

Managed Retreat of Agriculture in the Arid West

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U.S. agricultural policy has subsidized farming in place and sought to tame aridity with science, money, and dams. Now, the ongoing megadrought has severely contracted water supply and rendered western agriculture inviable at its present scale. In response, an increasing number of farms, particularly small farms, are shuttering agricultural operations, filing bankruptcy, fallowing fields, slaughtering livestock, and selling water rights. And the pain is only beginning. The current drought retreat is poised to be the most severe in western history due to climate change, urbanization of the West, and unaccounted for water claims. This Article makes two contributions to the western agricultural water crisis. The first is to provide the only scholarly account of the current “third wave” of western drought retreat—a massive societal event that has been virtually ignored by policymakers and researchers. The Article’s second contribution is to propose a solution: the federal government should adopt agricultural “managed retreat” to soften the pain of climate transition for stranded small farmers. We seek to shift thinking about agricultural climate policy from its longstanding and exclusive focus on supporting farming in place, to recognize a role for managed retreat. Our proposal for agricultural managed retreat is designed primarily as an economic relief policy, although one with secondary benefits to food security and water shortage. Options for implementing federal managed retreat include voluntary federal acquisition of western farmland or water rights or government relocation assistance (physical retreat) and repurposing farmland and retraining farmworkers (economic retreat).

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INTRODUCTION

This Article proposes an anathema to American agricultural policy: government should assist in relocating and repurposing drought-stricken farms in order to provide relief to small farms and farmworkers. It is no longer possible to maintain western agriculture at its current scale. Nonetheless, federal agricultural policy has hewed to the orthodoxy of maintaining farms and ranches in the West by subsidizing irrigation and compensating farmers for losses.¹ As

1. KENNETH D. FREDERICK & JAMES C. HANSON, WATER FOR WESTERN AGRICULTURE 66-70, 117-21 (2016) (describing federal irrigation subsidies); Joseph W. Glauber, *Crop Insurance Reconsidered*, 86 J. AGRIC. ECON. 1179, 1180-83 (2004) (recounting history of crop insurance and critiquing shortcomings); Christine A. Klein, *On Dams and Democracy*, 78 OR. L. REV. 642, 641-44, 659-65 (1999) (examining the political dynamics and social costs of damming rivers for agriculture). Moreover, crop insurance appears to increase water use and the need for irrigation, creating a circle of federal subsidy. See Prasenjit Ghosh et al., *Crop Insurance Premium Subsidy and Irrigation Water Withdrawals in the Western United States*, 48 GENEVA PAPERS ON RISK & INS.-ISSUES & PRAC. 968, 973 (2021).

currently located and practiced, agriculture uses the lion's share of the nation's water supply, accounting for 80-90 percent of consumptive water use.² Now, the combined effects of megadrought and climate change, urbanization of the West, and unaccounted for water claims are slamming into a dwindling western water supply. The Colorado River is diminishing, and water users have dangerously depleted groundwater, all against the backdrop of new federal limits on consumption of Colorado River water.³

Water shortage is forcing agriculture out of the arid West in a painful, ad hoc drought retreat as farms fold operations and fallow crops.⁴ Most small western farms lack the technical expertise and funds to relocate to water-rich regions, or to switch to less water-intensive crops or non-agricultural sources of revenue.⁵ Instead, small farmers and ranchers often drain their savings to withstand crop losses from drought, sometimes only to collapse in the end. In addition to individual losses, farm closures pose a growing threat to national food security. Market-based drought retreat has proven haphazard, chaotic, and regressive—a far cry from a just climate transition.

Policymakers and researchers have virtually ignored the current drought retreat, which this Article establishes as the third major western drought retreat in U.S. history. The first U.S. drought retreat occurred when the Union Pacific and Santa Fe railroads led settlers onto the Great Plains who believed that “rain would follow the plough,” only to be financially devastated and driven out by the 1890s drought.⁶ Following extensive federal irrigation projects, the Dust Bowl droughts of the 1930s led to a second drought retreat, which also caused horrific farmer suffering and dislocation and threatened the nation's food supply.⁷ We now face the third, and potentially most significant, wave of western agricultural dislocation. Despite this ongoing history, drought retreat, or other names for this phenomenon, are not even terms in the debate about the future of western water use. We have borrowed the term “retreat” from research and policy on government-sponsored residential relocation in response to sea-level rise and

2. GLENN D. SCHAIBLE & MARCEL P. AILLERY, U.S. DEP'T. OF AGRIC., ECON. RES. SERV., WATER CONSERVATION IN IRRIGATED AGRICULTURE: TRENDS AND CHALLENGES IN THE FACE OF EMERGING DEMANDS, *EIB-99*, 1 (Sept. 2012).

3. See Robert S. Pulwarty et al., *The Hardest Working River: Drought and Critical Water Problems in the Colorado River Basin*, in WATER CRISES: SCIENCE, TECHNOLOGY AND MANAGEMENT ISSUES 249, 258-59 (Donald A. White ed., 2005) (examining declining water quantity); Leonard F. Konikow, *Long-Term Groundwater Depletion in the United States*, 53 *GROUNDWATER* 2, 3-5 (2015); see generally BUREAU OF RECLAMATION, AGREEMENT CONCERNING COLORADO RIVER DROUGHT CONTINGENCY MANAGEMENT AND OPERATIONS (2019), <https://www.usbr.gov/dcp/docs/final/Companion-Agreement-Final.pdf> [hereinafter DROUGHT CONTINGENCY AGREEMENT].

4. See *infra* Part I.

5. See *infra* Part I.

6. Gary D. Libecap & Zeynep Kocabiyik Hansen, “Rain Follows the Plow” and Dryfarming Doctrine: The Climate Information Problem and Homestead Failure in the Upper Great Plains, 1890-1925, 62 *J. ECON. HIST.* 86, 93-94, 100-01 (2002) (examining rain follows the plow theory and how railroads benefit from endorsing this climate misinformation).

7. See *infra* Part II.B.

increased inland floods because it captures the need for some irrigated agriculture to relocate from arid regions due to climate change and water scarcity.⁸

The third wave of drought retreat is poised to be the most severe in U.S. history due to a confluence of climate change, western urbanization, unaccounted water rights, and U.S. agricultural policies that have misallocated water for over a century. Federal policies developed during the 1890s High Plains drought and the Dust Bowl to maintain agriculture in place through subsidy, federal crop insurance, and damming created an acute spatial misallocation of agricultural land relative to water supply that now must be addressed.⁹ These interventions have increased agriculture, and correspondingly water shortage and drought retreat, and handicapped the market mechanisms that would otherwise move agriculture out of the desert. Now, global climate change is accelerating, with intensifying effects on water supply, soil evaporation, crop resilience, and storms and other extreme events.¹⁰ Simultaneously, the West is experiencing an urbanization boom with massive population inflow to formerly sleepy towns and small cities.¹¹ In addition, western farmers must compete for water with legitimate, but previously unaccounted for, tribal water rights and claims by state governments to preserve in-stream flows.¹²

In the face of what is potentially the most severe drought retreat in U.S. history, there is no specific federal or state policy framework in place to address agricultural dislocation. Elected officials appear loathe to admit this failure of American farming, and the public, outside of western farming communities,

8. Leah A. Dundon & Mark Abkowitz, *Climate-Induced Managed Retreat in the U.S.: A Review of the Current Research*, 33 CLIMATE RISK MGMT. 1, 1 (2021); A.R. Siders, *Managed Retreat in the United States*, 1 ONE EARTH 216, 216-20 (2019); Edward Sullivan & A. Dan Tarlock, *The Paradox of Change in the American West: Global Climate Destruction and the Reallocation of Urban Space and Priorities*, 37 OR. J. ENV'T L. & LITIG. 23, 36-37 (2022). Drought is also susceptible to multiple meanings, with researchers referring to meteorological drought (rainfall dropping to a certain percentage of its long-term average), hydrological drought (surface and subsurface water supply shortage), or agricultural drought (a level of water scarcity that harms agriculture). Michael H. Glantz, *Drought, Desertification and Food Production*, in DROUGHT FOLLOWS THE PLOW 1, 911 (Glantz ed., 1994).

9. RICHARD W. WAHL, MARKETS FOR FEDERAL WATER: SUBSIDIES, PROPERTY RIGHTS, AND THE BUREAU OF RECLAMATION 24-25 (1985) (observing that without federal subsidy the market would have better sorted the location of irrigated agriculture). These subsidies have incentivized farmers into the "agricultural margins" of arid lands and ultimately increased the magnitude of relocation and crop loss. Glantz, *supra* note 8, at 20.

10. Richard M. Adams et al., *Global Climate Change and US Agriculture*, 345 NATURE 219, 220-21 (1990); Singh Malhi et al., *Impact of Climate Change on Agriculture and Its Mitigation Strategies: A Review*, 13 SUSTAINABILITY 1, 6-11 (2021).

11. *Fastest-Growing Cities Are Still in the West and South*, U.S. CENSUS BUREAU (May 26, 2022), <https://www.census.gov/newsroom/press-releases/2022/fastest-growing-cities-population-estimates.html>; see also BROOKINGS INST., BLUEPRINT FOR AMERICAN PROSPERITY: MOUNTAIN MEGAS 20-27 (2008), https://www.brookings.edu/wp-content/uploads/2016/06/IMW_full_report.pdf (describing ongoing urban population explosion in the Intermountain West).

12. See WATER & TRIBES INITIATIVE, THE STATUS OF TRIBAL WATER RIGHTS IN THE COLORADO RIVER BASIN, NAT. RES. POL'Y (2021), <https://www.naturalresourcespolicy.org/publications/policy-brief-4-final-4.9.21-.pdf> [hereinafter WATER & TRIBES INITIATIVE]; Jessie A. Boyd, *Hip Deep: A Survey of State Instream Flow Law from the Rocky Mountains to the Pacific Ocean*, 43 NAT. RES. J. 1151, 1153-1211 (2003).

appears largely unaware.¹³ The federal government, so generous with subsidies for maintaining agriculture, has turned a blind eye to support for relocating it.¹⁴ The overwhelming focus of federal funds (often disaster relief funding), state programs, and research is climate adaptation technologies to *maintain* western agriculture by increasing irrigation efficiency and crop drought resistance.¹⁵ While we recognize that climate adaptation in place is a viable strategy for some western land, standing alone it cannot redress the magnitude of the western water shortage and drought retreat.

In response to this growing crisis, this Article advocates a paradigm-shifting reform: federal agricultural policy should adopt managed retreat to aid stranded farmers in the arid West. We propose an agricultural retreat policy to ease climate transition for small farmers. As secondary benefits, managed retreat should also improve food security and, to a degree, water shortage when compared to climate transition left entirely to the subsidized agricultural market. We reserve to future work a parallel managed retreat program designed specifically to maximize western water and environmental benefits.¹⁶ Most broadly, our goal is to transform thinking about climate adaptation policy to include government-supported agricultural retreat. Notably, the federal government has a longstanding managed retreat program for residential property using Stafford Act disaster appropriations, while agricultural managed retreat remains a policy blind spot.¹⁷

We theorize agricultural managed retreat to encompass both economic and physical retreat. Physical retreat aids farmers (and shifts agricultural production out of severe drought zones) by buying out farms' land or water rights, helping farms and ranches to relocate operations if desired, and providing incentives for agriculture to locate in water-rich areas. Economic retreat provides government assistance for transitioning western farms to profitable, nonagricultural uses and for job retraining for former farmworkers and owners who do not wish to move. While the focus of this Article is on agriculture west of the Mississippi, primarily

13. See Nives Dolšak & Aseem Prakash, *The Politics of Climate Adaptation*, 43 ANN. REV. ENV'T RES. 317, 330-31 (2018) (politicians have incentives to ignore climate impacts, unless the adaptation solution is hard infrastructure, such as dams or levees, that the public typically supports).

14. See generally Nathan R.R. Watson, *Federal Farm Subsidies: A History of Governmental Control, Recent Attempts at a Free Market Approach, the Current Backlash, and Suggestions for Future Action*, 9 DRAKE J. AGRIC. L. 279 (2004) (describing the history and resilience of agricultural subsidies in the U.S.).

15. BRUCE L. GARDNER, *AGRICULTURE IN THE TWENTIETH CENTURY: HOW IT FLOURISHED AND WHAT IT COSTS* 187 (2002) (assessing federal subsidies for U.S. agriculture).

16. Stephanie Stern & A. Dan Tarlock, *Moving Water: Managed Retreat of Western Agricultural Water Rights for Instream Flows*, 49(S) COLUM. J. ENV'T L. 249 (2024).

17. Hazard Mitigation Grant Program, 42 U.S.C. § 5170(c); Helen J.P. Wiley & Carolyn Kousky, *Speeding Up Post-Disaster Housing Buyouts*, SOLUTIONS J. 59, 59 (2020) (HMGP is the largest source of buyout funding). The U.S. Department of Housing and Urban Development also funds a disaster retreat program, targeted at low-income communities. See 42 U.S.C. § 5301. The basic structure of residential managed retreat is that the federal government acquires properties voluntarily and pays residential owners the pre-disaster fair market value to relocate, with the acquired property then dedicated as permanent open space.

that located west of the 100th meridian, our proposal for government managed agricultural retreat is relevant to eastern and midwestern agriculture facing climate change impacts such as inundation or extreme storm events.

Our proposal is not for the federal government to manage the agricultural economy, which is far too complex and diverse for central control. Rather, it is for government to provide time-limited assistance with climate transition to a modest number of western farms. This transition support is financially viable because agriculture, unlike most climate transition problems, has vast funding and subsidies already in place. The reappropriation process and institutional framework of the Farm Bill offer an opportunity to use some of the sizable pot of agricultural subsidy to fund agricultural managed retreat.¹⁸

This Article makes two contributions. The first contribution is to establish and describe the third wave of American drought retreat—a significant societal event that has been virtually ignored. The Article’s second contribution is to propose that the federal government fund agricultural managed retreat as part of the solution to this crisis. The Article unfolds in six parts. Part I offers the first comprehensive account of the current, third wave of U.S. agricultural drought retreat. Part II situates the current drought retreat within a reoccurring historical pattern of drought retreat and misplaced faith that science and technology can conquer aridity. Part III contends that climate change, western urbanization, and unaccounted water claims by Tribes and for conservation will make the current drought retreat the most severe in U.S. history. Part IV considers the costs of ad hoc, market-based drought retreat. Part V presents our proposal for agricultural managed retreat and describes options for implementing managed retreat. Part VI considers objections and challenges to agricultural managed retreat. Of note, our agricultural managed retreat proposal does not encompass tribal farmlands, which have unique cultural and legal status and require different approaches.

I. THE THIRD WAVE OF DROUGHT RETREAT

A seismic shift in agriculture is occurring with little recognition: farmers, ranchers, and farmworkers are retreating from the West in response to drought. Retreat is taking a variety of forms, including shuttering operations, fallowing fields, relocating farms to wetter states, and transitioning to non-farm jobs. Drought is a major cause of this retreat, in combination with booming urban development in the West edging out agriculture, as we detail in Part III. The current agricultural retreat, which follows agricultural retreats in the 1890s and the 1930s, is poised to be the most economically severe and individually devastating drought retreat in U.S. history.¹⁹ We do not contest, and in fact

18. Agricultural Improvement Act of 2018, Pub. L. No. 115-334, 132 Stat. 4490 (2018). We thank Robin Craig for her helpful comment on this point.

19. Drought retreat has also occurred in the Southeast and Great Plains regions, with regression analysis indicating that drought influences population outflow. Justin T. Maxwell & Peter T. Soulé, *Drought and Other Driving Forces Behind Population Change in Six Rural Counties in the United States*, 51 SE. GEOGRAPHER 133, 139-45 (2011).

contend, that relocation is necessary for some western farmland. However, the current unmanaged, market-based retreat is imposing a great deal of pain, suffering, and inefficiency. In this Part, we first discuss two pressures on agriculture that have triggered retreat, the megadrought and the ensuing legal restrictions on water use. Then, we offer the first scholarly account of the “third wave” of western agricultural drought retreat.

The megadrought that began in 2000 in the West is one of the most severe in measurable history. A megadrought is a multi-decade drought with high severity that persists for longer than any drought event in historical record (i.e., the nineteenth or twentieth centuries).²⁰ Studies of tree rings, which reveal past drought years, indicate that 2000–21 was the driest twenty-two-year period globally since 800 CE.²¹ Since 2000, the megadrought has grown progressively more acute in the West, and now appears to have entered a period of rapid intensification.²² As a result, the Colorado River, the major source of western water, reached its lowest recorded levels in the summer of 2021.²³ At the same time, increased water demand mainly from rapid urbanization in the West has consumed water and competed with agriculture.²⁴ Scientists estimate that anthropogenic climate change accounts for 42 percent of the current megadrought.²⁵ Climate change has also increased the severity of the drought’s impact on agriculture by stunting crop growth, introducing new pests, and decreasing plant resilience.²⁶

In response to the megadrought, federal and state governments have restricted surface water use in an unprecedented manner, increasing the economic shock to agriculture. On August 16, 2021, the federal government announced an unprecedented “tier 1” shortage under the Drought Contingency Plan that curtailed Colorado River water delivery for the first time in U.S. history; a year later, the federal government enacted further water cuts pursuant to drops in water levels that triggered “tier 2” restrictions.²⁷ In April 2023, the

20. Benjamin I. Cook et al., *North American megadroughts in the Common Era: Reconstructions and Simulations*, 7 WIREs CLIMATE CHANGE 411, 411-12 (2016).

21. A. Park Williams et al., *Rapid Intensification of the Emerging Southwestern North American Megadrought in 2020–2021*, 12 NAT. CLIMATE CHANGE 232, 233 (2022).

22. *Id.* at 232-33 (using tree-ring analysis to estimate soil moisture). This research also found that dry conditions had accelerated during the most recent years of the current megadrought. *Id.* Researchers have established that droughts from 2011-2021 have developed more quickly, in significant part due to anthropogenic climate change. Virginia Iglesias et al., *Recent Droughts in the United States are Among the Fastest-Developing of the Last Seven Decades*, 37 WEATHER & CLIMATE EXTREMES 1, 4 (2022).

23. NOAA, NOAA DROUGHT TASK FORCE REPORT ON THE 2020-2021 SOUTHWESTERN U.S. DROUGHT 7 (2021).

24. See James L. Wescoat, *Legal Geography Series Water Law, Urbanization, and Urbanism in the American West: The “Place of Use” Reconsidered*, 14 URB. GEOGRAPHY 414, 417-18 (2013); see also *infra* Part III.

25. Williams et al., *supra* note 21, at 234 (analysis compared the predicted soil moisture in the absence of climate change versus actual soil moisture under current conditions of climate change).

26. See Sourav Mukherjee et al., *Climate Change and Drought: A Perspective on Drought Indices*, 4 CURRENT CLIMATE CHANGE REPS. 145, 148 (2018).

27. The 2019 Drought Contingency Plan, the basis of the recent tiered reduction system, is an agreement between the seven Basin States and the federal government that was negotiated under the

United States Department of Interior used its authority granted by the Supreme Court in *Arizona v. California* to propose further cuts to water delivery to the three Lower Basin states.²⁸ Weeks later, under the pressure of looming federal action, the seven Colorado River Basin states and the United States Bureau of Reclamation signed an agreement to “reduce diversions from the Colorado River System through the voluntary, compensated, and temporary reduction in use by water users.”²⁹ In addition to federal cuts to agricultural water, states have acted to shift water from agricultural to residential users. For example, in late 2021, the California Department of Water Resources announced that “the initial [water] allocation . . . will focus on the health and safety needs for 2022 . . . the [California State Water Project] will not be planning water deliveries through its typical allocation process until the state has a clearer picture of the hydrologic and reservoir conditions going into the spring.”³⁰

Western states have also curbed groundwater use in response to the megadrought.³¹ Historically, groundwater served as a piggy bank for irrigators to plunder when surface water was scarce—a situation created by inadequate legal protections for groundwater reserves and different legal regimes for groundwater and surface water.³² For example, Oregon irrigators in the stressed

backdrop of threat of federal action to protect the Colorado River if the Basin States did not agree to conservation measures and reductions. Colorado River Drought Contingency Plan Authorization Act, Pub. L. No. 116-14, 133 Stat. 850 (2019); DROUGHT CONTINGENCY AGREEMENT *supra* note 3. The tier one cutbacks occurred via agency action in 2021, *see* BUREAU OF RECLAMATION, RECLAMATION ANNOUNCES 2022 OPERATING CONDITIONS FOR LAKE POWELL AND LAKE MEAD (2021), <https://www.usbr.gov/newsroom/news-release/3950> [hereinafter Reclamation Operating Conditions]. Subsequently, the Department of the Interior announced additional, tier two restrictions, *see Interior Department Announces Actions to Protect Colorado River System, Sets 2023 Operating Conditions for Lake Powell and Lake Mead*, DEP’T OF INTERIOR (Aug. 16, 2022), <https://www.doi.gov/pressreleases/interior-department-announces-actions-protect-colorado-river-system-sets-2023>.

28. *Arizona v. California*, 373 U.S. 546 (1963). In April 2023, the Bureau of Reclamation released a draft environmental impact statement with two proposed courses of action, both of which would create additional cuts to Lower Basin water. BUREAU OF RECLAMATION, NEAR TERM COLORADO RIVER OPERATIONS, DRAFT SUPPLEMENTAL ENVIRONMENTAL IMPACT STATEMENT (last updated 2023), <https://www.usbr.gov/ColoradoRiverBasin/interimguidelines/seis/index.html>; *see also* CONG. RES. SERV., MANAGEMENT OF THE COLORADO RIVER: WATER ALLOCATIONS, DROUGHT, AND THE FEDERAL ROLE 27 (2023), <https://sgp.fas.org/crs/misc/R45546.pdf>.

29. *Letter from Seven Colorado River Basin States to U.S. Bureau of Reclamation About Lower Basin Plan*, DEP’T OF INTERIOR (May 22, 2023), <https://www.doi.gov/sites/doi.gov/files/lower-basin-plan-letter-5-22-2023.pdf> [hereinafter Letter from Seven Colorado River Basin States]. The Department of the Interior and the states agreed to reduce use by 2.3 million acre-feet in return for 1.2 billion dollars to mitigate the losses for farmers, Indian tribes, and cities. Christopher Flavelle, *A Breakthrough Deal to Keep the Colorado River from Going Dry, for Now*, N.Y. TIMES (May 25, 2023), <https://www.nytimes.com/2023/05/22/climate/colorado-river-deal.html>.

30. *DWR Announces Initial State Water Project Allocation, Additional Actions to Prepare for Third Dry Year*, CAL. DEP’T WATER RES. (Dec. 1, 2021), <https://water.ca.gov/News/News-Releases/2021/Dec-21/SWP-December-Allocation>.

31. *See, e.g.*, Cal. Water Code, § 10720 (2018) (recent California enactment); Ariz. Rev. Stat. Ann. §§ 45-401–45-704 (Arizona statute creating groundwater districts with different levels of regulation).

32. ROBERT GLENNON, WATER FOLLIES: GROUNDWATER PUMPING AND THE FATE OF AMERICA’S FRESHWATER 17-32 (2002) (observing that overexploitation of surface waters under prior appropriation doctrine was a factor in overconsumption of groundwater). For surface waters, all western states follow a

Klamath Basin pumped groundwater, at the encouragement of the Bureau of Reclamation, when the Bureau cut surface water deliveries to comply with the Endangered Species Act and protect tribal waters.³³ Now, the pump party is over. In California, subsidence and expanding pumping costs forced the state to enact legislation creating local water districts charged with developing sustainable use plans.³⁴ The state is now completing and reviewing these plans and fallowing and withdrawing land from irrigation are on the table. One of the driest states, Arizona, allowed water mining of aquifers until 1980 when it was forced to adopt legislation designed to limit pumping to safe yield levels in exchange for federal irrigation funding for the Central Arizona Project.³⁵ The Arizona Groundwater Management Act created Active Management Areas in four major urban areas and one in the prime agricultural area between Phoenix and Tucson.³⁶ The Act requires that the urban areas achieve safe yield by 2025, but it is highly unlikely that this goal will be achieved.³⁷

Faced with extreme hydrological and legal water shortage, coupled with an onslaught of urban development, western farms and ranches are retreating from the desert. Agricultural retreat is well underway, with farms closing or relocating operations, selling water rights, fallowing land, and converting farmland to

first in time rule awarding water rights to the first to appropriate, although riparian rights can still be asserted in California, Nebraska, and Oklahoma. Groundwater was initially subject to variants of common law rules of capture by overlying landowners. Today, most western states now apply the law of prior appropriation to groundwater, with five major exceptions: Arizona, Texas, California, Colorado, and Nebraska. A. Dan Tarlock, *Prior Appropriation: Rule, Principle, or Rhetoric?*, 76 N.D. L. REV. 881, 900-01 (2000) [hereinafter *Prior Appropriation*]. Less stringent legal rules and judge-made exceptions have enabled farmers to overdraw groundwater. The exceptions have major consequences. For example, California common law rules curtailing groundwater pumping (*See Katz v. Walkinshaw*, 74 P. 766, 771 (Cal. 1903)), never applied in the Central Valley, and thus groundwater pumping served as a stockpile for farmers in dry years.

33. Jessica Fu, *How a Federal Drought Relief Program Left Southern Oregon Parched—and Contributed to the Ongoing Groundwater Crisis in the West*, THE COUNTER (Nov. 23, 2021), <https://thecounter.org/federal-drought-relief-southern-oregon-groundwater-crisis-farmers-klamath-project/>. In the Klamath Basin, the farmers who followed the Bureau's advice found themselves with dry domestic wells. *Id.*

34. *See* Cal. Water Code, § 10720 (2018). Prior to this legislation, the California courts had begun to cut back groundwater use by developing common law rules that required long adjudications to decide groundwater claims. Burke W. Griggs, *Reaching Consensus About Conservation: High Plains Lessons for California's Sustainable Groundwater Management Act*, 52 U. PAC. L. REV. 495, 505-08 (2021).

35. Ariz. Rev. Stat. Ann. §§ 45-401–704.

36. *Id.* The goal is to preserve that economy for as long as feasible, while considering the need to preserve groundwater for future non-irrigation uses. *Id.* § 45-401.

37. As Kathleen Ferris writes,

[T]his goal will be challenging, and perhaps impossible, under its current regulatory authority. Mined groundwater continues to be a water source for agriculture, industries and municipal providers, and mandatory conservation has not produced the needed cutbacks in groundwater use. Even if the safe-yield goal were to be achieved, groundwater management problems would still persist in parts of the AMAs.

KATHLEEN FERRIS, THE MYTH OF SAFE-YIELD: PURSUING THE GOAL OF SAFE-YIELD ISN'T SAVING OUR GROUNDWATER 10 (2021).

alternative uses such as solar arrays and RV sites.³⁸ Small farmers, particularly of water-intensive fruit farms, have been hard hit, with farming publications reporting farmer “climate refugees” relocating from California to the Midwest and other areas with better water supply.³⁹ Arizona farmers, facing a federally declared water shortage and cutbacks on their water since 2021, are selling massive amounts of farmland with water rights to municipalities and investment companies for use in fast-growing cities and suburbs.⁴⁰ Retreat began earlier in Colorado. For several decades, Colorado farms in the South Platte and Arkansas River Basins have been selling water rights in response to declining water supply, most often to urban users.⁴¹

The megadrought and western urbanization operate as tandem forces in the third wave of drought retreat. Lucrative offers from developers and western municipalities to purchase water rights are tempting to drought stressed farmers. In California’s King County, agricultural landowners have sold so much groundwater to Southern California cities that the local board attempted to pass an ordinance forbidding groundwater transfer.⁴² The board’s goal was to prevent large farms and outside investors from buying farmers’ water rights to sell to cities.⁴³

As farms and ranches relocate, loss of rural population and farmland follows.⁴⁴ Over the past two decades of drought, San Joaquin Valley local schools in California have reported nearly 70 percent declines in student population.⁴⁵ By 2040, the San Joaquin Valley will lose at least 525,000 farmland acres (10 percent of its total agricultural land), and, if the drought

38. See Dan Frosch, *Drought in the U.S. West Leads Farmers to Look Elsewhere for Revenue*, WALL ST. J. (Sept. 30, 2022), <https://www.wsj.com/articles/drought-in-u-s-west-leads-farmers-to-look-elsewhere-for-revenue-11664535602> (interviewing farmers diversifying income with solar arrays, RV hook ups, gas and oil leases, and tours and festivals on their lands); Somini Sengupta, *It’s Some of America’s Richest Farmland. But What Is it Without Water?*, N.Y. TIMES (June 28, 2021), <https://www.nytimes.com/2021/06/28/climate/california-drought-farming.html> (describing decrease in farm crops and farmers turning to alternative, non-farming uses).

39. Shelby Vittek, *Western Drought Forces Farmers to Make Tough Decisions*, MOD. FARMER 2, 6, (June 7, 2021).

40. Ian James & Geoff Hing, *Investors are Buying up Rural Arizona Farmland to Sell the Water to Urban Homebuilders*, ARIZ. CENTRAL (Nov. 26, 2021), <https://www.azcentral.com/story/news/local/arizona-environment/2021/11/25/investors-buying-up-arizona-farmland-valuable-water-rights/8655703002/>.

41. See Charles W. Howe & Christopher Goemans, *Water Transfers and Their Impacts: Lessons from Three Colorado Water Markets*, 50 J. AM. WATER RES. ASS’N 1055, 1058 (2003).

42. Daniel Gligich, *Kings Co. Wants to Block Selling Groundwater to Southern California. Will a New Measure Solve the Problem?*, THE SUN (Nov. 30, 2022), <https://sjvsun.com/ag/kings-co-wants-to-block-selling-groundwater-to-southern-california-will-a-new-measure-solve-the-problem/>.

43. *Id.*

44. Hossein Azadi et al., *Agricultural Land Conversion: Reviewing Drought Impacts and Coping Strategies*, 31 INT’L J. OF DISASTER REDUCTION 184, 186 (2018) (studies of drought-induced migration in Australia and Africa).

45. See Scott Wilson, *As it Enters a Third Year, California’s Drought is Strangling the Farming Industry*, WASH. POST (Mar. 21, 2022), <https://www.washingtonpost.com/nation/2022/03/21/california-drought-vanishing-farms/>.

persists without new sources of water, almost double that amount.⁴⁶ Research and media reports often frame the conversion of agricultural land to urban use as the result of urbanization, exogenous to drought.⁴⁷ As Hossein Azadi and his fellow researchers observe, however, it is not only urbanization but also drought and climate change that drive the conversion of agricultural land to non-agricultural uses.⁴⁸

Drought retreat also wreaks economic and social harm on farmworkers. In California, the effect of worsening drought has resulted in 9,882 lost agricultural jobs from 2021–22 alone.⁴⁹ This is not even the most severe recent drought in California. In 2014–16, California drought conditions caused the loss of almost 43,000 agricultural jobs.⁵⁰ Agricultural job loss predicts negative outcomes for those left unemployed. One study of agricultural workers in a western drought region found greater food and water insecurity and lower well-being following the loss of work.⁵¹

In addition to full or near-full retreat, partial retreat is occurring at a rapid clip as farmers idle crops and ranchers cull herds. Partial retreat, as we use the term, refers to reductions in the scale of agricultural operations in response to drought (this also constitutes climate adaptation, but we use partial retreat to indicate the specific category of agricultural withdrawal within adaptation). In a recent American Farm Bureau Federation Survey, 37 percent of farmers reported that they are physically plowing under all or some of their already growing crops due to drought; the percentage rose to 50 percent in California where farmers are increasingly removing fruit and nut trees.⁵² Similarly, recent research on agriculture in California's Central Valley found a sharp increase in crop idling (i.e., leaving fields idle), a strategy which often precedes whole-farm retreat.⁵³ The story is similar, if not more dire, for livestock ranchers. Western ranchers are selling cattle en masse as drought reduces grass available for grazing. Farmers in Texas, New Mexico, and Oregon report herd reductions of 41-50 percent.⁵⁴ The 2022 American Farm Bureau Federation survey found that 40 percent of farmers

46. Sengupta, *supra* note 38.

47. See, e.g., Charles A. Francis et al., *Farmland Conversion to Non-Agricultural Uses in the US and Canada: Current Impacts and Concerns for the Future*, 10 INT'L J. AGRIC. SUSTAINABILITY 8, 10-11 (2012) (concerns about farmland loss, especially near urban centers).

48. Azadi, *supra* note 44, at 184-85.

49. JOSUÉ MEDELLÍN ET AL., UNIV. CAL. MERCED, ECONOMIC IMPACTS OF THE 2020-22 DROUGHT ON CALIFORNIA AGRICULTURE 21 (Mar. 8, 2023), https://wsm.ucmerced.edu/wp-content/uploads/2022/11/Economic_Impact_CA_Drought_V01.pdf.

50. See Christina Greene, *Broadening Understandings of Drought—The Climate Vulnerability of Farmworkers and Rural Communities in California*, 89 ENV'T SCI. & POL'Y 283, 289 (2018).

51. *Id.* at 285.

52. Vanessa Yurkevich, *American Farmers Are Killing Their Own Crops and Selling Cows Because of Extreme Drought*, CNN (Aug. 18, 2022), <https://www.cnn.com/2022/08/17/business/west-drought-farmers-survey-climate/index.html>.

53. MEDELLÍN ET AL. *supra* note 49, at 10-11 (estimating that from the baseline year of 2019 to 2022, California farmers idled an additional 752,000 acres of agricultural land).

54. Vanessa Yurkevich, *Farmers Forced to Sell Their Cows as Drought Conditions Worsen Across US*, CNN (July 25, 2022), <https://www.cnn.com/2022/07/25/business/drought-farmers-cows/index.html>.

reported selling off part of their herds due to severe drought, and cattle auction houses have reported as much as a fivefold increase in cows for sale.⁵⁵

Western tribal agriculture is also mired in a long-term partial retreat, with reservation farms shrinking crops and workforces. For example, the Ute Tribe of Colorado has downscaled a generations-old agricultural tradition of growing corn. This year, the Ute Mountain Ute Tribe Farm and Ranch Enterprise reduced corn harvests by 75 percent and cut its fifty-person work force in half because the federal Drought Contingency Plan reduced its agricultural water supply by 90 percent.⁵⁶ In Arizona, the Hopi Tribal Council has tried to require tribal ranches to reduce their herds to sustain enough water for the traditional corn crops produced with customary low-water techniques.⁵⁷ There has been an increase in dead cattle on reservations due to lack of water.⁵⁸ Tribes have little choice but to retreat agriculture without physically relocating it. Full retreat to other lands would impose enormous cultural and community costs, amount to another forced relocation, and require tribes to finance new land acquisition since most reservation land is owned by the U.S. government and held in trust for the tribes' use.⁵⁹ Of note, our managed retreat proposal does not apply to tribal lands, not due to lack of importance, but because tribal farmland is subject to different laws and treaty rights, tribal sovereignty, collective agricultural management, and unique cultural barriers to relocation. A just climate transition for tribal agriculture demands its own policy framework to address these issues, one that we hope may benefit from our research on agricultural retreat for non-tribal farmland.⁶⁰

Alarming, the West is only in the beginning stage of drought retreat. Research indicates that the amount of unfarmable land will increase dramatically across this century due to water scarcity and global warming. For example, a recent NASA study projected that maize production, a staple crop in the western U.S., will decline 24 percent between 2021 and 2030 because of changes in precipitation, temperature, and carbon dioxide.⁶¹ Other crops, such as wheat, will spread to areas with sufficient water and cooler temperatures, in what will be the most massive agricultural reorganization in world history.⁶² Areas with the

55. *Id.*

56. Tim Vanderpool, *Colorado River Basin Tribes Address a Historic Drought—and Their Water Rights—Head-on*, NRDC (Nov. 14, 2022), <https://www.nrdc.org/stories/colorado-river-basin-tribes-address-historic-drought-and-their-water-rights-head>.

57. See Simon Romero, *In Arizona, Drought Ignites Tensions and Threatens Traditions Among the Hopi*, N.Y. TIMES (Oct. 2, 2021), <https://www.nytimes.com/2021/10/02/us/arizona-megadrought.html>.

58. *See id.*

59. Under the Indian Reorganization Act, tribals lands are held by the federal government in trust for the tribes. 25 U.S.C. § 5108.

60. It also requires full participation of the sovereign tribes in crafting federal government policies for their agricultural retreat or adaptation.

61. Ellen Gray, *Global Climate Change Impact on Crops Expected Within 10 Years, NASA Study Finds*, NASA NEWS (Nov. 2, 2021), <https://climate.nasa.gov/news/3124/global-climate-change-impact-on-crops-expected-within-10-years-nasa-study-finds/>. Crops that grow in more temperate climates, such as wheat, should increase in production as temperatures rise in colder regions. *Id.*

62. *See id.*

highest temperatures and aridity, including swaths of the western United States, will become unsustainable for any crop at all.⁶³

The extreme situation that the West now faces—agricultural drought retreat—has not been acknowledged by policymakers or researchers. It remains curiously under the radar of public attention, except for the farmers and workers who cannot escape it. In light of public resistance to shifting agriculture out of the West, politicians have incentives to proclaim that science and climate adaptation projects can solve drought and aridity.⁶⁴ Technology and irrigation companies benefit from arid farming and subsidies that maintain western agriculture in place.⁶⁵ This means that important questions about the effect of ad hoc retreat on the distribution of climate-related losses (e.g., small farmers), national food security, and environmental interests have gone unanswered.

The third wave of drought retreat, which is proceeding in an ad hoc fashion, poses interrelated challenges. The first is the question of how the pain of retreat should be distributed. The market may help alleviate the pain by shifting agricultural land to uses that consume less water (e.g., farmers switching to solar arrays or tourism).⁶⁶ Some crops may be able to adapt to climate change through new growing techniques, as the wine industry is doing with the development of more drought resistant varieties, or data-driven water conservation techniques.⁶⁷ However, this still leaves “stranded” farmers whose land is not viable or cost-effective to adapt or who cannot afford to switch land uses or adopt adaptation technologies. There has been virtually no discussion of whether or how to distribute this climate pain, a void this Article seeks to fill.

A second question is how ad hoc drought retreat affects U.S. food security. The United States lacks a coherent food security policy to address crop losses and interruptions from ad hoc retreat. Overall, about 15 percent of the country’s food is imported, but the percentage is much higher for fruits, vegetables, and sweeteners.⁶⁸ Imports are likely to increase as retreat deepens, absent a policy to relocate western farms or otherwise increase farming in productive, water-rich regions of the United States. The questions of whether it is important to the United States to maintain current domestic production levels and how to manage

63. For example, a model by James Rising and Naresh Devineni predicts that by 2070, 5 percent of U.S. agricultural land will become unusable for agriculture due to water shortage and temperature. James Rising & Naresh Devineni, *Crop Switching Reduces Agricultural Losses from Climate Change in the United States by Half Under RCP 8.5*, 11 NATURE COMM. 1, 4 (2020).

64. Dolšak & Prakash, *supra* note 13.

65. See Gareth P. Green & David L. Sunding, *Land Allocation, Soil Quality, and the Demand for Irrigation Technology*, 22 J. AGRIC. & RES. ECON. 367, 373-74 (1997).

66. See Frosch, *supra* note 38.

67. See Ali Raza et al., *Impact of Climate Change on Crops Adaptation and Strategies to Tackle Its Outcome: A Review*, 8 PLANTS 1, 9-16 (2019) (crop engineering); Steven Savage, *Why California’s 46 Billion Wine Industry Is Better Prepared for Climate Change Than Some of Its Competitors*, FORBES (Nov. 29, 2022), <https://www.forbes.com/sites/stevensavage/2022/11/29/why-californias-46-billion-wine-industry-is-better-prepared-for-climate-change-than-some-of-its-competitors/?sh=2866b7137096> (adaptation technology adopted by California wine growers).

68. *Agricultural Trade*, U.S. DEP’T OF AGRIC. (May 8, 2023), <https://www.ers.usda.gov/data-products/ag-and-food-statistics-charting-the-essentials/agricultural-trade/>.

shifts in the import-export ratio are not currently on the national radar. In addition, retreat poses a risk of food supply interruption, as discussed in detail in Part IV.D.2, that the federal government has evaded by ignoring the ongoing drought retreat.

A third question is how the post-retreat landscape should be managed. Considerable attention has been devoted to efforts, largely unsuccessful, to prevent water rights transfers that adversely impact rural areas.⁶⁹ However, little attention has been given to how post-retreat landscapes should be used. Although beyond the scope of this Article to examine in detail, environmental costs need to be part of any retreat strategy. It is also possible that retreat may have positive environmental benefits, once the pain is fairly distributed. For example, there is now serious talk of rewilding places such as the San Joaquin Valley, where millions have been spent to sustain the agricultural economy.⁷⁰

Before turning to these questions and our proposal for managed retreat, in Part II we contextualize the third wave of drought retreat as one in a line of agricultural retreats, caused in part by U.S. subsidies to settle and irrigate the West. Part III examines why the current third wave of drought retreat will be the most severe in U.S. history.

II. THE FIRST AND SECOND WAVES OF DROUGHT RETREAT: SCIENCE AND TECHNOLOGY SETTLE THE “GREAT AMERICAN DESERT”

The third wave of drought retreat is the most recent link in a series of painful and costly dislocations resulting from government subsidizing farming the desert. From damming and irrigation in the early 1900s to climate adaptation funding today, the U.S. government has responded to the agricultural limitations of the desert with money and science.⁷¹ We examine this history to establish three points that are important to our proposal for an agricultural managed retreat policy. First, the history of western agricultural retreat unsettles the prevailing assumption that arid land is suitable or can be made suitable for agriculture at its present scale. Second, it belies the belief that all or most of western agriculture should persist by virtue of its longstanding history. As we describe below, western agriculture is the product of a relatively recent series of historical misjudgments about the long-term viability of desert agriculture, a fake science movement, and a staggering level of government intervention in response to

69. See e.g., James & Hing, *supra* note 40; Gligich, *supra* note 42.

70. See generally H. SCOTT BUTTERFIELD ET AL., *REWILDING AGRICULTURAL LANDSCAPES: A CALIFORNIA STUDY OF RELANCING THE NEEDS OF PEOPLE AND NATURE* 5-12 (2021) (examining how to rewild the San Joaquin Valley and other farmlands).

71. See ERIC KUHN & JOHN FLECK, *SCIENCE BE DAMMED: HOW IGNORING INCONVENIENT SCIENCE DRAINED THE COLORADO RIVER* 23-25 (2019) (examining early irrigation and damming in the desert West); see generally *Climate Adaptation*, U.S. DEP'T OF AGRIC., <https://www.usda.gov/oce/energy-and-environment/climate/adaptation> (last visited July 20, 2023).

repeated droughts and retreats.⁷² Third, for over a century, government intervention to sustain agriculture in place has distorted the agricultural economy, increased agriculture in the desert, and prolonged and failed to mitigate the harm to farmers and food supply from drought retreat. This history calls into question leaving climate transition and drought retreat entirely to the intervened upon agricultural market and sets the stage for considering agricultural managed retreat.

A. *The Post Civil War Settlement of the “Desert”*

The Great American Desert, as the area west of the Mississippi was called, was considered impossible to settle in the early nineteenth century.⁷³ Until the last quarter of the nineteenth century, American agricultural and settlement patterns proceeded on two basic tracks: small farms modeled after farms in northern Europe in the north and the plantation economy in the south.⁷⁴ But, the European experience did not work in much of the arid and semi-arid territory west of the Mississippi acquired between 1803 and 1853. Early explorers considered much of the Louisiana Purchase an uninhabitable desert.⁷⁵ Later, the 100th meridian, which runs through the Great Plains and Texas, was accepted as the dividing line between aridity and farmable humidity.⁷⁶

White settlement of the West began in earnest after the Civil War with the completion of the first transcontinental railroad and later railroads, as well as federal confinement of Native Americans to reservations. The first continental railroad was completed in 1869, and that transit route, plus the railway’s aggressive marketing of Western land, rapidly settled Nebraska.⁷⁷ In the 1880s, the Santa Fe Railroad opened southern Kansas and the Southwest to settlement,⁷⁸

72. See B. DOUGLAS HURT, *THE DUST BOWL: AN AGRICULTURAL AND SOCIAL HISTORY* 54-55, 99 (1981) (relocation caused by the 1930s Dust Bowl); Robert E. Lang et al., *Is There Still a Frontier?* 13 J. RURAL STUD. 377, 381 (1997) (shrinkage in settled western land following the 1890s drought).

73. *The Great American Desert*, LEGENDS OF AM., <https://www.legendsofamerica.com/great-american-desert/> (last visited July 20, 2023).

74. Slavery never gained a foothold in the West for political reasons and the unsuitable climate for a plantation economy. The question of slavery in the Louisiana Purchase and territories acquired from Mexico and England was the major political issue between the Missouri Compromise of 1820 and the Civil War. See generally ERIC FRONER, *FREE SOIL, FREE LABOR, FREE MEN: THE IDEOLOGY OF THE REPUBLICAN PARTY BEFORE THE CIVIL WAR* 84-156 (1970).

75. The phrase “Great American Desert” to describe present-day Oklahoma, Kansas, and Nebraska was coined by Edwin James in his chronicle of Stephen H. Long’s 1820 exploration of the region. ROBERT V. HINE & JOHN MACK FARAGHER, *THE AMERICAN WEST: A NEW INTERPRETIVE HISTORY* 160 (2000). Zebulon Pike was even harsher. After his 1806 exploration, he concluded that Americans would have to “leave the prairies . . . to the wandering and uncivilized aborigines of the country.” LEGENDS OF AM., *supra* note 73.

76. See Richard Seager et al., *Whither the 100th Meridian? The Once and Future Physical and Human Geography of America’s Arid-Humid Divide. Part I: The Story so Far*, 22 EARTH INTERACTIONS 1, 1 (2018).

77. Barry B Combs, *The Union Pacific Railroad and the Early Settlement of Nebraska 1868-1880*, 50 NEB. HIST. 1, 10-21 (1969).

78. KEITH L. BRYANT JR. & FRED W. FRAILEY, *THE HISTORY OF THE ANTECHSON, TOPEKA AND SANTA FE RAILWAY* 10 (2020).

while the Chicago and Northwestern, the Great Northern, the Chicago and Milwaukee Railroad, and the Northern Pacific brought settlers to western Dakota and Montana.⁷⁹ At that time, Mormons (now the Church of Jesus Christ of Latter Day Saints) had been practicing small-scale, communal agriculture in the intermountain West since 1847, which had gradually spread to southern Idaho.⁸⁰ However, the western territory remained primarily a mining and livestock economy until irrigation projects were built in the Snake River Plain.⁸¹ The western gold and silver mining economy began to decline in the 1870s as the low-hanging fruit had been picked. Next, a vibrant range cattle industry developed, but it lasted only into the 1890s.⁸² Only with the decline of mining and then cattle ranching did it become necessary to try and find non-northern European solutions to farming to draw settlement to the region too by cultivating an agricultural industry in the West. It was still an open question in 1880s whether enough people would settle in the West. Historian Frederick Jackson Turner didn't declare the frontier closed until the 1890s.⁸³

Two theories were advanced to promote farming and settlement of the West. The first was fake science. After the Civil War, railroads lured settlers to the Great Plains and beyond by the false scientific theory that “rain follows the plow.”⁸⁴ Reversing causation, farmers and scientists believed that trees increased rainfall, leading government to support tree planting.⁸⁵ This belief expanded to include cultivation. Easterners flocked to the West with the misguided expectation that their farming would produce rain.⁸⁶ At the cost of great human suffering, the theory was proved wrong after severe drought in the 1890s in the Great Plains and has been assigned to the ash heap of history like pre-Galilean astronomy.⁸⁷

While the “rain follows the plow” was beginning to lure settlers to the Great American Desert, John Wesley Powell argued that settlement should recognize

79. See, e.g., James B. Hedges, *The Colonization Work of the Northern Pacific Railroad*, 13 *MISS. VALLEY HIST. REV.* 311, 333-40 (1926) (describing how the Northern Pacific and other major railways settled the Western states).

80. See D.W. Meinig, *The Mormon Culture Region: Strategies and Patterns in the Geography of the American West, 1847-1964*, 55 *ANNALS AM. ASS'N GEOGRAPHERS* 191, 204-07 (1965).

81. See *id.* at 206.

82. See generally ERNEST STAPLES OSGOOD, *THE DAY OF THE CATTLEMAN* (1957); EDWARD EVERETT DALE, *THE RANGE CATTLE INDUSTRY: RANCHING THE GREAT PLAINS FROM 1865 TO 1925* (1960); RICHARD W. ETULAIN, *BEYOND THE MISSOURI: THE STORY OF THE AMERICAN WEST* (2006).

83. Frederick Jackson Turner, *The Significance of the Frontier in American History*, *ANN. REP. AM. HIST. ASS'N* 197, 227 (1893).

84. See Glantz, *supra* note 8, at 23.

85. See *id.*

86. *Id.* Historian Walter Prescott Webb wrote, “in the Great Plains proper there was as yet little thought of general irrigation. The people were settling there under the illusion that rainfall would follow agriculture.” WALTER PRESCOTT WEBB, *THE GREAT PLAINS* 349 (2d ed. 2022). They believed that plowing and cultivating land would improve its ability to hold moisture, increase evaporation, and hence precipitation. *Id.* at 369.

87. The theory that cultivation of the soil and tree planting would make the semi-arid Great Plains suitable for large-scale farming developed between 1865-1875 and was promoted by federal government scientists, the railroads, and land speculators. See Henry Nash Smith, *Rain Follows the Plow: The Notion of Increased Rainfall for the Great Plains, 1844-1880*, 10 *HUNTINGTON LIBR. Q.* 169, 170 (1947).

the natural limits of an arid climate. In 1878, he published his famous Report on the Lands of the Arid Regions of the United States, and a more detailed Account of the Lands of Utah.⁸⁸ In brief, Powell argued that the West should be settled along the lines of the then-small Mexican and Mormon irrigation communities. Powell's theory was decisively rejected by the federal government in favor of supporting publicly funded science and irrigation technology.⁸⁹ But, as discussed below, Powell's theories continue to play a role in agriculture in the arid West.⁹⁰

The second theory was that science and technology could tame aridity and enable Western agriculture. Agriculture was becoming a science, especially after the creation of practical, secular land grant universities. Science and technology-based solutions, such as irrigation, prevailed because they fit with the goal of settling the whole country and enlightenment faith in science. The dual regard for agricultural persistence and scientific innovation still prevails over government policy. The 2022 Inflation Reduction Act includes four billion dollars for drought relief, primarily in the stressed Colorado River Basin.⁹¹ A Bureau of Reclamation letter, "Funding Opportunity for Voluntary Participation in the Lower Colorado Conservation and Efficiency Program," announced that the Bureau would use the best available science to fund grants for proposals for "long-term durable system efficiency improvements that result in water conservation."⁹²

*B. The First and Second Waves of Drought Retreat:
The 1890s Drought and the 1930s Dust Bowl*

The 1890s drought retreat in the Great Plains and the 1930s "Dust Bowl" were the result of a continuing effort to farm arid and semi-arid areas that began in the late nineteenth century. Farmers poured into Kansas, Nebraska, and the Dakotas in the 1880s and established farms under the Homestead Act of 1862.⁹³ The decade was relatively wet, and the farmers prospered.⁹⁴ Then came the drought of the 1890s. The population of Kansas and Nebraska remained virtually stable from 1890 to 1900, but this was largely due to settlement in the more urban eastern part of the state.⁹⁵ In the western part hit hardest by the drought, as

88. J. W. POWELL, REPORT ON THE LANDS OF THE ARID REGION OF THE UNITED STATES (2d ed. 1878).

89. See DONALD WORSTER, A RIVER RUNNING WEST: THE LIFE OF JOHN WESLEY POWELL 495-501 (2001). This book traces Powell's fascinating life.

90. See generally VISION AND PLACE: JOHN WESLEY POWELL AND REIMAGINING THE COLORADO RIVER BASIN (Jason Robison et al., eds., 2020) (exploring modern-day applications of Powell's work).

91. Inflation Reduction Act, Pub. L. No. 117-169, 136 Stat. 1818 at §§ 50231-50233 (2022).

92. See Letter from Department of the Interior Bureau of Reclamation Funding Opportunity for Voluntary Participation in the Lower Colorado Basin Conservation and Efficiency Program Enclosure, U.S. BUREAU OF RECLAMATION 1 (May 24, 2023), <https://www.usbr.gov/inflation-reduction-act/docs/Funding-Opportunity-River-LC-Basin-Conservation-Efficiency-05-24-2023.pdf>.

93. An Act To secure Homesteads to actual Settlers on the Public Domain, Pub. L. No. 37-64, 12 Stat. 392 (1861).

94. See, e.g., DOROTHY WEYER CREIGH, NEBRASKA: A BICENTENNIAL HISTORY 10 (1977) (describing early period of homesteading).

95. See, e.g., *Drought and Depression in 1980s Nebraska*, HISTORY NEB. <https://history.nebraska>

historian Jane Porter describes, “[h]alf the population . . . moved out between 1888 and 1892 and large portions of the Plains from Kansas to North Dakota were virtually depopulated. . . . Twenty towns in western Kansas were reported as totally depopulated.”⁹⁶ However, the retreat was short-lived because science, technology, and public policy allowed agriculture to survive the drought.

The main scientific contribution in response to the 1890s drought was the promotion of dryland farming, which was promoted with religious zeal.⁹⁷ Dryland farming refers to cultivating crops largely without irrigation. During this era, for example, both individual settlers and federal government researchers sought out drought-resistant wheat varieties.⁹⁸ German immigrants who had settled on the Russian Steppes brought winter wheat to the United States, where it thrived in a similar climate. It is planted in the winter and fed by spring’s rain.⁹⁹ Today, it is still grown throughout the Great Plains, Montana, and Washington. The main contributions of technology were mechanized agriculture, including the tractor, the disc plow, the reaper, and center-pivot irrigation.¹⁰⁰

The main public policy solution to the 1890s drought was publicly funded irrigation. The Spanish brought irrigation, which they learned from the Arab people, to California, New Mexico, and a small sliver of southern Colorado.¹⁰¹ Immediately after their arrival in Utah in 1847, the Mormons began to practice collective small-scale irrigation.¹⁰² However, it was the movement of settlers to Idaho and the first drought retreat in the Great Plains that triggered the irrigation crusade.¹⁰³ As settlers moved into the arid inner-mountain West, they used direct diversions and short canals to bring local water to the fields.¹⁰⁴ As local supplies were put to use, farmers began to bring water from more distant sources. They soon realized that a sustainable irrigation economy required considerable financial resources and some form of collective organization to build larger-scale irrigation systems and carry-over storage.¹⁰⁵

.gov/publications_section/drought-and-depression-in-1890s-nebraska/ (last visited July 15, 2023).

96. Jane Porter, *Droughts Influence Settlement Patterns, Yesterday and Today*, RURAL DEV. POPULATION PERSP. 2, 2-3 (Oct. 1989).

97. For the leading history text on this topic, see generally DONALD J. PISANI, FROM FAMILY FARM TO AGRIBUSINESS: THE IRRIGATION CRUSADE IN CALIFORNIA AND THE WEST (1984).

98. Porter, *supra* note 96, at 3.

99. See WALTER PRESCOTT WEBB, THE GREAT PLAINS 31, 394 (1931).

100. *Id.* at 391.

101. See B.A. Krantz, *Water Conservation, Management, and Utilization in Semiarid Lands*, in ADVANCES IN FOOD PRODUCING SYSTEMS FOR ARID AND SEMIARID LANDS PART A 339, 340 (Jamal Manassah & Ernest J. Briskey eds., 1981).

102. See SANDRA POSTEL, PILLAR OF SAND: CAN THE IRRIGATION MIRACLE LAST 47-48 (1999).

103. See Steven R. Evett et al., *Past, Present, and Future of Irrigation on the U.S. Great Plains*, 63 TRANSACTIONS OF THE ASABE 703, 710 (2020); Ralph H. Hess, *The Beginnings of Irrigation in the United States*, 20 J. POL. ECON. 807, 827, 830 (1912).

104. See Hess, *supra* note 103, at 821, 824.

105. In the 1870s and 1880s, hundreds of private irrigation companies tried to reclaim the West’s arid lands, only to collapse from lack of know-how, profiteering, chaotic western water laws, drought, harsh winters, or the devastating depression of the 1890s. Private efforts that *did* succeed proved it was possible to make the desert bloom, but large-scale projects presented great financial risk, making private capital hesitant to invest. In Wyoming, for example, even a man as famous and wealthy as William F.

Congress initially assumed that private capital would construct irrigation projects. Congress's first effort to promote this was the Desert Land Act of 1877, which increased homestead patents from 160 to 320 acres per individual.¹⁰⁶ When this did not prove sufficient, Congress tried the railroad grant solution. The 1894 Carey Act authorized Congress to transfer up to one million acres of unused public land to western states provided the land could be made profitable through irrigation works constructed by private enterprise.¹⁰⁷ However, only Idaho and Wyoming constructed significant projects.¹⁰⁸ Next, the Carey Act experimented with larger land grants to spur private financing, but when that too failed, westerners turned to the federal government for a bailout.¹⁰⁹ The irrigation crusade produced the Reclamation Act of 1902.¹¹⁰ The original goal of the Act was to support the Jeffersonian dream of yeomen farms by providing loans to irrigation districts.¹¹¹ However, the Act coincided with the development of high-arch dam technology, and by the 1930s, the Bureau had moved on to building large dams to support large-scale irrigation.¹¹² Irrigated acreage increased throughout most of the twentieth century.¹¹³

The second drought retreat came in the 1930s: the Dust Bowl. The High Plains had slipped into depression in the 1920s, and commodity prices fell after World War I.¹¹⁴ Intensive ploughing to meet the demands generated by the war made the region vulnerable to the combination of drought and high winds that

“Buffalo Bill” Cody abandoned his dream of using Shoshone River water to irrigate 60,000 acres around his newly founded town of Cody due to costs. The Wyoming State Board of Land Commissioners then turned to the U.S. Congress for help, and Buffalo Bill in 1904 transferred his water rights to the federal government for the irrigation project. *Water in the West*, NAT'L PARK SERV. (July 18, 2017), <https://www.nps.gov/articles/2-water-in-the-west.htm>.

106. 43 U.S.C. § 321; Evans Holbrook, *Water and Water Courses - The Effect of the Desert Land Act of 1877*, 20 MICH. L. REV. 805, 805-06 (1922).

107. 43 U.S.C. §§ 611-648.

108. Hugh T. Lowe, *The Carey Act in Idaho: 1895-1925: An Experiment in Free Enterprise*, 78 PAC. NW. Q. 122, 122 (1987).

109. *See generally id.*

110. 43 U.S.C. § 391.

111. Kathleen B. Freeland, *Examining the Politics of Reclamation: The 1944 Acreage Limitation Debate in Congress*, 67 THE HISTORIAN 217, 220, 233 (2005).

112. DONALD J. PISANI, WATER AND AMERICAN GOVERNMENT: THE RECLAMATION BUREAU, NATIONAL WATER POLICY, AND THE WEST, 1902-1935, 98-99, 226-27 (2002). Building large multipurpose dams in the West's deep canyons is part of a longstanding belief, common across the developed world, that technology or mechanization can drought proof arid lands. *See Glantz, supra* note 8, at 21. While irrigation technology or mechanization work in the short-term, they often exacerbate harm by moving agriculture into increasingly arid lands or, in the case of mechanized ploughs, damaging topsoil. *See Ann Schulz, Reorganizing Deserts: Mechanization and Marginal Lands in Southwest Asia, in DESERTIFICATION AND DEVELOPMENT: DRYLAND ECOLOGY IN SOCIAL PERSPECTIVE* 27, 34 (Brian Spooner & Harachan Singh Mann eds., 1982).

113. AARON HROZENCIK & MARCEL AILLERY, ECON. RSCH. SERV., TRENDS IN U.S. IRRIGATED AGRICULTURE: INCREASING RESILIENCE UNDER WATER SUPPLY SCARCITY 10 (Dec. 2021), <https://www.ers.usda.gov/webdocs/publications/102928/eib-229.pdf?v=980.9>.

114. Allen H. Olson, *Federal Farm Programs – Past, Present and Future—Will We Learn from our Mistakes?*, 6 GREAT PLAINS NAT. RES. J. 1, 2-3 (2001).

swept across the region in the 1930s.¹¹⁵ The numbers tell the story of the resulting agricultural retreat. In 1920, the farm population of the western region stood at 2,637,315 compared to 1,734,020 in 1950.¹¹⁶ Between 1920 and 1950, only three mountain states, all less dependent on agriculture, showed a steady population increase.¹¹⁷

The New Deal Administration of President Franklin Roosevelt was deeply engaged in efforts to keep people on the land in rural America.¹¹⁸ The Dust Bowl triggered a debate within the Roosevelt Administration about maintaining western farms and population. Morris Cook, a leading New Deal proponent of applying scientific management to social problems, was tasked with producing a report on the Great Plains.¹¹⁹ The 1936 Report of the Great Plains Drought Area Committee referenced John Wesley Powell's area of natural limitations and suggested that small farms were more appropriate for the harsh climate of the area.¹²⁰ The advice went unheeded. The New Deal was committed to rural development based on the "sustainable and equitable use of water, power, and land," with sustainability interpreted to favor development rather than water supply preservation.¹²¹

The immediate response to the Dust Bowl drought was shelter belts (multiple rows of trees and shrubs to protect farmland), pushed very hard by the Roosevelt Administration, but other factors ultimately helped revive farming in the Great Plains.¹²² In the end, a combination of natural and external factors, combined with substantial government programs, managed the drought retreat.¹²³ The fortuitous factors were the return of wet years starting in 1941. This coincided with the outbreak of World War II, which created a strong demand for commodities. The principal government programs were the soil conservation service, new cropping patterns, crop insurance, rural electrification, and irrigation projects.¹²⁴ Rural electrification and rising crop prices allowed farmers

115. See ROBERT G. ATHEARN, *THE HIGH COUNTRY EMPIRE: THE HIGH PLAINS AND THE ROCKIES* 297-317 (1960).

116. *Id.* at 10.

117. See *id.* at 318.

118. GEORGE MCJIMSEY, *THE PRESIDENCY OF FRANKLIN DELANO ROOSEVELT* 56-65 (2000).

119. For a reflection on the Report's continuing legacy by a leading geographer, see generally Gilbert F. White, *The Future of the Great Plains Revisited*, 5 *GREAT PLAINS Q.* 84 (1986).

120. See A. Dan Tarlock, *Rediscovering the New Deal's Environmental Legacy*, in *FDR AND THE ENVIRONMENT* 155, 165-66 (Henry L. Henderson & David B. Woolner eds., 2005).

121. SARAH T. PHILLIPS, *THIS LAND, THIS NATION: CONSERVATION, RURAL AMERICA, AND THE NEW DEAL* 151, 202 (2007).

122. B. Putney, *Reconstruction in the Dust Bowl*, 2 *EDITORIAL RES. REP.* 1, 1 (1937), <https://library.cqpress.com/cqresearcher/document.php?id=cqresrre1937080300>.

123. See Jonathan Coppess, *The Conservation Question, Part 3: Lessons in Settling Dust*, 9 *FARMDOC DAILY* 1, 2-6 (2019).

124. Robert A. McLeman et al., *What We Learned from the Dust Bowl: Lessons in Science, Policy, and Adaptation*, 35 *POPULATION & ENV'T* 417, 429-432 (2014); Steven L. Rhodes & Samuel E. Wheeler, *Rural Electrification and Irrigation in the U.S. High Plains*, 12 *J. RURAL STUD.* 311, 312 (1996).

to invest in center-pivot pumps. Center-pivot irrigation led to large farm sizes and to the mining of the Ogallala Aquifer.¹²⁵

Following the Dust Bowl drought retreat, irrigation has gradually moved eastward to areas with more rainfall and exploitable groundwater resources, despite increases in the use of pivot irrigation from groundwater.¹²⁶ The U.S. Department of Agriculture's (USDA) Economic Research Service notes that “[b]etween 1949 and 2017, the share of U.S. irrigated cropland in the Mountain and Pacific regions decreased from 77 percent to 44 percent, while the share of irrigated cropland in the Mississippi Delta and Northern Plains regions increased from 8 percent to 34 percent.”¹²⁷ Agriculture increased in Nebraska and Kansas as farmers mined the Ogallala Aquifer, production increased in the Lower Mississippi Valley, and South Carolina, Georgia and Florida increased their reliance on supplemental irrigation.¹²⁸ The gradual movement of traditionally irrigated areas away from the western United States reflects increasing regional competition for available water supplies, changes in surface flow regimes largely reliant on mountain snowpack melt, and diminishing groundwater availability.¹²⁹

III. THE THIRD WAVE OF DROUGHT RETREAT WILL BE THE MOST SEVERE: CLIMATE CHANGE, WESTERN URBANIZATION, AND COMPETING WATER CLAIMS

The current drought retreat is almost certain to be the most severe of the three waves of western drought retreat. Irrigated agriculture faces a continuum of stresses not present in the two prior drought retreats. There are two potentially interrelated existential threats: climate change and the continued urbanization of the West. Climate change, recognized since at least the 1990s, means less water when needed, crop stress, and more crop-destroying disasters, such as floods.¹³⁰ At the same time, dramatic population increases from urbanization are also straining western water supplies.¹³¹ In addition, many western farmers now face competition from senior, but previously unexercised, tribal water rights and state government rights to preserve instream flows.¹³²

125. Richard Hornbeck & Pinar Keskin, *The Historically Evolving Impact of the Ogallala Aquifer: Agricultural Adaptation to Groundwater and Drought*, 6 APPLIED ECON. 190, 191 (2014).

126. *Irrigation & Water Use*, U.S. DEP'T AGRIC. (May 6, 2022), <https://www.ers.usda.gov/topics/farm-practices-management/irrigation-water-use/>.

127. AARON HROZENICK & MARCEL AILLREY, ECON. RSCH. SERV., TRENDS IN IRRIGATED AGRICULTURE REVEALS SECTOR'S ABILITY TO ADAPT TO CLIMATE, RESOURCE, AND MARKET TRENDS (2022), <https://www.ers.usda.gov/amber-waves/2022/january/trends-in-irrigated-agriculture-reveal-sector-s-ability-to-adapt-to-evolving-climatic-resource-and-market-conditions>.

128. *See id.*

129. *Id.*

130. *See generally* United Nations Framework Convention on Climate Change, May 9, 1992, S. Treaty Doc No. 102-38, 1771 U.N.T.S. 107 (early treaty recognizing climate change and its impacts); Raza et al., *supra* note 67, at 2-4.

131. A. Dan Tarlock, *Western Water Law and the Challenge of Climate Disruption*, 48 ENV'T L. 1, 1 (2018).

132. *See generally* WATER & TRIBES INITIATIVE, *supra* note 12, at 1153-1211.

First, climate change has taken a toll on agriculture and will continue to exact costs.¹³³ Agriculture has always depended on a climate that provides the right combination of rainfall, temperature, and humidity necessary for profitable crop yields. Pineapples are grown in Hawai'i, not Montana. Global climate change can have both positive and negative impacts on crop production. In some areas, warmer temperatures could produce longer growing seasons and increased soil fertilization.¹³⁴ But, on balance, the negative impacts predominate.¹³⁵ This is especially true in the West, where farmers have always had to cope with aridity and severe and frequent climate variation.

The most serious risks to agriculture include decreased water availability compared to historic flow variation, crop intolerance to heat, and climate-related extreme events. The U.S. Environmental Protection Agency (EPA) has described the wide-ranging harms to agriculture:

“[E]levated CO₂ has been associated with reduced protein and nitrogen content in alfalfa and soybean plants, resulting in a loss of quality. Reduced grain and forage quality can reduce the ability of pasture and rangeland to support grazing livestock. Warming temperatures and increased precipitation can prevent crops from growing. Extreme events, especially floods and droughts, can harm crops and reduce yields.”¹³⁶

These effects of rising temperature are nonlinear, as J.B. Ruhl and Robin Kundis Craig have observed, with multiplicative and unpredictable effects on social and biological systems which are already transforming in response to climate change.¹³⁷ There are also indirect consequences to farmers from climate change. For example, climate has prompted a dialogue about sustainable clothing choices that could decrease demand for cotton.¹³⁸

The wine industry is the canary in the coal mine for the impact of climate change on agriculture. The wine industry is a good example of both the negative impacts of climate change on agriculture and efforts to combat them.¹³⁹ Wine

133. PETER H. LEHNER & NATHAN A. ROSENBERG, *FARMING FOR OUR FUTURE: THE SCIENCE, LAW, AND POLICY OF CLIMATE-NEUTRAL AGRICULTURE* 35-37 (2021) (“These changing weather patterns and increased extreme weather events [due to climate change] are exacting a heavy toll on American agriculture.”).

134. Richard M. Adams et al., *Effects of Global Climate Change on Agriculture: An Interpretative Review*, 11 CLIMATE RES. 19, 28 (1998).

135. *Id.* at 20.

136. *Climate Impacts on Agriculture and Food Supply*, EPA <https://climatechange.chicago.gov/climate-impacts/climate-impacts-agriculture-and-food-supply> (last visited July 1, 2023).

137. J.B. Ruhl & Robin Kundis Craig, *4°C*, 106 MINN. L. REV. 191, 218 (2021).

138. It takes approximately 2,700 gallons of water to produce a single cotton t-shirt. Replacement fabrics that have cotton's breathability and durability characteristics such as bamboo, hemp, and linen are being promoted. The cotton industry is promoting both the features of cotton and the ability to recycle it. *Behind the Scenes, Replacing Cotton: Fabrics that Represent the Future of Sustainable Fashion*, WORMS SAFETY, <https://wsafety-news.com/blog/replacing-cotton-fabrics-that-represent-the-future-of-sustainable-fashion/> (last visited May 1, 2023).

139. *See generally* BRIAN FREEDMAN, *CRUSHED: HOW A CHANGING CLIMATE IS ALTERING THE WAY WE DRINK* (2022) (describing how climate change has affected the wine industry and its efforts to adapt).

producers have no escape from extreme heat and drought.¹⁴⁰ Increased temperatures can change the balance of acid and sugar that distinguishes a variety, as well as impact the growing season, a grape's geographic range, and the very idea of terroir.¹⁴¹ Extreme heat is already shrinking the production of wine grapes in California.¹⁴² The wine industry illustrates a climate change strategy that will take place along with retreat: adaptation. For example, vineyards are exploring the use of soil sensors to better determine the needed amount of irrigation, finding vines with deeper roots, and putting canopies over vines to lessen the temperature.¹⁴³ Although some agricultural water users can adapt in these ways, overall they have less immediate technical and economic adaptive capacity than municipalities, who can increase water prices or restrict lawns and other water uses relatively quickly.¹⁴⁴ The adaptive capacity of farmers varies among crops and with the state of technology.¹⁴⁵ For example, cotton farmers may be able to adapt through genetic engineering, but those advances will take time.¹⁴⁶

The second threat is the continued urbanization of the West, because people want to live where water is becoming ever scarcer. Our water institutions were designed to support an irrigation economy, but they are adapting to support an urban one. In 1920, the largest western city outside the Pacific Coast was Denver,

140. Kim Chipman, *California's \$45 Billion Wine Industry Faces Climate Peril*, BLOOMBERG (Sept. 7, 2022), <https://www.bloomberg.com/news/articles/2022-09-07/california-s-wine-industry-faces-climate-tipping-point>.

141. Steven Savage, *Why California's 46 Billion Wine Industry Is Better Prepared for Climate Change Than Some of Its Competitors*, FORBES (Nov. 29, 2022), <https://www.forbes.com/sites/stevensavage/2022/11/29/why-californias-46-billion-wine-industry-is-better-prepared-for-climate-change-than-some-of-its-competitors/?sh=2866b7137096>.

142. See generally Chipman, *supra* note 140.

143. Don Sonderling, *Climate Change and California's Wine Industry*, MONARCH WINE (Apr. 5, 2023), <https://monarch.wine/climate-change-and-californias-wine-industry/>.

144. Las Vegas, Nevada is a case in point. In 2021, Nevada's Colorado River allocation was reduced from 300,000 to 279,000 acre-feet. Reclamation Operating Conditions, *supra* note 27. However, due to the Southern Nevada Water Authority's turf retirement program, the metro area had already reduced its withdrawals by 70,000 acre-feet over 2002 levels and currently only withdraws 256,000 acre-feet annually.

145. For an example of farmers struggling to adapt to climate change with limited technology options, see Catherine Porter, *The Rigid World of French Cheesemaking Meets Unbound Climate Change*, N.Y. TIMES (October 29, 2023), <https://www.nytimes.com/2023/10/29/world/europe/french-cheese-climate-change.html>. The article describes the problems that cheese makers in southern France face in trying to keep their valuable terroir designation as climate change makes it difficult if not impossible to comply with French and EU regulations.

146. See *Cotton Production in the Southwestern United States*, SW CLIMATE HUB BULLETIN, <https://swclimatehub.info/bulletin/cotton-southwestern-us> (last visited Feb. 12, 2023). In contrast, municipalities have multiple, effective avenues to adapt to water scarcity. New technologies for residential appliances use less water, and there are simple behavioral changes such as shorter showers and less frequent car washes and yard watering that legislatures can require or households can voluntarily adopt. For example, Las Vegas successfully paid homeowners to xeriscape their yards rather than planting grass, and the state adopted a turf retirement mandate for properties other than single family homes. Assembly Bil 356, 81st Sess., (Nev. 2021); *Water Smart Landscapes Rebate*, LAS VEGAS VALLEY WATER DIST., <https://www.lvwwd.com/conservation/rebates/index.html#:~:text=Upgrade%20existing%20grass%20to%20water,at%20702%2D258%2DSAVE> (last visited July 29, 2023).

and the West was the least urbanized area.¹⁴⁷ Today, the West is the most urbanized area of the country, with rapidly growing cities from the Phoenix metropolitan area to Saint George, Utah.¹⁴⁸ A map of western counties primarily dependent on agriculture shows that there are very few, with the exception of eastern Montana, the Dakotas, Nebraska, and western Kansas.¹⁴⁹ Since John Wesley Powell's famous, but largely ignored, "Report on the Arid Lands of the United States," farmers and proponents of urban growth have denied the limits to settlement in arid and semi-arid areas on the theory that technology can outwit nature.¹⁵⁰

Determined municipalities are increasingly buying up water rights, despite the fact that transactions are more costly in the United States' underdeveloped water markets. Until the 1970s, cities and irrigated agriculture observed an unwritten rule that cities would not poach irrigation supplies. But, in the 1960s, economists began to argue that too much water was devoted to low-value uses, including crops such as alfalfa, and recommended markets to transfer water to higher valued uses, primarily urban use.¹⁵¹ This recommendation has become reality. Western municipalities are now vigorously purchasing water rights from farmers or from intermediary investment firms that buy water rights from farmers.¹⁵²

The third threat is the problem of previously unaccounted-for water claims from 1) Native American tribes who hold unsettled water rights; and 2) state governments with unexercised rights to conserve instream flows. These stakeholders are now asserting water rights in response to climate change and water shortage.¹⁵³ During the height of the Big Dam era, little attention was paid

147. In 1920, Denver was the nation's 25th largest city with a population of 256,491; the next largest in the West outside of the Pacific Coast was Salt Lake City with a population of 118,110. See *Table 15. Population of the 100 Largest Urban Places: 1920*, U.S. CENSUS BUREAU (June 15, 1998), <https://www2.census.gov/library/working-papers/1998/demographics/pop-twps0027/tab15.txt>.

148. In the West, 88.9 percent of the population lives in urban areas. See *Nation's Urban and Rural Populations Shift Following 2020 Census*, U.S. CENSUS BUREAU (Dec. 29, 2022), <https://www.census.gov/newsroom/press-releases/2022/urban-rural-populations.html#:~:text=Of%20the%20nation's%20four%20census,Northeast%20Region%2C%20at%2084.0%25>. For an argument that the urban West is the "real" West, see A. Dan Tarlock, *The "Empty" West as Urban Hinterland*, 56 IDAHO L. REV. 27, 32-36 (2020).

149. CAROLYN DIMITRI ET AL., U.S. DEP'T. OF AGRIC., *THE TWENTIETH CENTURY TRANSFORMATION OF UNITED STATES AGRICULTURE AND FARM POLICY* 4 (2005), https://www.ers.usda.gov/webdocs/publications/44197/13566_eib3_1_.pdf.

150. See POWELL, *supra* note 88.

151. Jediah Brewer et al., *Transferring Water in the American West: 1987-2005*, 40 U. MICH. J. REFORM, 1021, 1021-24 (2007) (tracing the early arguments by economists that too much water was devoted to low value crops such as alfalfa to the emergence of water markets as a major component of water law reform).

152. See e.g., James & Hing, *supra* note 40; Gligich, *supra* note 42.

153. Agriculture has considerable advantages in contesting these interests, although these advantages are not as strong as they once were. Farms and ranches often hold high-seniority water rights perfected under the prior appropriation doctrine before the West's urban explosion and before most tribes perfected their rights via water rights settlement. Agricultural producers also have considerable clout due to a federal system that still disproportionately favors rural areas. As a result, farmers benefit from an enormous federal

to either state non-consumptive or tribal rights. In the past two decades, Western states have developed legal frameworks for state instream flow rights and integrated these conservation rights into state water management.¹⁵⁴ With respect to the tribes, the Supreme Court in the 1908 case of *Winters v. United States* confirmed that Native American reservations had super-riparian consumptive water rights that antedated most state water rights claimed by non-Indian settlers.¹⁵⁵ *Winters* identified water rights as a way to turn Native Americans into a pastoral and irrigation society alongside their white counterparts.¹⁵⁶ Currently, twenty-two tribes in the Colorado River Basin hold water rights to approximately 22–26 percent of the Colorado River Basin’s average annual water supply but currently only use a small fraction of that water, due to lack of irrigation infrastructure.¹⁵⁷ Twelve other tribes in the Colorado River Basin have unresolved water claims not yet factored into that percentage.¹⁵⁸ As tribes develop more irrigation infrastructure and settle their rights under *Winters*, non-tribal agriculture will face more competition with tribal water rights holders.

Water rights claims held by governments also compete with agricultural water use, especially in basins with federally listed endangered or threatened fish. Beginning with the 1968 enactment of the Wild and Scenic Rivers Act, the concept of environmental flows has slowly gained traction.¹⁵⁹ All western states now recognize instream appropriations or have mechanisms to reserve instream flows, but the amount of water devoted to non-consumptive, environmental protection remains small and often contested compared to the amount of consumptive agricultural water rights.¹⁶⁰ We briefly describe three conflicts over instream appropriations, one tense and ongoing; one emerging; and one that suggests a model for climate change-driven efforts to balance instream flows, fish, and productive agriculture.

and state support system, including federal crop insurance, to mitigate the effects of drought and curtailed water supply.

154. Cynthia F. Coveli et al., *Update to a Survey of State Instream Flow Programs in the Western United States*, 20 U. DENV. WATER L. REV. 355, 356 (2017).

155. *Winters v. United States*, 207 U.S. 564, 577 (1908). Reserved rights are a mix of prior appropriation and riparian law. They have a priority date on which the reservation was created, but they do not have to put to beneficial use to maintain them. They can be asserted at any time. Reserved rights were later extended to federal lands used for a water-related purpose. *Arizona v. California*, 373 U.S. 546, 579-80 (1963); see also BARBARA COSENS & JUDITH ROYSTER, *THE FUTURE OF INDIAN AND FEDERAL RESERVED WATER RIGHTS: THE WINTERS CENTENNIAL 5–14* (2012) (detailing the history of the *Winters* doctrine).

156. *Winters*, 207 U.S. at 576. However, Congress and the Bureau of Reclamation shortchanged Native Americans, who received far less irrigation project funding than whites.

157. WATER & TRIBES INITIATIVE, *supra* note 12, at 1.

158. *Id.*

159. See 16 U.S.C. §1271 (2023).

160. See, e.g., Laura Ziemer et al., *How the West Is Won: Advancing Water Law for Watershed Health*, 42 PUB. LAND & RES. L. REV. 81, 84–86 (2020) (survey of western states instream flow laws); Courtney Watts, *Symposium: Western Instream Flows: Fifty Years of Progress and Setbacks*, 36 ENV'T L. 1113, 1113–14 (2006) (introducing symposium issue devoted to research on instream flows).

The first example of instream flow conflict comes from the Klamath Basin in Oregon, one of the first Reclamation projects, which still represents the original goal of family farms.¹⁶¹ The project sits below the Klamath Lake and the Klamath Reservation. The listing under the Endangered Species Act of two types of fish (called suckers) that are revered by the Tribe, and the ensuing Biological Opinion under the Endangered Species Act, led the Bureau of Reclamation to withhold water from irrigators starting in 2001.¹⁶² This has created tension during the frequent drought years. The Tribes' position was strengthened in 2019, when the Federal Court of Claims held that the Tribe had non-consumptive rights to Klamath Lake (i.e., to protect water flow for the suckers), which changed a decades-old power structure.¹⁶³ While there is no evidence that this water conflict has caused population loss at present, the majority of the projected growth in the next two decades is expected to be in Klamath Falls, rather than in rural areas.¹⁶⁴

The debate over the future of the Great Salt Lake is a second example of an emerging agricultural versus environmental conflict. Since Brigham Young led the Mormons to Utah in 1847, the Great Salt Lake is now nineteen feet below its average and has lost 73 percent of its water and 60 percent of its surface area.¹⁶⁵ The Lake is a closed basin fed by three rivers. As the Lake shrinks, the thin salt layer that traps toxic dust is disappearing, threatening the air quality of Greater Salt Lake City.¹⁶⁶ To restore the Lake, more freshwater flows are needed, and upstream alfalfa farms have been identified as targets.¹⁶⁷ In 2023, the Utah legislature failed to act on reports that upstream diversions needed to be cut by 30-40 percent.¹⁶⁸ Instead, the state is following California, waiting for wet year relief, which happened in the spring of 2023.

To end on a more positive note, the Yakima Basin in eastern Washington state illustrates how stakeholder-driven integrated water resources management

161. The average farm is under 500 acres, well below the allowed Homestead and Desert Land Act entries. See *2017 Census of Agric., Klamath County Oregon*, U.S. DEP'T AGRIC. (2017), https://www.nass.usda.gov/Publications/AgCensus/2017/Online_Resources/County_Profiles/Oregon/cp41035.pdf.

162. See HOLLY DOREMUS & A. DAN TARLOCK, *WATER WAR IN THE KLAMATH BASIN: MACHO LAW, COMBAT BIOLOGY AND DIRTY POLITICS* 10-40 (2008).

163. *Bailey v. United States*, 134 Fed. Cl. 619, 671 (2017), *aff'd*, 942 F.3d 1312 (Fed.Cir. 2019).

164. POPULATION RES. CTR., *COORDINATED POPULATION FORECAST 2022-2072 KLAMATH COUNTRY* 13 (2022), <https://www.pdx.edu/population-research/sites/g/files/znlchr3261/files/2022-06/Klamath.pdf>.

165. Margaret Osborne, *Drying Great Salt Lake Could Expose Millions to Toxic Arsenic-Laced Dust*, SMITHSONIAN (Jan. 13, 2023), <https://www.smithsonianmag.com/smart-news/drying-great-salt-lake-could-expose-millions-to-toxic-arsenic-laced-dust-180981439/>.

166. See *id.*

167. Editorial, *Why It's Time for Utah to Buy Out Alfalfa Farmers and Let the Water Flow*, SALT LAKE TRIB. (Dec. 4, 2022), <https://www.sltrib.com/opinion/editorial/2022/12/04/why-its-time-utah-buy-out/>.

168. It did appropriate 200 million to improve irrigation techniques, which experts claim only addresses about 15 percent of the needed reductions. See *Water Legislation and Funding Passed During the 2023 General Session*, UTAH SENATE (March 8, 2023), <https://senate.utah.gov/water-legislation-and-funding-passed-during-the-2023-general-session/>.

can lead to adaptive strategies that conserve both fish and agriculture. The Basin has a population of four hundred thousand and no major urban area competing for water; however, it hosts tribes and others who are concerned about salmon runs.¹⁶⁹ It is a productive agricultural area in the state, producing quality wines and 75 percent of the nation's hops.¹⁷⁰ Climate change could impact both these valuable crops adversely, shifting wine growing further north and into British Columbia (benefitting an already major wine region). In 2013, the Washington state legislature appropriated money for an integrated planning process which explicitly recognizes the need for climate change adaptation.¹⁷¹ The plan has already produced a number of initiatives, including increased fish runs, aquatic habitat restoration, water markets, groundwater storage, and enhanced irrigation conservation.¹⁷²

This Part has examined the factors that are poised to make the third wave of drought retreat the most severe that western agriculture has faced, potentially dwarfing the Dust Bowl. In the face of this massive threat, Part IV examines the costs of the current market-based, ad hoc allocation of drought retreat.

IV. MARKET FAILURE AND MANAGED RETREAT: THE COSTS OF LEAVING RETREAT TO MARKETS

Why not let the market sort out drought retreat? Market failures in the agricultural economy, as well as the limitations of markets to create equitable solutions, point to the fact that drought retreat should not be left entirely to the market. At present, the allocation of retreat is based primarily on: 1) farmers' private rights in surface water and groundwater (including state and federal regulations impacting water rights); and 2) the individual wealth of the farm or ranch. Government agricultural subsidy also influences who retreats, distorts the market, and delays and protracts retreat.¹⁷³ The United States has left the process of drought retreat largely to market forces and its pain to individual farmers. As we discuss below, retreat based on water rights and wealth, in a subsidized and intervened-upon agricultural market, has increased farmer suffering and imposed a variety of costs, including to individual profits, food security, distributional justice, and the environment.¹⁷⁴

169. DOREMUS & TARLOCK, *supra* note 162, at 10–13.

170. Alice Gabriel, *In the Yakima Valley, Serious Wines and Sweeping Vistas*, N.Y. TIMES (Aug. 18, 2017), <https://www.nytimes.com/2017/08/18/travel/yakima-valley-wines.html>.

171. See *Yakima River Basin Integrated Plan*, WASH. DEP'T ECOLOGY, <https://ecology.wa.gov/water-shorelines/water-supply/water-supply-projects-ew/yakima-river-basin-projects/yakima-integrated-plan> (last visited July 29, 2023).

172. See YAKIMA BASIN INTEGRATED PLAN HIGHLIGHTS, U.S. BUREAU RECLAMATION 5-7, 15, 17 (2022), <https://www.usbr.gov/pn/programs/yrbwep/2011integratedplan/newsletter/2022ybip.pdf>.

173. See *infra* Part IV.C.

174. See *infra* Part I.

A. Allocating Retreat by Water Rights

The strongest determinant of agricultural drought retreat is the pre-existing allocation of private water rights. The western United States has a system of private water rights based on the first in time to claim water and put it to continuous, beneficial use.¹⁷⁵ The most senior, or first in time, rights holders receive their full volume of water, and then the more junior rights holders get their water, in order of priority, if there is water remaining.¹⁷⁶ This system has inconsistently recognized the rights of indigenous users as first in time.¹⁷⁷ The water rights of many farmers and ranchers date back hundreds of years to miners who staked claims to water during the country's settlement.¹⁷⁸ Notably, the U.S. system is anomalous among global water systems, most of which treat all or part of their water as public property.¹⁷⁹

The quantity and priority of water rights owned or leased strongly predict whether a farm or ranch has the option to continue operations or must retreat, either by fallowing fields or relocating entirely. High priority and volume water rights increase the ability to farm in place, as well as the option to fund relocation or change to a different business by selling those water rights.¹⁸⁰ For example, a farm that owns a large volume of senior water rights can use their water to continue farming or, in some cases, can opt to sell water to a nearby municipality. In contrast, farms with a low priority or insufficient quantity of water rights are more vulnerable to forced retreat.¹⁸¹ In the earlier stages of drought, crop-switching, more efficient irrigation, or federal subsidy can forestall retreat for farms with insufficient water rights.¹⁸² However, as the western drought worsens, many farms and ranches have exhausted options or adopted measures too late and have no choice but to shutter operations or relocate.

In the poorly functioning U.S. water market, water users cannot easily reallocate water in response to drought and climate change by buying and selling water rights. Unlike municipalities with legal departments and water staff, small farmers who seek to buy or sell water must navigate numerous market barriers without assistance. Small farms and less affluent farmers and ranchers not only can't afford to buy additional water rights (especially as water supply dwindles and prices increase), but in many cases they cannot even sell their water rights at

175. Douglas S. Kenney, *Prior Appropriation and Water Rights Reform in the Western United States*, in WATER RIGHTS REFORM: LESSONS FOR INSTITUTIONAL DESIGN 167, 170–71 (Bryan Randolph Bruns et al. eds., 2005).

176. *Id.*

177. See WATER & TRIBES INITIATIVE, *supra* note 12, at 1153-1211.

178. Lawrence J. Macdonnell, *Prior Appropriation: A Reassessment*, 18 U. DENV. L. REV. 228, 229, 232 (2015).

179. See George E. Radosevich, *Global Water Law Systems and Water Control*, 6 DENV. J. INT'L L. & POL'Y 263, 266-78 (1976) (describing different countries' legal approaches to water).

180. *Cf. infra* Part I.

181. This is an age-old issue for the small farm as evidenced in the 1890s drought retreat and the Dust Bowl retreat, *see infra* Part II.

182. See, e.g., *infra* notes 68, 146-47.

full value.¹⁸³ Farmers that have small volumes of water rights, own water rights at a distance from urban centers without water conduits, or lack the expertise to negotiate individual transactions or access to water investment middlemen cannot sell their water rights at value or in some cases at all. Water is difficult and expensive to transport over long distances and uphill, which limits the practical ability to buy water from a distance or from lower-elevation sources.¹⁸⁴ Institutionally, U.S. water markets lack a comprehensive private water system or national exchange for transfers.¹⁸⁵ Because state law governs water rights, the rights are not standard across states, which increases the costs and risk of trades.¹⁸⁶ There is also a large volume of “unsettled” water rights that cannot be traded until the holders, often tribes, quantify their rights and formalize ownership in legal proceedings.¹⁸⁷

B. Allocating Retreat by Wealth

Parallel to water rights, the size and wealth of farms allocate drought retreat. Wealthier farming and ranching operations not only tend to own more water, they also have more funds for adaptation (e.g., to diversify crops, install more water-efficient irrigation, and pay for cattle feed to replace parched grazing lands).¹⁸⁸ In particular, they are better able to purchase technology for adaptation to drought, such as the newest drip irrigation systems or agrovoltatics.¹⁸⁹ Larger operations also tend to have better access to government resources and subsidies, an important stream of income that smaller operations (particularly Black-owned farms) often lack.¹⁹⁰ The vulnerability and harsh consequences that smaller, less wealthy farms face in major droughts is longstanding. As is the case today, in the 1930s Dust Bowl, large farms were more likely to survive than smaller ones, who could not afford to diversify crops or revenue streams or to fallow land to reduce

183. For a discussion of equity in retreat, *see infra* Part I.

184. *See* Robert A. Young, *Why Are There so Few Transactions Among Water Users?*, 68 AM. J. AGRIC. ECON. 1143, 1145 (1986).

185. Barton H. Thompson, *Institutional Perspectives on Water Policy and Markets*, 81 CALIF. L. REV. 671, 701–15 (1993) [hereinafter *Institutional Perspectives*] (describing barriers to water transfers in U.S. and potential benefits of moving from a prior appropriation model to a better-functioning water market); *see also* BARTON H. THOMPSON, *LIQUID ASSET: HOW BUSINESS AND GOVERNMENT CAN PARTNER TO SOLVE THE FRESHWATER CRISIS* 2–3 (2023).

186. *Institutional Perspectives*, *supra* note 185, at 723–30.

187. *See infra* Part III.

188. *See, e.g.*, S. Mushtaq et al., *Reconfiguring Agriculture Through the Relocation of Production Systems for Water, Environment, and Food Security Under Climate Change*, 153 J. AGRIC. SCI. 1 (2014) (describing how diversification of farms in the Queensland region of Australia enables adaptation of their production processes).

189. Agrovoltatics locates solar arrays over crops to produce energy and shade and reduce water use. *See* Michele Boyd, *The Potential of Agrovoltatics for the U.S. Solar Industry, Farmers, and Communities*, U.S. DEP’T ENERGY (Apr. 17, 2023), <https://www.energy.gov/eere/solar/articles/potential-agrovoltatics-us-solar-industry-farmers-and-communities>.

190. Megan Horst & Amy Marion, *Racial, Ethnic and Gender Inequities in Farmland Ownership and Farming in the U.S.*, 36 AGRIC. & HUM. VALUES 1, 4 (2019).

soil erosion.¹⁹¹ Notably, our proposal for managed retreat focuses on facilitating climate transition and aiding vulnerable small farms, even though retreating the largest water users and most senior water rights holders would produce greater water savings.

C. Subsidy: Market Distortion and Failure

Government subsidies for agriculture in place are an important determinant of how much and how quickly drought retreat occurs. Subsidies also affect who retreats, with farms that receive proportionally more subsidy money (often larger farms) better insulated from forced retreat. To date, government subsidy has increased the amount of agriculture in the West that must be retreated and underproduced and protracted retreat. While subsidy can forestall retreat for a period and allow doomed operations to limp along accruing losses, it ultimately cannot prevent the need for some western farms to retreat. Our proposal for managed retreat, while a subsidy itself, is warranted in part because of the massive subsidization of agriculture in place and resulting distortion of the market.

The federal government supports agriculture in place through a panoply of subsidies.¹⁹² One of the most extensive and well-funded is the Conservation Reserve Program (“CRP”). The CRP contracts with farmers and pays them rent to leave environmentally sensitive land fallow or plant species that provide environmental benefits.¹⁹³ It operates nationwide and is not limited to arid land, although many western farmers participate.¹⁹⁴ In 2023, farmers enrolled over five million acres in the CRP for terms of ten to fifteen years.¹⁹⁵ In theory, the CRP could function as a partial drought retreat program by leasing acres in areas of severe water shortage or even leasing water rights. In practice, because the CRP rental contracts are typically for part, not all, of a farm’s land, they may provide farmers with a financial cushion to cultivate the rest of their land and encourage western agriculture to persist. Of note, the USDA recently announced a plan to monitor and measure climate benefits from the CRP and to incentivize carbon sequestration and emissions reductions by farmers; however, this

191. See Robert A. McLeman et al., *What We Learned from the Dust Bowl: Lessons in Science, Policy, and Adaptation*, 35 *POPULATION & ENV'T* 418, 426–29 (2013).

192. As Michael Glantz writes, during relatively wet periods, “governments tend to encourage the exploration of [marginal agricultural] lands and often overlook or misjudge the long-term difficulties in sustaining agricultural production there.” Glantz, *supra* note 8, at 20-21.

193. *Conservation Reserve Program*, U.S. DEP’T AGRIC., <https://www.fsa.usda.gov/programs-and-services/conservation-programs/conservation-reserve-program/> (last visited July 10, 2023).

194. The Farm Service Agency ranks applications to the Conservation Reserve Program based on an environmental benefits index, which concentrates on wildlife, water and air quality, and soil erosion. U.S. DEP’T AGRIC., *CONSERVATION RESERVE PROGRAM FACT SHEET* (2021), <https://www.fsa.usda.gov/Assets/USDA-FSA-Public/usdafiles/FactSheets/2020/crp-56th-ebi-fact-sheet-12-31-2020.pdf>.

195. *Id.*

assessment does not include the costs of enabling more agriculture to persist in unsuitable arid locations.¹⁹⁶

The federal government also funds other, drought-specific subsidies to maintain arid farming. Recent federal payments to farmers to fallow fields in order to reduce the strain on the Colorado River function to preserve western farming.¹⁹⁷ The USDA Emergency Assistance for Livestock, Honey Bees, and Farm-Raised Fish program compensates ranchers in counties with a prolonged “severe” drought ranking for the costs of moving livestock to better grazing or transporting water into their ranches.¹⁹⁸ In 2023, the federal Bureau of Reclamation announced the Water Smart grant, a competitive grant for climate adaptation that funds 50 percent of the cost of a project that conserves water or uses it more efficiently in the western United States.¹⁹⁹ Water Smart and certain other government programs advance climate adaptation, a goal this paper does not dispute as a general matter. Standing alone, however, policies promoting water efficiency are an incomplete solution because they exclusively incentivize water conservation in place, rather than also moving some agriculture to more water rich regions.

Federal crop insurance, authorized under the Agricultural Adjustment Act of 1938 and the Federal Crop Insurance Act of 1980, is an enormous driver of agricultural persistence in the West. Federal crop insurance offers subsidized insurance policies to farmers for suboptimal crop yields or market prices.²⁰⁰ In the West, crop insurance is de facto drought insurance. At taxpayer expense, crop insurance distorts market forces that otherwise would have transferred some arid agriculture into water-rich locations. Federal crop insurance has an extensive reach, with over 90 percent of planted acres for corn, soybeans, and cotton and over 85 percent of the planted acres of wheat insured by the federal government at subsidized, below-market rates at a cost of three billion dollars annually.²⁰¹ In addition to crop insurance, the federal government offers subsidized loans and loan guarantees to farmers and ranchers who cannot obtain credit in the private

196. U.S. DEP’T AGRIC., CONSERVATION RESERVE PROGRAM, WHAT’S NEW? (2021), <https://www.fsa.usda.gov/Assets/USDA-FSA-Public/usdafiles/FactSheets/crp-whats-new-fact-sheet.pdf>.

197. Ian James, *As Drought Worsens, California Farmers Are Being Paid Not to Grow Crops*, L.A. TIMES (Oct. 10, 2021), <https://www.latimes.com/environment/story/2021-10-10/colorado-river-california-farmers-dry-fields-fallow-drought>; Joshua Partlow et al., *Arizona’s Water Troubles Show How Climate Change is Reshaping the West*, WASH. POST (June 4, 2023), <https://www.washingtonpost.com/climate-environment/2023/06/04/water-shortage-arizona-california-utah-climate-change/>; Tate Wilkins, *Pay a Farmer, Save the Colorado?*, PROP. & ENV’T RSCH. CTR. (Dec. 20, 2022), <https://www.perc.org/2022/12/20/pay-a-farmer-save-the-colorado/>.

198. 7 C.F.R. § 1416 (2023).

199. *WaterSMART Water and Energy Efficiency Grants*, U.S. BUREAU RECLAMATION, <https://www.usbr.gov/watersmart/weeg/> (last updated Feb. 26, 2024).

200. Agricultural Adjustment Act of 1938, 7 U.S.C. §§ 1281–1407; Federal Crop Insurance Act of 1980, 7 U.S.C. §§ 1501–1524.

201. STEPHANIE ROSCH, CONG. RSCH. SERV., FEDERAL CROP INSURANCE: A PRIMER 2 (2021); Glauber, *supra* note 1, at 1182.

market for farming purchase, operations, natural disasters, and other costs.²⁰² The U.S. Farm Service Agency (FSA), an agency of the USDA, manages the program's loans, which include 2.1 billion for farm purchase loans alone.²⁰³

States also subsidize agriculture in place during drought.²⁰⁴ For example, Missouri Governor Mike Parsons recently made the water at state parks and conservation areas available to farmers via executive order.²⁰⁵ In addition, many states subsidize arid farming indirectly, by inadequately protecting groundwater reserves and allowing farmers to increase pumping during drought.²⁰⁶

D. Costs of Market-Based Retreat

Retreat based on water rights and wealth is costly and chaotic. Farmers and ranchers cling to their operations as losses accumulate, in some cases only to fold in the end due to water shortage.²⁰⁷ As a result of individual preferences to remain in place and agricultural subsidies for persistence, ad hoc retreat also produces too little retreat relative to water supply and crop quality and quantity.²⁰⁸ The pain and suffering occurring in the third wave of drought retreat follows the historical pattern of drought retreats. For example, the midwestern drought of 2011–12 created thirty-five billion dollars of agricultural losses, damage to grasslands and pastures, and food inflation,²⁰⁹ and the 1950s Texas drought eliminated one hundred thousand Texas farms and ranches and

202. U.S. DEP'T AGRIC., YOUR GUIDE TO FSA FARM LOANS 8, 11–12 (2019), https://www.fsa.usda.gov/Assets/USDA-FSA-Public/usdafiles/Farm-Loan-Programs/pdfs/your_guide_to_farm_loans.pdf. The loan limits for operating and purchase loans are sizeable, with for example operating loans available to a maximum of \$400,000. *Id.* at 14. The FSA also guarantees loans from commercial lenders to farmers and ranchers, up to a limit of 95 percent, and provide guarantees to sellers who sell via land contract to a new or socially disadvantaged farmer.

203. *Farm Loan Programs*, U.S. DEP'T AGRIC., [https://www.fsa.usda.gov/programs-and-services/farm-loan-programs/index_\(last visited May 4, 2023\)](https://www.fsa.usda.gov/programs-and-services/farm-loan-programs/index_(last%20visited%20May%204,%202023)); *Program Data*, U.S. DEPT AGRIC., [https://www.fsa.usda.gov/programs-and-services/farm-loan-programs/program-data/index \(last visited July 1, 2023\)](https://www.fsa.usda.gov/programs-and-services/farm-loan-programs/program-data/index_(last%20visited%20July%201,%202023)).

204. Cf. Lawrence W. Libby & Patrick A. Stewart, *The Economics of Farmland Conversion*, in UNDER THE BLADE 137, 160–61 (Richard K. Olson & Thomas A. Lyson eds., 1999) (describing widespread state and local programs that similarly require or incentivize farmland preservation).

205. Mo. Exec. Order No. 23-05 (2023); *Governor Parson Announces Emergency Water and Hay Access for Farmers*, OFF. GOVERNOR MICHAEL L. PARSON (June 13, 2023), <https://governor.mo.gov/press-releases/archive/governor-parson-announces-emergency-water-and-hay-access-farmers-0>.

206. See MEDELLÍN ET AL., *supra* note 49, at 10–11, 23 (describing increased groundwater pumping as climate “adaptations” by farmers).

207. See *infra* Part I.

208. Cf. Robert M. Beyer et al., *Relocating Croplands Could Drastically Reduce the Environmental Impacts of Global Food Production*, 3 COMM. EARTH & ENV'T 2 (2022) (modeling magnitude of relocation necessary for water, carbon, and environmental improvement).

209. Neil S. Grigg, *The 2011–2012 Drought in the United States: New Lessons From a Record Event*, 30 INT'L J. WATER RES. DEV. 183, 183, 191–92 (2014) (2011–12 midwestern drought depressed U.S. economic growth, created 35 billion in losses in the Midwest and Plains regions, increased food prices, dried up grasslands, and closed major livestock processing facilities.). The author contends that the federal and state governments responses to drought, such as planning, technical assistance, and subsidies, are “principal coping mechanisms to mitigate adverse effects from water shortages.” *Id.* at 195.

approximately 10 percent of the state's rural residents.²¹⁰ Writing about the 1930s Dust Bowl agricultural exodus, historian Donald Worster states, "In no other instance was there greater or more sustained damage to the American land, and there have been few times when so much tragedy was visited on its inhabitants."²¹¹ As discussed previously, the current third wave of drought retreat is likely to impose *higher* magnitude losses than these past droughts, due to climate change, urbanization, and uncounted water claims.²¹² The following Subparts describe the harms to the farmers, food security, equity, and the environment from the current drought retreat.

1. Costs to Individual Farmers and Workers

The current system of ad hoc retreat imposes high, concentrated losses on individual farmers and farmworkers, especially from small farms. Drought significantly reduces agricultural yields as farmers plant fewer acres and the plants or animals produced are smaller in size.²¹³ In severe drought conditions, farmers and ranchers often spend more money for water, feed, pesticides, and adaptation technologies in order to produce less food.²¹⁴ Without government support for relocation, farmers may stay in place, racking up losses and escalating debt year after year, only to have to shutter their operations in the end. Moreover, a rushed, chaotic retreat driven by financial exigency is likely to increase losses to farmers and their workers compared to government-assisted retreat that allows adequate time to wind down businesses and find alternative sources of income.

Water shortage is now widespread and affects many farms and ranches, likely causing greater total losses than if some agriculture relocated, leaving the remaining farms and ranches with adequate water supply (e.g., groundwater). In game theory, this situation is similar in some respects to a "prisoner's dilemma" game where individuals have an incentive to choose options that create worse outcomes for the group.²¹⁵ Cooperation does not occur because each individual prisoner (i.e., farmer) cannot control the actions of others. Also, in the case of agriculture in the West, cooperation fails because there is no mechanism for individual farmers who relocate to capture the gains to society and other farmers. Therefore, each one has an incentive to choose an option that delivers a smaller, often short-term, individual gain, rather than to gamble on a larger gain that

210. John Burnett, *How One Drought Changed Texas Agriculture Forever*, NPR (July 7, 2012), <https://www.npr.org/2012/07/07/155995881/how-one-drought-changed-texas-agriculture-forever#:~:text=How%20One%20Drought%20Changed%20Texas%20Agriculture%20Forever%20Texas%20farmers%20were,event%20of%20another%20dry%20spell>.

211. DONALD WORSTER, *DUST BOWL: THE SOUTHERN PLAINS IN THE 1930S* 24 (1979).

212. See *infra* Part III.

213. See EPA, *supra* note 136.

214. See Cynthia Rosenzweig et al., *Climate Change and Extreme Weather Events - Implications for Food Production, Plant Diseases, and Pests*, 2 GLOB. CHANGE & HUM. HEALTH 90, 93–94, 97 (2001).

215. See Robert Axelrod, *Effective Choice in the Prisoner's Dilemma*, 24 J. CONFLICT RESOL. 3, 4 (1980).

materializes only if the other players choose to cooperate (i.e., forego their own smaller individual gains).²¹⁶

Ad hoc drought retreat also creates pain for farmworkers that the agricultural market worsens, rather than mitigates. As farmers fallow land or close operations, farmworkers experience job and income losses.²¹⁷ In many cases, unplanned retreat doesn't provide notice to workers, which worsens the economic shock. Without government support for agricultural retreat, assistance for farmworkers is limited to unemployment insurance, which often does not apply due to immigration status or low earnings.²¹⁸ Currently, there are not enhanced unemployment insurance benefits for climate-displaced workers, policies extending unemployment assistance to undocumented workers, or other climate transition aid mechanisms for farmworkers.

Although we focus on economic relief to farmers and farmworkers, it is worth noting that market-based drought retreat also depresses gross domestic product (GDP). Given the large amount of crop production in the West, particularly California, the third wave of drought retreat will have negative effects on national GDP, as has occurred in past droughts.²¹⁹ In addition, crop losses cost taxpayers due to federal crop insurance. A 2021 study of crop insurance claims found that climate change created twenty-seven billion dollars in crop losses from 1991–2017, representing 19 percent of national crop insurance losses during that time period.²²⁰ Research by the Grantham Research Institute on Climate Change and the Environment at the London School of Economics found that if crop locations are held constant in the United States, then crop yields will decrease profits by 31 percent by 2070.²²¹ The economic loss drops to 16 percent when crops relocate to their optimal growing areas.²²² Other studies similarly indicate that without prompt relocation to areas with adequate water, the economic value of crop output will decline substantially.²²³

216. *See Id.*

217. *See, e.g.,* Cecilia Tortajada et al., *The California Drought: Coping Responses and Resilience Building*, 78 ENV'T SCI. & POL'Y 97, 100 (2017) (examining resilience of crops, workers, and other actors to the California drought from 2011–16).

218. *See* Emma Janger et al., *Making Unemployment Insurance Work for Working People*, 68 UCLA L. REV. DISCOURSE 102, 106–07 (2020) (criticizing that federal law nearly always makes undocumented workers ineligible for unemployment insurance); Walter Nicholson & Karen Needels, *Unemployment Insurance: Strengthening the Relationship Between Theory and Policy*, 20 J. ECON. PERSP. 47, 51 (2006) (describing how some state laws block unemployment compensation for seasonal workers through monetary eligibility formulas).

219. A drop in GDP has occurred in past droughts, such as the drought of 2011–12, *see* Grigg, *supra* note 209, at 191.

220. Noah S. Diffenbaugh et al., *Historical Warming Has Increased U.S. Crop Insurance Losses*, 16 ENV'T RES. LETTERS 1, 6–10 (2021), <https://iopscience.iop.org/article/10.1088/1748-9326/ac1223/pdf>.

221. Rising & Devineni, *supra* note 63, at 4 (modeling the major U.S. crops of barley, corn, cotton, soybeans, rice, and wheat).

222. *Id.*

223. *See, e.g.,* Mushtaq et al., *supra* note 188.

2. Food Security and Nutritional Losses

Ad hoc retreat threatens food supply as farms produce inadequate crop yields or shutter operations in close succession. At the extreme, we could see food supply insecurity as prices increase in response to lower crop yields.²²⁴ Highlighting the risk, California's rapidly dwindling agricultural powerhouse, the Central Valley, produces approximately 25 percent of the nation's food and 40 percent of its fruits and vegetables.²²⁵ In response to agricultural drought retreat, imports will likely increase, consonant with the longstanding U.S. choice not to produce our full food supply (although the United States to date is a net food exporter). However, the transition to more imported food will take time to smooth out and risk food supply interruptions initially. In addition to crops sold as commodities, drought also reduces the quantity of donated crops. A 2018 study found that food banks reported a decrease in donated food from farmers during droughts.²²⁶

Market-based, ad hoc retreat also increases nutritional losses by underproducing retreat (i.e., too much agriculture remains in drought areas) or moving agriculture to land that is also arid or otherwise disaster-prone. There is abundant evidence that drought reduces the vitamin and mineral content of plants so that they are less nutritious to consume. Plant scientists predict that the protein concentrations in staple crops will fall by 6–18 percent by 2050 due to climate change and micronutrient levels will continue to drop.²²⁷ These nutritional losses occur because lack of water lowers the microbial and mineral content of soil and impairs the transport of nutrients from the roots to the leaf system of the plants.²²⁸ The seeds produced by drought-affected plants are lower in number and quality as well.²²⁹ There is no way for consumers to measure the nutritional content of crops (e.g., lettuce grown in drought conditions versus more nutrient-rich lettuce). As a result, agricultural markets operate primarily on quantity, not nutritional quality. This enables drought-affected farms to continue so long as they can produce a sufficient volume of food and profit, regardless of crops' degraded nutritional value.

224. S. Chakraborty & A.C. Newton, *Climate Change, Plant Diseases and Food Security: An Overview*, 60 *PLANT PATHOLOGY* 2, 4–5 (2011).

225. Wilson, *supra* note 45, at 2.

226. Greene, *supra* note 50, at 289.

227. Danielle E. Medek et al., *Estimated Effects of Future Atmospheric CO₂ Concentrations on Protein Intake and the Risk of Protein Deficiency by Country and Region*, 125 *ENV'T HEALTH PERSP.* 087002-3—087002-6 (2017), <https://ehp.niehs.nih.gov/doi/epdf/10.1289/EHP41>.

228. Youssef Roupael et al., *Effects of Drought on Nutrient Uptake and Assimilation in Vegetable Crops*, in *PLANT RESPONSES TO DROUGHT STRESS: FROM MORPHOLOGICAL TO MOLECULAR FEATURES* 171, 172–74, 177 (Ricardo Aroca ed., 2012); *see also* Elizamar Ciriaco da Silva et al., *Drought Stress and Plant Nutrition*, 5 *PLANT STRESS* 32, 33 (2011) (“Under conditions of water stress, roots are unable to take up many nutrients from the soil due to a lack of root activity as well as slow ion diffusion and water movement rates.”).

229. Akanksha Sehgal et al., *Drought or/and Heat-Stress Effects on Seed Filling in Food Crops: Impacts on Functional Biochemistry, Seed Yields, and Nutritional Quality*, 9 *FRONTIERS PLANT SCI.* 1, 11 (2018).

3. Distribution and Equity

Leaving retreat largely to private water rights, farm size and wealth, and market forces places much of the burden of retreat on small farms and disproportionately affects farmers of color.²³⁰ Far from a just transition, ad hoc agricultural retreat inequitably distributes uncompensated relocation to small-scale farms and Black, Latino, and Indigenous farmers. Scholars such as Christina Greene characterize these disproportionate impacts as climate change “maladaptation,” noting that “[t]he redistribution of climate risk and vulnerability often accumulates among marginalized groups by increasing exposure and sensitivity or by decreasing adaptive capacity.”²³¹

Small farms are highly vulnerable to water scarcity because they lack the capital to weather crop losses or invest in climate adaptation technology.²³² Small farms generate relatively small amounts of income (1 percent of agricultural income nationally) and have less diversification of crops and income streams, making them vulnerable to climate shocks such as drought.²³³ Nearly three-fifths of small farms earn under \$10,000 annually.²³⁴ Small farms also have proportionately high operation costs due to limited machinery and technology, diseconomies of scale, and labor-intensive types of farming, such as organic.²³⁵ The harsh outcomes for small farms in drought follow from their limited resources to adopt adaptation measures and technology, diversify crops and income streams, or fund relocation to water-rich regions. For example, research indicates that smaller farms may use fewer water-saving practices in irrigation or crop selection because they cannot afford these adaptations.²³⁶ When prolonged droughts occur, small farms are typically the first to crumble.

There are also disproportionate racial impacts of unmanaged retreat. Black farmers are more vulnerable to drought due to a combination of small farm size and disproportionately low enrollment in government subsidy programs.²³⁷ The Agricultural Census reports that the average size of Black-operated farms is 132

230. See, e.g., *2017 Census of Agriculture: Black Producers*, U.S. DEP’T AGRIC. (2017), https://www.nass.usda.gov/Publications/Highlights/2019/2017Census_Black_Producers.pdf (noting that Black farms are smaller in size and agricultural sales than non-Black owned or operated farms).

231. Greene, *supra* note 50, at 284; see also Sirkku Juhola et al., *Redefining Maladaptation*, 55 ENV’T SCI. & POL’Y 135, 138–39 (2015) (shifting vulnerability from one group to another, potentially to more marginalized group, is a major component of climate response maladaptation).

232. See *infra* Part II.

233. Tamar Haspel, *Small vs. Large: Which Size Farm is Better for the Planet?*, WASH. POST (Sept. 2, 2014), https://www.washingtonpost.com/lifestyle/food/small-vs-large-which-size-farm-is-better-for-the-planet/2014/08/29/ac2a3dc8-2e2d-11e4-994d-202962a9150c_story.html.

234. *Id.*

235. *Id.* (small farms are inefficient due to lack of machinery and technology).

236. Cf. Zeynep K. Hansen & Gary D. Libecap, *Small Farms, Externalities, and the Dust Bowl of the 1930s*, 112 J. POL. ECON. 665, 672–86 (2004) (describing how collective action and inability to internalize the full benefits of investments in soil erosion control led small farms to underinvest in following land during the Dust Bowl).

237. Jess Gilbert et al., *The Loss and Persistence of Black-Owned Farms and Farmland: A Review of the Research Literature and its Implications*, 18 J. RURAL SOC. SCI. 1, 9–10 (2002).

acres, and 57 percent had sales of less than \$5,000 per year.²³⁸ Compared to White farmers, who own approximately 98 percent of agricultural land and generate the same percentage of farm-related income, Black and other farmers of color cumulatively own only 2 percent of land and garner only 2 percent of farm-related income.²³⁹ In addition to lower income and assets, research has found that Black farmers receive less government subsidy, due to exclusion from local farmer groups that implement certain federal funding programs and lack of information about available subsidies.²⁴⁰ Climate change may be the breaking point for Black farmers, a group which has already decreased in size in the last hundred years, from 14 percent of all farmers to under 2 percent.²⁴¹

Indigenous farmers are another group at high risk from climate change and market-based retreat. Indigenous farmers on reservations with unsettled water rights or insufficient irrigation infrastructure are uniquely hard-pressed by ad hoc retreat. Under the Indian Reorganization Act of 1934, tribal land, including farmland, may be held in trust for the tribes by the U.S. government, held individually but subject to federal trust restrictions, or in private fee simple plots patchworked among reservation trust land.²⁴² When land is restricted by the federal government, or in some cases tribal law, farmers cannot fund either adaptation in place or relocation by selling or mortgaging their land in unrestricted fee simple or freely leasing it.²⁴³ The cultural significance of lands and communities, and the need to relocate tribal members as a group, are also steep barriers to relocation. We do not prescribe our proposed managed retreat reform for tribes due to the need for a specific, culturally and historically aware agricultural transition policy for western tribes; however, we underscore that unmanaged retreat inflicts harm on tribes.²⁴⁴

4. Environmental Inefficiency

While managed retreat, as we envision it, primarily aims to provide economic relief for stranded farmers, it should also create some environmental gains beyond what the market would provide. Managed retreat offers a critical environmental benefit: long-term retirement of agriculture or repurposing of land

238. U.S. DEP'T AGRIC., *supra* note 230.

239. Horst & Marion, *supra* note 190, at 11.

240. *Id.* at 4.

241. *Id.* at 3, 8.

242. 25 U.S.C. §§ 461–64; *see* 25 U.S.C. §§ 331 et seq. (repealed).

243. Terry L. Anderson & Dean Lueck, *Land Tenure and Agricultural Productivity on Indian Reservations*, 35 J.L. & ECON. 427, 428–30, 434 (1992). They observe that the “peculiar mixture of tenure systems (on tribal lands) . . . tend[s] to increase the costs of land use for modern agriculture, making it difficult to move Indian land to higher-valued alternative uses.” *Id.* at 448 (inefficiency due to fragmentation of land and restrictions).

244. Notably, the federal government also has failed to protect tribal water against drought and climate change, a situation unlikely to change. In *Arizona v. Navajo Nation* (2023), the Supreme Court rejected the Navajo Nation’s claim that the federal government had violated its fiduciary duty to the reservations by failing to plan for the effects of climate change on tribal water. 599 U.S. 555, 569–70 (2023).

to less thirsty uses. With ad hoc, market-based retreat, there is no way to ensure that the land won't be re-farmed by a subsequent owner during the drought, thereby negating any water savings or environmental benefits of retreat (and likely creating additional economic losses for the new farmer). This compounds the costs of climate adjustment failure, at least in the medium-term before farmers, and their lenders, fully value drought risk.²⁴⁵ In addition, ad hoc retreat is insensitive to environmental interests such as habitat recovery, biodiversity, and wildlife corridors.²⁴⁶ In managed retreat of small farmers, the government at least can prioritize environmental interests in funding decisions among similarly vulnerable and impacted farmers. Of course, standing alone, managed retreat to aid small farms may risk environmental adverse selection if the owners of the least environmentally valuable land and smallest volume water rights opt into the program.²⁴⁷ We envision, and discuss in other work, a parallel managed retreat policy to address water shortage and environmental interests.²⁴⁸

With respect to carbon, the fact that ad hoc retreat underproduces and delays drought retreat increases global carbon. Agriculture is a major source of greenhouse gas emissions (soil and vegetation release carbon and cattle produce methane).²⁴⁹ Arid lands use more water and land, and thus create more carbon, to produce food.²⁵⁰ Notably, reforestation tracts of western land with drought-resistant trees or vegetation in exchange for more compact, higher-yielding farms and ranches elsewhere would create new carbon sinks (natural sources of carbon sequestration) and decrease carbon levels.

Computer models reveal the stunning environmental gains possible from planned crop relocation. A recent study by Robert Beyer at the Potsdam Institute for Climate Impact Research created a model of optimal crop relocation that maximizes environmental benefits while maintaining or increasing yield.²⁵¹ The researchers found that globally redistributing the location of twenty-five major crops could decrease losses of carbon sinks by 71 percent and biodiversity loss by 87 percent.²⁵² With respect to water, the model brings freshwater use by agriculture to zero by relocating to areas with sufficient rainfall.²⁵³ If crops relocate only within national borders, the environmental benefits remain massive, with 59 percent lower carbon, 77 percent less biodiversity impact, and

245. For an illuminating examination of adjustment failure costs, see Michael Pappas & Victor B. Flatt, *Climate Changes Property: Disasters, Decommodification, and Retreat*, 82 OHIO STATE L.J. 331, 350–72 (2021).

246. Beyer, *supra* note 208, at 2.

247. I thank Michael Pappas for this point.

248. Stern & Tarlock, *supra* note 16.

249. Beyer et al., *supra* note 208, at 2; Nigel Dudley & Sasha Alexander, *Agriculture and Biodiversity: A Review*, 18 BIODIVERSITY 45, 45 (2017) (agriculture is the largest contributor to biodiversity loss).

250. R. Lal, *Carbon Emissions from Farm Operations*, 30 ENV'T INT'L 981, 982–84 (2004).

251. Beyer et al., *supra* note 208, at 2–3.

252. *Id.* at 2.

253. *Id.*

nearly all croplands using zero freshwater.²⁵⁴ Of course, managed retreat offers only a modest portion of these benefits (perhaps more if incentives are used to shift agriculture to better areas). A massive volume of eminent domain coupled with strict regulation of the location of new farms—political and likely constitutional non-starters—would be necessary to optimize environmental benefits. Also, owners with the most water rights are less likely to retreat (as they have sufficient water). On balance though, managed retreat will likely produce environmental gains above what the market would provide by accelerating retreat, restricting retreated land from being re-farmed, and, in some cases, incentivizing relocation of farms to water-rich areas.

V. MANAGED RETREAT FOR AGRICULTURE

There are three primary strategies for responding to the current drought retreat: 1) continued reliance on adaptation technologies (e.g., more drought resistant crops, water conservation); 2) letting the market determine the fate of irrigated agriculture; or 3) managed retreat. Thus far, the United States has chosen market-based retreat, tempered with federal subsidies for climate adaptation in place. This Article proposes a different approach, one that is novel in modern federal agricultural law: managed retreat. Rather than leaving climate transitions to market forces and wealth, managed retreat uses government funding to buy out land or water rights or convert land to profitable non-agricultural use.²⁵⁵ In the residential sector, the U.S. government has implemented over forty-five thousand buyouts of homes, but there has been no comparable managed retreat framework for agriculture.²⁵⁶ In this Part, we advocate a policy of government-supported managed retreat for agriculture. This proposal represents a transformation from the federal government’s “anti-retreat” policy of exclusively subsidizing agriculture in place. Our primary goal in this Article is to make the case for agricultural managed retreat as a climate transition policy for small and otherwise vulnerable farmers; however, we also describe policy options for implementing agricultural managed retreat.

A. A Proposal for Agricultural Managed Retreat

Shifting agriculture to water-rich regions, and doing so promptly, efficiently, and humanely, is a momentous issue for western water. The Colorado River has shrunk precipitously; groundwater is at record lows; pollution has increased due to concentration and aerosolization of pollutants in water and sediment; and migrating birds have lost feeding and nesting sites.²⁵⁷ Farmers are

254. *Id.* at 3.

255. For a discussion of climate retreat, see Ruhl & Craig, *supra* note 137, at 236-37.

256. Elise Gout, *Are Buyouts a Viable Tool for Climate Adaptation?*, COLUM. CLIMATE SCH. (June 29, 2021), <https://perma.cc/QLE3-Z7LX> (noting 48,000 buyouts); see also Katharine J. Mach & A.R. Siders, *Reframing Strategic, Managed Retreat for Transformative Climate Adaptation*, 372 SCI. 1294, 1294 (2021) (noting 45,000 buyouts).

257. See U.S. DEP’T AGRIC, *supra* note 2; NOAA, *supra* note 23.

already in active retreat, as described previously, with small farmers suffering harsh outcomes. Yet, the federal government's response has been limited to facilitating temporary water cuts by western states and funding climate adaptation.²⁵⁸

We propose that the federal government add managed retreat to agricultural climate adaptation policy in order to reduce the pain of climate transition for small farmers. We suggest that agricultural managed retreat encompass both physical retreat (i.e., buyouts of arid farmland) and economic retreat (i.e., funding, technical assistance, and retraining to transition some western agricultural lands to other uses and some agricultural workers to other livelihoods) and be voluntary for farmers. While we conceptualize agricultural managed retreat primarily as an economic relief policy, this policy also improves food security and, to a degree, water shortage compared to ad hoc retreat of highly subsidized agriculture. Although the farmers with the most water rights will likely remain or sell their water rights privately, the movement of even a small portion of agriculture away from arid lands should positively impact water supply. This is because agriculture is extremely water-intensive, consuming 80–90 percent of western water.²⁵⁹

What is agricultural managed retreat? The concept of managed retreat comes from the climate adaptation literature and refers to government policies that relocate residents, most often homeowners, from areas at high risk from flooding or other climate-related harm to lower risk locations.²⁶⁰ As applied to agriculture, we envision a narrow policy to facilitate climate transition for a number of drought-impacted farmers—not government control or management of the agricultural economy. In broad strokes, agricultural managed retreat would provide federal funding to farmers, often in the form of farmland or water buyouts, to voluntarily relocate their farming operations to water-rich regions (physical retreat) or to remain in place but transition to low-water, non-agricultural land uses (economic retreat). Whether the government buys farm land with water rights or the water rights alone, the water rights should be permanently restricted from consumptive uses or restrictions should be indexed to the region's water supply or the Colorado River level.²⁶¹ There is also the option for the government to acquire farmland and dedicate it as open space or conservation areas (a more durable and drought-oriented version of current federal programs that lease farmland to preserve biodiversity or water

258. The spring 2023 agreement with the Lower Basin states to reduce water provided funding from the Inflation Reduction Act to pay farmers to reduce their water use for the next three years. Partlow et al., *supra* note 197. The Bureau of Reclamation in cooperation with state water agencies also has distributed significant funds in recent years to pay farmers to not water their fields or to switch from water-intensive alfalfa to more drought-friendly crops. See James, *supra* note 197.

259. SCHAIBLE & AILLERY, *supra* note 2, at 1. It is also possible that government policy for agricultural retreat will affect public perceptions. Specifically, managed retreat policy could signal the riskiness of western farming and discourage new or expanded agricultural operations on arid lands.

260. See *infra* notes 291-301.

261. Michael Pappas and Victor Flatt refer to this as “decommodification” in response to climate change. See Pappas & Flatt, *supra* note 245, at 364-68.

quality).²⁶² In addition, conservation easements, a longstanding conservation tool of governments and NGOs, can provide compensation and tax benefits to farmers who agree to forego their farming or water consumption rights through an easement that restricts former farmland or water rights to conservation.²⁶³

In our policy model, managed retreat would assist a subset of western agricultural owners and tenants who opt to participate. Agricultural managed retreat, as we envision it, is not a wholesale relocation of western agriculture or sweeping federal control of the agricultural economy. It should be used selectively to aid farmers or farmworkers who are highly vulnerable to climate-induced drought, primarily small farmers. In selecting farms, we advocate that government prioritize lower-income, small farms and, within that group, also consider which buyouts will offer the most water savings or environmental benefits.²⁶⁴

Our proposal for voluntary managed retreat eschews the emotional, political, and constitutional costs of eminent domain. Targeted, science-based eminent domain, based on water and environmental benefits, would deliver exponentially greater gains with respect to water shortage, biodiversity, and other environmental interests since the government could study and select the most beneficial land or water rights to acquire. However, eminent domain on a large scale is not merely a political non-starter, but political dynamite. It would set back not only managed retreat, but other government conservation and climate adaptation policies that depend on trust and goodwill from farmers. Eminent domain will also increase farmer pain. Compared to voluntary policies, eminent domain does not reveal those eager to sell versus those who place an above market value premium on retaining their farmland. It creates additional pain from the loss of control and perceived insult from governmental involuntary appropriation.²⁶⁵ In addition, there are important equity concerns. In the face of limited resources, governments may target small farmers, who are disproportionately people of color, for coercive appropriation of their western farmland or water rights.

Of course, managed retreat for small farms, like any subsidy, may distort incentives. First, managed retreat may prompt a form of adverse selection if small farmers who would have relocated or repurposed operations anyway, apply for government funds for retreat. Adverse selection reduces the marginal value of federal funds to produce retreat; however, on the whole it still accomplishes the goal of easing the pain of climate transition for small farmers. Another conceivable incentive problem is that managed retreat will promote farming in the arid West due to the availability of retreat funds (this incentive for risky

262. For a description of the Conservation Reserve Program, *see infra* Part IV.C.

263. We thank Robert Glennon for this suggestion.

264. This paper primarily addresses managing climate transition for small farmers, we note different managed retreat policies or sub-programs could focus on maximizing water savings and environmental benefits. *See* Stern & Tarlock, *supra* note 16.

265. *See* STEPHANIE M. STERN & DAPHNA LEWINSOHN-ZAMIR, THE PSYCHOLOGY OF PROPERTY LAW 85-114 (2020).

location is a concern with funding residential managed retreat).²⁶⁶ In the case of farming, however, the disincentives of water unavailability and instability and the steep price of land due to western urbanization will likely countervail any incentive effect from managed retreat funding. Agricultural managed retreat policy could also address this issue with a temporal cut-off so that funds are not available to farms purchased after a certain date (e.g., after the federal government reductions in Colorado River water or a set number of years following the adoption of managed retreat policy).

We envision that the money for managed retreat would come largely from the deep pockets of existing federal agricultural funds (although it is also plausible for states to fund and operate their own managed retreat programs). Agricultural managed retreat has far more potential for funding than virtually any other U.S. climate transition problem (e.g., residential retreat), making it a viable and attractive candidate for reform. Agriculture has massive federal funding already in play and extensive processes, through the Farm Bill reappropriation every five years, for allocating those funds.²⁶⁷ In addition to ample agricultural subsidy money, the recent 1.2-billion-dollar federal payoffs to Arizona, California, and Nevada to accept water restrictions suggest another alternative: some or all of this money could fund farmland or water rights buyouts or other managed retreat policies in these states.²⁶⁸ There is also federal disaster money. The loosening of money from a presidential drought disaster declaration can provide short-term funds for more expensive retreat options, such as buyouts of large volume of water rights or full farms.²⁶⁹ If managed retreat funding comes from federal disaster relief appropriations under the Stafford Act, the state or local government would likely have to provide a share of the cost.²⁷⁰

Given the political force of the agricultural lobby, there is the risk that interest groups will effectively pressure government to increase farm subsidy, rather than to fund managed retreat, or to target managed retreat funds to larger,

266. See Stephanie M. Stern, *Climate Transition Relief: Federal Buyouts for Underwater Homes*, 72 DUKE L.J. 161, 186–92 (2022).

267. Agricultural Improvement Act of 2018, Pub. L. No. 115-334; see generally Watson, *supra* note 14 (describing the magnitude and nature of U.S. federal farm subsidies). As a new, stand-alone program, managed retreat would be best positioned to obtain funding during the five-year Farm Bill reauthorization process (or from federal disaster relief funds, if available). If managed retreat becomes part of an existing agricultural program already funded within the Farm Bill, such as the Conservation Reserve Program, it could use funds from that program in advance of the reauthorization process.

268. For a description of the massive federal dollars recently spent to secure state water use reductions, see Flavelle, *supra* note 29.

269. See, e.g., BRUCE R. LINDSAY & JUSTIN MURRAY, CONG. RES. SERV., DISASTER RELIEF FUNDING AND EMERGENCY SUPPLEMENTAL APPROPRIATIONS (2010) (presenting data on high dollar federal funding and emergency supplemental relief following disaster declarations).

270. 42 U.S.C. § 5170(c). Drought qualifies as a disaster and can qualify for emergency loans through USDA or Farm Service Administration disaster funding. U.S. DEP'T. AGRIC., DISASTER ASSISTANCE: EMERGENCY DISASTER DESIGNATION AND DECLARATION PROCESS, https://www.fsa.usda.gov/Assets/USDA-FSA-Public/usdfiles/FactSheets/emergency_disaster_designation_declaration_process-factsheet.pdf (last visited July 7, 2023).

more politically powerful farms.²⁷¹ The amount of public attention to farm subsidies, and the growing number of organizations fighting to reduce agricultural subsidies, make it less likely that future reauthorizations of the federal Farm Bill will dramatically increase funding.²⁷² Political capture is a thorny issue. Avoiding political capture of managed retreat funds by large farms and agrobusiness will require vigilance, agency oversight, and statutory assurances to protect small farmers.

Although the federal government will be the major funding source, state or even local governments could implement the managed retreat. In some cases, western states may not be motivated to participate for political or economic reasons (e.g., preserving state economic product), unless the state faces exigent water shortage or has formally agreed to reduce water use. Those circumstances are now occurring, with the West in water crisis and three western states agreeing in spring 2023 to reductions in water consumption under the threat of federal action.²⁷³ Extreme water shortage, federal regulation, and the ongoing third wave of retreat (often in the form of fallowed land) make it likely that western states will become more receptive to managed retreat, especially if funded primarily by the federal government. If states do not wish to participate in agricultural managed retreat, the federal government can administer retreat policies, possibly at a smaller scale, through the Department of Agriculture.

In our proposed reform, traditional adaptation in place remains an important, but not exclusive, policy tool. Climate stress does not automatically spell retreat. Agriculture in the West is already adapting to a changed climate. For example, vineyards are adopting sensors to fine-tune irrigation and improving shading techniques for vines.²⁷⁴ The vast system of land grant universities with schools of agriculture provide a wide range of adaptation opportunities, as does increasing federal technical and funding assistance for agricultural drought adaptation. However, even with the most efficient drought adaptation, not all western agriculture can remain in place.

Conceptually, we advocate that federal policy incorporate managed retreat as *part* of agricultural climate adaptation. Our proposed reform would place managed retreat for stranded farmers squarely within federal agricultural policy and its climate adaptation toolkit. The Biden administration has made a push to increase funding for climate adaptation technologies, provide information and assistance so farmers can operate more efficiently, and spur technological

271. See Kishore Gawande & Bernard Hoekman, *Lobbying and Agricultural Trade Policy in the United States*, 60 INT'L ORG. 527, 556 (2006) (concluding from their research that "interest group money bends agricultural policy in the United States").

272. See Garrett Downs, *Some of the Billions in Farm Bill Funds Could Flow to Lawmakers Writing the Bill*, POLITICO (May 2, 2023), <https://www.politico.com/news/2023/05/01/farm-bill-funds-lawmakers-00093821> (highlighting advocacy work of Environmental Working Group to contest questionable farm subsidies); Chris Edwards, *Agricultural Subsidies*, DOWNSIZING FED. GOV'T (Apr. 16, 2018), <https://www.downsizinggovernment.org/agriculture/subsidies> (describing interest groups opposing farm subsidies).

273. See Letter From Seven Colorado River Basin States, *supra* note 29.

274. See Sonderling, *supra* note 143.

innovations for farming in place.²⁷⁵ To this end, the USDA and other federal agencies have produced hundreds of pages of federal guidance, regulations, and announcements about agricultural climate adaptation. For example, the General Accounting Office (GAO) recently issued a report setting out thirteen resiliency options for the Department of Agriculture. However, the closest that the GAO came to retreat was the suggestion for regional resiliency planning.²⁷⁶ The federal Fifth National Climate Assessment briefly hinted that crop relocation is on the federal radar. A few lines in the voluminous report noted that “fundamentally reimagining how and *where* crops are produced . . .” may be more effective in the medium- and long-term than “cheaper and easier incremental changes like improved irrigation.”²⁷⁷

*B. Physical and Economic Retreat:
Implementing Agricultural Managed Retreat*

Agricultural managed retreat policy should encompass physical retreat and economic retreat. Physical retreat of agriculture refers to buyouts of farmland or water rights, relocation assistance, and incentives for relocation to other regions (reoccurring leases to fallow farmland are a form of partial physical retreat, but suboptimal for reasons we will discuss). Economic retreat provides assistance to convert farmland to non-agricultural uses (e.g., tourism, solar arrays) and provides funds to retrain farmworkers. Instead of a singular policy, different options for agricultural managed retreat are necessary to respond to the diversity of western farming operations, fluctuating federal budgets, differences in state water law, and state political and cultural context. In addition, we choose not to prescribe a single form of managed retreat because the federal government may develop an overarching approach to domestic climate migration or climate adaptation and seek to fit agriculture within these frameworks. To date, the federal government’s climate reports and assessment have addressed climate adaptation and migration sector-by-sector, in a piecemeal fashion.²⁷⁸

275. See, e.g., Pub. L. No. 117-169 §§ 50231–50233, 136 Stat. 1818 (2022); *Fact Sheet: Biden-Harris Administration Makes Historic Investments to Build Community Climate Resilience*, WHITE HOUSE (June 19, 2023) [hereinafter *Biden-Harris Climate Resilience*], <https://www.whitehouse.gov/briefing-room/statements-releases/2023/06/19/fact-sheet-biden-harris-administration-makes-historic-investments-to-build-community-climate-resilience/>.

276. U.S. GEN. ACCOUNTABILITY OFF., CLIMATE CHANGE OPTIONS TO ENHANCE RESILIENCE OF AGRICULTURAL PRODUCERS TO REDUCE FEDERAL FISCAL EXPOSURE 31 (2023), <https://www.gao.gov/assets/gao-23-104557.pdf> (“Several experts told us that a robust regional strategic planning process that is inclusive could help build consensus and facilitate participant buy-in to climate resilience policies drive research priorities or technical assistance initiatives to address region-specific vulnerabilities [and] identify gaps in available information and on climate resilience good practices, or gaps in the technical assistance available to producers in different regions.”).

277. E. Wasley et al., *Adaptation*, in FIFTH NATIONAL CLIMATE ASSESSMENT (U.S. Glob. Change Rsch. Program ed. 2023) (emphasis added), <https://nca2023.globalchange.gov/chapter/31/#fig-31-3>.

278. For example, the recent U.S. Fifth National Climate Assessment offers a staggering array of approaches to adaptation but does not identify an overarching framework for adaptation or migration or even well-defined priorities for agricultural adaptation. U.S. GLOB. CHANGE RSCH. PROGRAM, FIFTH NATIONAL CLIMATE ASSESSMENT (2023), <https://nca2023.globalchange.gov/chapter/front-matter/>.

First, borrowing from the model of residential retreat, government could acquire, or buy out, farmland to physically retreat agriculture from drought-stricken areas. Buyouts of farmland, and as discussed below water rights, are key strategies of our agricultural managed retreat proposal. To improve water shortage, land buyouts should either include water rights or restrict water use. For example, following land buyout, the land could be restricted to low-water uses or dedicated as open space. More flexibly, the government could restrict the land contingently based on water supply, such as the level of the Colorado River or a combined index of water supply and temperature. This would allow agricultural or high-density residential uses to resume if adequate water supply develops. A more difficult problem is preventing farmers from accepting buyouts and then using the money to purchase another farm in a drought zone. It is possible for buyouts to include agreements that farmers will resume farming operations in non-arid locations, although such provisions would be intrusive and difficult to enforce. An alternative that leaves the farmer in place and resolves the problem of re-farming in another arid location is for the government to purchase, through conservation easements, permanent restrictions on farming and other water-intensive uses, rather than buying the land in full.²⁷⁹

As another option, the government could offer partial economic relief, and water savings, by buying or renting part of farms (e.g., specific acreage less than the whole) and restricting water use proportionally. Farmers are often reluctant to sell off pieces of their farms for reasons ranging from economies of scale to personal and familial attachments. We view such “partial retreat” as less efficacious than full land or water buyouts. If the government leases rather than purchases acreage, there will be ongoing rental payment expenditures and monitoring costs, presumably for several decades or more of climate change. Widespread partial retreat funding also risks promoting large numbers of barely profitable farms and forestalling the transition to a smaller, more sustainable level of western agriculture. That said, partial payments and leases are sometimes the only politically viable option and thus we include them in this discussion. The Conservation Reserve Program, discussed in Part IV.C, provides lease payments for fallowing farmland.²⁸⁰ In addition, payments to farmers to conserve water are occurring now via time-limited funding from the Bureau of Reclamation for farmers to fallow fields or switch to less thirsty crops.²⁸¹

Second, the government could buy water rights and use them for conservation and in-stream flows, at least for the duration of the megadrought. In the West, surface water rights are usually severable and alienable from land;

279. Conservation easements have a long history of use for ecosystem and wildlife preservation, *see* Federico Cheever & Nancy A. McLaughlin, *An Introduction to Conservation Easements in the United States: A Simple Concept and a Complicated Mosaic of Law*, 1 J.L., PROP. & SOC'Y 108, 111–15 (2015).

280. *See infra* Part IV.C.

281. *See* James, *supra* note 197; Partlow et al., *supra* note 197.

groundwater is more likely to attach to the land, but this varies by state.²⁸² Water rights buyouts would ease climate transition pain while conserving water. A water rights buyout may be attractive to farmers who cannot easily sell their water rights because they are small volume or distant from metropolitan areas. In addition, managed retreat could couple water buyouts with economic retreat funds to help farmers transition land to less thirsty uses.

Third, either as part of buyouts or a standalone policy, the federal government could create incentive payments or higher levels of subsidy for farms and ranches that relocate, or locate initially, in climate- and water-friendly areas.²⁸³ Likely, many western farmers will not want to relocate their households or farming operations eastward due to personal attachments and family ties to the region. However, there are some farmers interested in moving operations, as indicated by recent reports of small western farmers who have moved their farms to the Midwest.²⁸⁴ Incentive payments could ease those transitions and guide farmers to water-rich locations. The research on optimized crop-switching and agricultural relocation indicates that even modest amounts of geographic change will deliver palpable water and climate benefits.²⁸⁵

Fourth, the federal government could offer technical and planning assistance with western farm relocation, or with locating new farms, as part of a buyout or other agricultural managed retreat policy.²⁸⁶ On the one hand, farmers and ranchers who wish to relocate operations (likely a modest number) or new farmers choosing initial farming locations could benefit from government expertise, for example maps of the lowest climate risk, most profitable farming areas of the country. They may also need assistance, whether from government or farming organizations, to find land, develop a new network of suppliers and service providers (an important point for farmers who often work on low profit margins), and determine whether or how to move costly equipment. On the other hand, government relocation assistance and advising may be interpreted, or morph over time, into a government incursion. It is possible that relocation assistance could become intrusive, coercive, or biased, and in the worst case, flirt with “soviet-style” government-determined relocation—or at least incite citizen fear of these outcomes.²⁸⁷

282. James L. Huffman et al., *Constitutional Protections of Property Interests in Western Water*, 41 PUB. LAND & RES. L. REV. 27, 31, 32 n.18 (2019) (alienability of surface water); *Prior Appropriation*, *supra* note 32, at 900-01 (law of groundwater).

283. Incentive payments are used in residential managed retreat, although counterproductively they often reward residents for relocating within the county. *See* Stern, *supra* note 266, at 221.

284. *See* Vittek *supra* note 39.

285. *See infra* Part IV.D.1 & 4.

286. In residential property law, relocation assistance has helped low-income tenants find housing through federal “housing navigators” who assist tenants in finding and negotiating rentals that will accept subsidized federal rental vouchers. *See* PETER BERGMAN ET AL., NAT’L BUREAU ECON. RSCH., CREATING MOVED TO OPPORTUNITY: EXPERIMENTAL EVIDENCE ON BARRIERS TO NEIGHBORHOOD CHOICE, WORKING PAPER NO. 26164 13, 19–29 (2020), https://www.nber.org/system/files/working_papers/w26164/working_papers/w26164_revisions/w26164.rev1.pdf.

287. We thank Robert Glennon for his comments on this point.

Fifth, the federal government or state governments could fund economic, rather than physical, retreat.²⁸⁸ We use the term economic retreat to describe government assistance to convert farmland to profitable, non-agricultural uses and to retrain farm owners, tenants, and workers for new livelihoods. Already some farmers have retained their farms by converting all or part to tourism, solar arrays, and other uses.²⁸⁹ Financial or technical assistance from government to farmers who opt to participate could boost the conversion rate of farmland to less water-intensive uses. Economic retreat differs from traditional climate adaptation, which emphasizes techniques and technologies for farming in place. Of course, adaptation techniques such as higher-efficiency irrigation or water distribution remain as options but are not the focus of this Article. Job retraining is another important form of economic retreat, one that extends climate transition assistance to a neglected group: farmworkers. The focus on owners has been a troubling bias of residential managed retreat and U.S. climate adaptation policy generally.²⁹⁰ Economic retreat, in contrast, should encompass farm tenants and farmworkers, as well as owners. In addition to job retraining, economic retreat funding for farmworkers could take the form of enhanced unemployment payments or financial assistance to relocate to other regions of the country with better non-agricultural job opportunities.

We suggest targeting buyouts, economic retreat, and other managed retreat assistance to drought-stranded farmers (usually small- to mid-sized farms). Small, thinly capitalized farms are the most vulnerable to losses from drought and least equipped to adapt or to relocate cost-efficiently. They have the highest need for climate transition relief to stem their losses. Among this group of stranded farmers, government could secondarily prioritize anticipated water and environmental benefits. For example, alfalfa and nut crops are heavy water users and might be prioritized for buyout or other managed retreat funding. Another category that government could prioritize for buyout or relocation funding are lands owned by small farmers with high biodiversity benefits or ecosystem services. Concededly, small farms consume less water than larger ones, so federally funded managed retreat for small farms will not deliver maximal water savings.

C. *Precedents for Agricultural Managed Retreat*

A model for agricultural managed retreat comes from the federal government's existing framework for residential managed retreat of homeowners. Residential managed retreat has enabled over forty-five thousand households to date to voluntarily move from areas at severe climate or disaster risk via federal buyouts of their properties.²⁹¹ Residential managed retreat aims

288. We thank Brigham Daniels for his helpful suggestions on this point.

289. See Frosch, *supra* note 38.

290. Cf. Leah A. Dundon & Janey S. Camp, *Climate Justice and Home-buyout Programs: Renters as a Forgotten Population in Managed Retreat Actions*, 11 J. ENV'T. STUD. SCI. 420, 422–29 (2021).

291. Gout, *supra* note 256; Mach & Siders, *supra* note 256, at 1299.

to relocate severely damaged or at-risk properties, and in some cases infrastructure, out of harm's way from natural disasters and climate risks.²⁹² Five federal programs offer buyouts for homeowners in hazard zones, with most of the buyouts emanating from the Federal Emergency Management Agency (FEMA) Hazard Mitigation Grant Program and to lesser degree the Department of Housing and Urban Development (HUD) Community Development Block Grant-Disaster Relief.²⁹³ These federal agencies use disaster relief funds, authorized by the Stafford Act.²⁹⁴ Frequently, the state government, local government, or homeowner must provide a 25 percent cost share.²⁹⁵ In a buyout, the government acquires residential properties at pre-disaster fair market value from owners who opt to participate.²⁹⁶ Federal regulations require that the property acquired with federal funds be restricted in perpetuity to undevelopable open space or wetlands management or buffer areas.²⁹⁷

Residential buyouts have reduced loss of human life and injury, stemmed financial losses by enabling relocation for households at repeat risk of climate damage, and created buffer spaces and wetlands that benefit the environment and climate resilience. However, managed retreat buyouts in residential real estate have also created challenges. Buyouts may increase the incentives for households to locate in climate risk zones by providing a de facto, free insurance policy (on top of the incentives created by highly subsidized national flood

292. A.R. Siders, *Social Justice Implications of US Managed Retreat Buyout Programs*, 152 *Climatic Change* 239, 240 (2019) [hereinafter *Social Justice*].

293. See Kelsey Peterson et al., *A Review of Funding Mechanisms for US Floodplain Buyouts*, 12 *SUSTAINABILITY* 10112, 3 (2020) (providing a table of common federal buyout funding mechanisms). The HUD buyout program ("CDBG-DR") arises under Title I of the Housing and Community Development Act of 1974 but is specifically reserved for disaster recovery. 42 U.S.C. § 5306(c); *Community Development Block Grant Disaster Recovery Program*, U.S. DEP'T HOUS. & URB. DEV., https://www.hud.gov/program_offices/comm_planning/cdbg-dr (last updated Feb. 23, 2024). The other FEMA programs that fund residential buyouts are the Flood Mitigation Assistance Program and the Building Resilient Infrastructure and Communities ("BRIC") program (formerly the Pre-Disaster Mitigation Program), both of which receive annual appropriations. 42 U.S.C. § 4104c(a); Flood Mitigation Assistance Program, 44 C.F.R. § 78(2020); *Building Resilient Infrastructure and Communities*, FED. EMERGENCY MGMT. AGENCY, U.S. DEP'T HOMELAND SEC., <https://www.fema.gov/grants/mitigation/building-resilient-infrastructure-communities> (last updated Feb. 20, 2024).

294. 42 U.S.C. § 5170c; FED. EMERGENCY MGMT. AGENCY, U.S. DEP'T HOMELAND SEC., *HAZARD MITIGATION ASSISTANCE GUIDANCE* 22–23 (2015). *But see* Caroline M. Kraan et al., *Promoting Equity in Retreat Through Voluntary Property Buyout Programs*, 11 *J. ENV'T STUD. & SCI.* 481, 484 (2021) (describing factors that can lead to under-compensation for lower-income households).

295. States and localities sometimes garner additional federal funds from HUD community-development block grants to pay all or part of the 25 percent cost share. See 42 U.S.C. § 5170c(a). BRIC buyout funds provide a cost-share of up to 75 percent, with special provision for up to 90 percent cost-sharing for economically disadvantaged localities with under 3,000 residents. 42 U.S.C. § 5133(a), (h)(1)–(2). There is no cost-share provision for Community Development Block Grants ("CDBG") and Community Development Block Grants-Disaster Relief ("CDBG-DR").

296. Federal regulations explicitly prohibit the implementing entity, usually a locality or state, from involuntarily taking property through eminent domain. See 44 C.F.R. § 80.13(a)(4) (2022).

297. 42 U.S.C. § 5170c(b)(2)(B)(i). No new structures are permissible except for restrooms or public facilities open on four sides.

insurance).²⁹⁸ Critics have also pointed to the potential for coercion and other injustices against low-income residents, tribes, and communities of color.²⁹⁹ These issues require refinement and reform of federal managed retreat policy, some of which is already occurring. For example, FEMA recently initiated a “community-driven relocation” initiative, and it is possible that future reform of buyout policy may better address incentive problems.³⁰⁰

Buried in the tumultuous history of western agriculture, there is also a policy precedent, albeit short-lived, for agricultural managed retreat: the New Deal’s Resettlement Administration.³⁰¹ This program briefly provided loans and relocation assistance to farmers and tenants stranded on barren, unproductive farms.³⁰² In addition, the government also built relief camps in California for migratory farmworkers facing homelessness because of the Dust Bowl and provided “rehabilitation” in the form of farm and home management “retraining.”³⁰³ The Administration’s original goal was to acquire ten million acres of deteriorated farmland, convert it to parks and forests, and resettle twenty thousand farm families.³⁰⁴ The program fell far short of this goal and was met with great resistance.³⁰⁵ The shortfall was due to multiple factors. Conservative politicians strongly objected to the program as “socialist.”³⁰⁶ In the face of weak political support and vast rural distress, the Administration’s efforts and resources could not match the staggering amount of farmer poverty.³⁰⁷ In addition, as Charles Kenneth Robert describes, administrative shortcomings, including the failure to define the program’s goals or clearly specify its methods, stymied farm resettlement and rehabilitation.³⁰⁸

298. See Stern, *supra* note 266, at 181–92.

299. See *Social Justice*, *supra* note 292, at 240; see also Kevin A. Lynn, *Who Defines ‘Whole’: An Urban Political Ecology of Flood Control and Community Relocation in Houston, Texas*, 24 J. POL. ECOLOGY 951, 957 (2017) (equity in Houston buyouts); Juliette Landphair, “*The Forgotten People of New Orleans*”: *Community, Vulnerability, and the Lower Ninth Ward*, 94 J. AM. HIST. 837, 844 (2007) (historical to modern-day account of New Orleans communities of color on floodplains).

300. See Stern, *supra* note 266, at 224–33 (proposing reforms of means-testing, enhanced assistance for tenants, and requirements that buyout recipients relocate outside of climate risk zones). FEMA is already advancing community engagement efforts with a subcommittee appointed to advance “community-driven relocation.” FED. EMERGENCY MGMT. AGENCY, U.S. DEP’T HOMELAND SEC., *FEMA EFFORTS ADVANCING COMMUNITY-DRIVEN RELOCATION* (2022), <https://www.fema.gov/node/fema-efforts-advancing-community-driven-relocation>.

301. See *History of USDA’s Farm Service Agency*, U.S. DEP’T AGRIC., <https://www.fsa.usda.gov/about-fsa/history-and-mission/agency-history/index> (last visited Apr. 2, 2023).

302. See REXFORD G. TUGWELL, *RESETTLEMENT ADMINISTRATION PROGRAM* 1, 7-11 (1936).

303. See *id.* at 6; Charles Kenneth Roberts, *Client Failures and Supervised Credit in the Farm Security Administration*, AGRIC. HIST. SOC’Y 368, 371 (2013).

304. SIDNEY BALDWIN, *POVERTY AND POLITICS: THE RISE AND DECLINE OF THE FARM SECURITY ADMINISTRATION* 105 (1968).

305. *Id.* at 106.

306. *The Farm Security Administration Photo Project*, NAT’L ARCHIVES, <https://www.archives.gov/files/atlanta/education/depression-curriculum/section-2.pdf> (last visited Nov. 17, 2023).

307. See Roberts, *supra* note 303, at 369.

308. *Id.*

Compared to residential retreat, agricultural managed retreat policy faces two structural challenges. First, the United States has no coherent food security policy against which to assess irrigated agriculture's argument that it must be preserved to feed the country. In the past, the United States has been amenable to imported food, which currently represents 15 percent of American food supply and a higher proportion of fruits, vegetables, and sugars.³⁰⁹ It is unclear if crops from other regions of the United States or imported food will replace retreated western crops or how the country will address any interruptions in food supply. Well-crafted managed retreat policy should *reduce* shocks and food interruption by relocating domestic agriculture, rather than allowing farms to shutter. Nonetheless, agricultural interest groups may be able to persuade lawmakers that subsidizing agricultural persistence is vital to food security.

Second, federal agricultural policy is at the earliest stages of creating a coherent climate adaptation policy and has not addressed the link between agricultural climate adaptation and managed retreat.³¹⁰ Comparatively, FEMA and HUD have made greater (albeit imperfect) progress in integrating climate adaptation into residential buyouts and creating different "disaster relief" programs to increase community resiliency to climate change and fund managed retreat.³¹¹ Currently, the USDA is addressing climate change adaptation under a broad resiliency framework.³¹² This is useful, but the USDA is following a shotgun approach, pursuing initiatives without zeroing in on hard policy choices.³¹³ As a result of the nascent adaptation framework, agricultural managed retreat policy does not readily slot into existing policy and thus will require more effort to develop and implement. In addition to these two structural challenges, we discuss other issues and objections in Part VI.

VI. CHALLENGES AND OBJECTIONS TO AGRICULTURAL DROUGHT RETREAT

Our proposal to extend managed retreat to agriculture will reduce individual and social losses from climate adaptation and confer substantial gains to terrestrial biodiversity and water conservation. However, managed retreat for agriculture also raises concerns, some of which are evident in the federal experience with residential managed retreat.³¹⁴ This Part responds to issues and potential objections to agricultural managed retreat and elaborates on our vision for managed retreat policy.

309. About 15 percent of America's food supply is imported, but the numbers are much higher for fruits, vegetables and sugars. *Agricultural Trade*, U.S. DEP'T AGRIC. (May 8, 2023), <https://www.ers.usda.gov/data-products/ag-and-food-statistics-charting-the-essentials/agricultural-trade/>.

310. A newly created National Resiliency Plan was released during summer 2023 by the Biden administration. *Biden-Harris Climate Resilience*, *supra* note 275.

311. For a description, *see* Stern, *supra* note 266, at 173–80.

312. *See Biden-Harris Climate Resilience*, *supra* note 275.

313. *See id.*

314. *See, e.g.,* Stern, *supra* note 266, at 181–211 (criticizing incentive problems from compensating retreat).

A. *Cultural Losses: Western Farming and Ranching*

A managed retreat policy focused on farmers in the arid West may affect culture and way of life in western states and jeopardize western small farms. The first concern is that managed retreat may erode western culture and way of life, even if only a minority of western farms retreat.³¹⁵ The second, overlapping concern is that managed retreat will undermine western small farms, a form of farming that many Americans treasure. We acknowledge that the loss of western culture and small farms are important concerns, but in this case, managed retreat is not the major cause of either. The social and cultural changes from losing western small farms are primarily due to climate change, not managed retreat. As we have established, farms and ranches are already retreating, often in an ad hoc, hardscrabble way. The third wave of drought retreat is well underway and is irreversible in the near and medium terms. Eschewing government assistance will not end small farm retreat and the accompanying cultural losses to the West; it will prolong the relocation process and increase its pain. An ameliorative is to prioritize small farms for federal funding for adaptation in place, as well as managed retreat, to lessen the role of financial exigency in retreat choices.

Second, in some cases managed retreat policy may preserve farming culture or small farms, albeit in a different region of the country. Managed retreat that enables or incentivizes western farmers to continue agricultural operations in a new, non-arid location continues farming way of life, but in a different place. Admittedly, only a minority of western farmers will relocate due to reluctance to leave the West. However, western farmers that do relocate, as well as new farms arising in water-rich areas, will increase small farming way of life in midwestern and eastern states. Of course, this does not remedy cultural losses to the West or to western farmers, but rather to the country. Managed retreat can preserve a farming way of life, but it cannot affix it in western geographic space.

Third, although the loss of culture and of small farms are important, we should view these losses in historical context and weigh them against other costs and benefits. Farming in the arid West is the result of fake science, historical accident and Mormon religious vision, and federal dam-building.³¹⁶ The tradeoffs to honoring history have become apparent, and painful, as the Colorado River suffers record low levels, farms fallow and shutter operations, and concerns about national food security simmer. In the face of climate change, should we subsidize agricultural persistence in the West at its present scale for time evermore? We counsel against this result in view of the ongoing drought retreat, as well as the financial and social costs of large-scale farming in drought.

315. Cf. PAUL F. STARRS, *LET THE COWBOY RIDE: CATTLE RANCHING IN THE AMERICAN* 22–23 (1998) (stating that some aspects of ranching culture attributed to the West are global characteristics of ranching culture).

316. See *infra* Part II.

B. Equity and Climate Burden

As with residential retreat, the equity issues in agricultural retreat are complex, encompassing concerns both about under- and over-funding vulnerable groups. There is a risk of underfunding the relocation of vulnerable farmers, as has occurred with other types of agricultural subsidies that have delivered fewer dollars to Black and tribal farmers.³¹⁷ Yet, at the same time, there is the opposite concern: that vulnerable farmers will be targeted for too much physical or economic retreat funding and subject to disparate relocation or even coercion.³¹⁸

Targeting small farms for managed retreat funding would increase the options available to historically disenfranchised and now climate-displaced Black and Latino farmers, who disproportionately own and operate small farms. Our proposal envisions directing managed retreat to small farm operations that would otherwise be unable to relocate or repurpose land, as well as to farmworkers for economic assistance and retraining. It also responds to the reality that small farms are the most vulnerable to concentrated losses from drought and ad hoc retreat.³¹⁹

There is, however, a significant concern that directing aid to small farmers, and thus to farmers of color, will coerce their relocation or unfairly burden them with physical or economic transitions to preserve western water supply. Professor Elizabeth Marino defines adaptation oppression as “[t]he limitation of adaptation options, or the limits in inventories of political possibilities, when faced with risk”³²⁰ In the flooding literature, scholars have described the inequity of relocating low-income people or people of color in order to create flood buffers in flood zones or otherwise preserve the ability of other, wealthier, and often whiter, residents to stay.³²¹ Relocation is a particularly difficult and sensitive issue as a result of the federal government’s unpopular and race- and class-biased “urban renewal” policy in the 1950s and 60s that razed allegedly blighted neighborhoods to build highways and infrastructure.³²²

We advocate choice as a partial prophylactic to adaptation oppression. As with residential disaster retreat, regulation should prohibit the use of eminent

317. Horst & Marion, *supra* note 190, at 3, 8.

318. Cf. James R. Elliott et al., *Racial Inequities in the Federal Buyout of Flood-Prone Homes: A Nationwide Assessment of Environmental Adaptation*, 6 *SOCIUS* 1, 3 (2020) (finding for residential buyouts that nonwhite neighborhoods in otherwise white counties accepted the greatest number of government buyout offers).

319. See *infra* Part I.

320. See Elizabeth Marino, *Adaptation Privilege and Voluntary Buyouts: Perspectives on Ethnocentrism in Sea Level Rise Relocation and Retreat Policy in the US*, 49 *GLOB. ENV’T CHANGE* 10, 12 (2018).

321. See *Social Justice*, *supra* note 292, at 252.

322. See William J. Collins & Katharine L. Shester, *Slum Clearance and Urban Renewal in the United States*, 5 *AM. ECON. J.* 239, 241–42, 265 (2013) (describing how urban renewal imposed high dislocation costs, but also had positive effects on income, property values, and population in participating cities). For tribes, the comparisons are even worse: the relocations they face from climate change will be second moves (or more) following the U.S. government’s involuntary relocation of tribes to reservations.

domain by government to expropriate farms in managed retreat.³²³ Of course, this safeguards small farms from government coercion, but not from financial disparities. One ameliorative may be to prioritize small farms for federal funding for adaptation in place, as well as managed retreat, to lessen the role of financial exigency in retreat choices.

In addition, for equitable climate transition, agricultural policy must address the legal, financial, and cultural differences in small farm ownership by farmers of color. For example, thousands of poor and minority families own land, including farmland, as tenants in common with many extended family members holding small shares.³²⁴ This may necessitate new legal structures that enable the many owners of a property to vote on accepting aid for managed retreat buyouts and opportunities for owners who wish to remain to avoid partition by buying out their co-owners.³²⁵ As another example, the Biden administration and tribes have begun to lay the legal and financial groundwork for retreat of tribes.³²⁶ In fall 2022, the Department of the Interior committed seventy-five million dollars for the voluntary, community-driven relocation of the Alaskan Newtok Village and Native Village of Napakiak Tribes in Alaska and the Quinalt Indian Nation in Washington.³²⁷

C. Regional Losses and Politics: Winners and Losers

It is possible that political resistance could derail managed retreat for agriculture. Western states may resist managed retreat that harms their economic bottom line by diverting taxable farm revenues, reducing jobs, and depressing regional vitality and growth. There may be resistance from irrigation districts, who will need to pay more per farmer for infrastructure and administration as farms retreat.³²⁸ In our view, three factors should mitigate state political opposition to managed agricultural retreat. First, western states may welcome the water savings from managed retreat. For example, under the terms of a recent interstate agreement, Arizona, Nevada, and California will reduce water consumption until 2026 in an amount equal to 13 percent of the total lower

323. See 44 C.F.R. § 80.13(a)(4) (2023).

324. Thomas W. Mitchell, *Reforming Property Law to Address Devastating Land Loss*, 66 ALA. L. REV. 1, 1 (2014). There are also owners of other races who own land in fractionalized form. *Id.* at 5.

325. Outside the climate context, Thomas Mitchell has proposed a mandatory buyout option for tenants in common against their co-tenants who have filed an action for judicial partition (division or sale of the property to split it among co-tenants). *Id.* at 13–18. Several states have adopted the buyout provision and the broader Uniform Partition of Heirs Property Act drafted by Professor Mitchell. *Id.* at 7.

326. *Biden-Harris Administration Makes \$135 Million Commitment to Support Relocation of Tribal Communities Affected by Climate Change*, U.S. DEP'T INTERIOR (Nov. 30, 2022), <https://www.doi.gov/pressreleases/biden-harris-administration-makes-135-million-commitment-support-relocation-tribal>.

327. *Id.* An additional 40 million of funding will support tribal adaptation and relocation planning. *Id.*

328. See Thompson, *supra* note 185, at 732.

Colorado River Basin use.³²⁹ Agricultural managed retreat offers a way for states to accomplish these reductions (if the federal government limits yearly payments to farmers not to use their water rights).

Second, the political interests of states receiving agriculture may counterbalance any resistance from western states. Non-arid states positioned to gain agriculture are likely to support managed retreat. States have always competed for agriculture, with many offering subsidized loans, grants, and tax incentives to promote agribusiness and attract new farms to their states.³³⁰ In response to climate-driven relocation, some water-rich areas may even create additional state or local programs specifically to entice western farms and ranches to relocate in their states, as has occurred in recent efforts by rural states to lure remote technology workers.³³¹

Third, if western resistance remains formidable, there is the option of “paying off the losers” in managed retreat.³³² This would not necessarily entail new federal expenditures. As discussed above, the federal government agreed to pay out \$1.2 billion to Arizona, California, and Nevada to secure their recent agreement to water reductions.³³³ It seems likely that federal compensation will be necessary to renew this agreement following its expiration in 2026 or to create other voluntary reduction agreements involving the Upper Basin states. If political opposition occurs from western states, the federal government could negotiate acceptance of managed retreat as a prerequisite to such federal payoffs or the payoffs could take the form of managed retreat funding in the future.

CONCLUSION

The current displacement of western agriculture is the most recent in a series of painful dislocations, including exoduses following the 1890s Great Plains drought and the Dust Bowl. The current third wave of drought retreat is likely to be more severe than these prior western retreats, due to climate change, urbanization, and uncounted water claims. Yet, in the face of the third wave of drought retreat, the most profound agricultural relocation in the United States’ history, federal agricultural law remains stubbornly focused on subsidizing

329. See Flavelle, *supra* note 29. The deal resulted in large part from significant pressure from the federal government who threatened additional federal cuts, or “calls,” on water supply and a federally created redistribution of water among the Basin states. *Id.*

330. Emma Kuhns et al., *The Use of State Business Incentives to Support Agriculture*, 13 FARMDOC DAILY 205, 205–06 (2023).

331. There is precedent for state and city incentives for residential location for tech and other workers, including relocation bonuses and moving assistance payments. See *Benefits*, TULSA REMOTE, <https://tulsaremove.com/#benefits> (last visited Mar. 26, 2024); *Remote Worker Grant Program*, STATE OF VT., AGENCY OF COM. & CMTY. DEV., <https://accd.vermont.gov/content/new-remote-worker-grant-program-guidelines> (last visited Apr. 17, 2024).

332. The necessity of compensating those made less well off by a policy transition applies in many policy arenas. See generally MICHAEL J. TREBILCOCK, *DEALING WITH LOSERS: THE POLITICAL ECONOMY OF POLICY TRANSITIONS* (2015) (writing about political necessity of compensation for losers in policy transitions).

333. See Flavelle, *supra* note 29.

agricultural production in place. In this Article, we advocate that the federal government respond to the drought retreat crisis by providing economic relief to small farmers via agricultural managed retreat. Agricultural managed retreat will face challenges and potential resistance from some farmers, farming community residents, and local and state governments. Yet, retreat cannot be avoided: unmanaged retreat is already occurring and will accelerate over time. Government assistance can buffer the disproportionate impacts of drought and climate change on small farms, as well as improve western water supply and food security.

We welcome responses to this Article. If you are interested in submitting a response for our online journal, Ecology Law Currents, please contact cse.elq@law.berkeley.edu. Responses to articles may be viewed at our website, <http://www.ecologylawquarterly.org>.