-crisis-drought/621007/; Jonathan Thompson, *As Temperatures Rise, Arizona Sinks*, HIGH COUNTRY NEWS (Apr. 1, 2020), https://www.hcn.org/issues/52.4/infographic-water-as-temperatures-rise-arizona-sinks.

248. Bowlin, *supra* note 144.

249. *Id.*

250. *Id*.

to fallow fields.[251] Currently, there is more water leaving the aquifers in the Valley than entering them.[252] The megadrought, combined with the economics of water pumping, has exposed flaws in the system.

Water managers, politicians, and users in the Valley are aware of this.[253] Many are aware that a painful future is looming. Despite their best efforts, they have not been able to do enough. The inability to conserve water without the threat of a well shut-off in the Valley should serve as a lesson. The biggest takeaway by far is that without institutional accountability, other efforts will not be enough to conserve groundwater.

Water users in the Valley are human. But, as demonstrated earlier, they will not stop pumping water until forced.[254] People need someone to come in and enforce limits on water. Otherwise, as the Valley has shown us, even in the face of a dire future, economics and human behavior will always keep some users pumping water to the detriment of others.[255] Enforcement of mandatory measures, such as limits or restrictions, is the only way forward to conserve groundwater in the face of climate change.

---

251. Carswell, *supra* note 32.

252. Bowlin, *supra* note 144 (infographic).

253. Bowlin, *supra* note 144.

254. *See supra* Part II (discussing ineffectiveness of self-governance measures without enforcement power).

255. 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/.